

Full SAP Calculation Printout



Property Reference	FURNERS LANE 1				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 1, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	3.90	TER	8.53	
Environmental	96 A	% DER < TER				54.28
CO ₂ Emissions (t/year)	0.61	DFEE	40.95	TFEE	41.03	
Compliance Check	See BREL	% DFEE < TFEE				0.21
% DPER < TPER	9.20	DPER	40.67	TPER	44.79	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880 (1b) - (3b)
First floor	83.2900 (1c)	x 2.7000 (2c)	= 224.8830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.1710 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1576 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4076 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3465 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4417	0.4331	0.4244	0.3811	0.3724	0.3291	0.3291	0.3205	0.3465	0.3724	0.3898	0.4071 (22b)
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			45.1200	1.1450	51.6641		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Rooflight S			0.7600	1.1450	0.8702		(27a)
Ground Floor			91.3700	0.1100	10.0507	75.0000	6852.7500 (28a)
Brick	209.4400	47.0700	162.3700	0.1800	29.2266	9.0000	1461.3300 (29a)
Ashlar	5.9400		5.9400	0.1800	1.0692	9.0000	53.4600 (29a)
Joists FF	77.7400		77.7400	0.1100	8.5514	9.0000	699.6600 (30)
Rafters	6.4400	0.7600	5.6800	0.1300	0.7384	9.0000	51.1200 (30)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400 (30)
GF Flat	1.0600		1.0600	0.1300	0.1378	9.0000	9.5400 (30)
Total net area of external elements Aum(A, m ²)			398.5500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	104.9801		(33)
GF			120.0000			9.0000	1080.0000 (32c)
FF			140.0000			9.0000	1260.0000 (32c)
Internal Floor 1			82.3900			18.0000	1483.0200 (32d)
Internal Ceiling 1			83.2900			9.0000	749.6100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13759.5300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							78.7789 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E12 Gable (insulation at ceiling level)	13.1600	0.0600	0.7896
E10 Eaves (insulation at ceiling level)	29.4300	0.0600	1.7658
E16 Corner (normal)	45.3000	0.0900	4.0770
E17 Corner (inverted - internal area greater than external area)	24.9000	-0.0900	-2.2410
R6 Flat ceiling	4.9500	0.0600	0.2970
R8 Roof to wall (rafter)	4.9500	0.0800	0.3960
E2 Other lintels (including other steel lintels)	28.9300	0.0500	1.4465
E3 Sill	28.0000	0.0500	1.4000
E4 Jamb	60.5400	0.0500	3.0270
E5 Ground floor (normal)	44.9200	0.1500	6.7380
E6 Intermediate floor within a dwelling	42.5800	0.0000	0.0000
R1 Head of roof window	0.7800	0.0600	0.0468
R2 Sill of roof window	0.7800	0.0800	0.0624
R3 Jamb of roof window	1.9600	0.0600	0.1176
E14 Flat roof	2.9200	0.0400	0.1168
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			18.0395 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	123.0196 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	87.5888	87.0335	86.4892	83.9326	83.4542	81.2275	81.2275	80.8151	82.0852	83.4542	84.4219	85.4336	(38)
Heat transfer coeff	210.6084	210.0531	209.5087	206.9521	206.4738	204.2470	204.2470	203.8347	205.1048	206.4738	207.4415	208.4531	(39)
Average = Sum(39)m / 12 =												206.9498	
HLP	1.2058	1.2026	1.1995	1.1849	1.1821	1.1694	1.1694	1.1670	1.1743	1.1821	1.1877	1.1935	(40)
HLP (average)												1.1849	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9688 (42)
Hot water usage for mixer showers													
92.4956	91.1055	89.0800	85.2045	82.3444	79.1550	77.3421	79.3523	81.5558	84.9804	88.9391	92.1412	(42a)	
Hot water usage for baths													
31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361	(42b)	
Hot water usage for other uses													
45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332	(42c)	
Average daily hot water use (litres/day)												155.8343	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	169.4729	165.9709	161.6397	154.8948	149.4748	143.6250	141.2597	145.5709	150.1343	156.2908	163.1443	169.0105	(44)
Energy conte	268.4037	236.3403	248.4342	212.0432	201.2219	176.6037	170.8413	180.2471	185.1306	212.0852	232.4290	264.6296	(45)
Energy content (annual)										Total = Sum(45)m =		2588.4099	
Distribution loss (46)m = 0.15 x (45)m													
40.2605	35.4510	37.2651	31.8065	30.1833	26.4906	25.6262	27.0371	27.7696	31.8128	34.8644	39.6944	(46)	
Water storage loss:													
Store volume												300.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7368	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.2281	(55)
Total storage loss													
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)	
If cylinder contains dedicated solar storage													
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3310.5470	(64)
Electric shower(s)												3311	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
138.3100	122.9006	131.6701	117.9874	115.9720	106.2037	105.8705	108.9979	109.0389	119.5841	124.7656	137.0551	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.6549	193.3679	174.6549	180.4767	174.6549	180.4767	174.6549	174.6549	180.4767	174.6549	180.4767	174.6549 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.2728	349.8660	340.8112	321.5346	297.2013	274.3314	259.0530	255.4597	264.5145	283.7912	308.1245	330.9943 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510 (71)
Water heating gains (Table 5)	185.9005	182.8878	176.9760	163.8713	155.8764	147.5052	142.2991	146.5026	151.4429	160.7313	173.2856	184.2138 (72)
Total internal gains	777.3598	796.6534	762.9737	736.4142	698.2642	669.8449	643.5385	644.1488	663.9658	689.7090	732.4184	760.3947 (73)

6. Solar gains

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[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	8.2200		10.6334		0.6300		0.7000		0.7700		26.7126 (74)	
East	17.2500		19.6403		0.6300		0.7000		0.7700		103.5400 (76)	
South	6.3000		46.7521		0.6300		0.7000		0.7700		90.0146 (78)	
West	13.3500		19.6403		0.6300		0.7000		0.7700		80.1310 (80)	
South	0.7600		45.6416		0.6300		0.7000		1.0000		13.7675 (82)	
Solar gains	314.1657	582.6038	903.1594	1263.9933	1524.3540	1554.7573	1482.1787	1285.7933	1029.9855	674.4231	385.4278	262.6896 (83)
Total gains	1091.5255	1379.2572	1666.1330	2000.4075	2222.6181	2224.6022	2125.7173	1929.9421	1693.9513	1364.1321	1117.8462	1023.0843 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	18.1479	18.1958	18.2431	18.4685	18.5113	18.7131	18.7131	18.7509	18.6348	18.5113	18.4249	18.3355
alpha	2.2099	2.2131	2.2162	2.2312	2.2341	2.2475	2.2475	2.2501	2.2423	2.2341	2.2283	2.2224
util living area	0.9468	0.9138	0.8605	0.7638	0.6390	0.4984	0.3852	0.4314	0.6275	0.8280	0.9222	0.9532 (86)
MIT	17.7479	18.2188	18.8944	19.7114	20.3392	20.7364	20.8940	20.8603	20.5330	19.6549	18.5572	17.6755 (87)
Th 2	19.9153	19.9179	19.9204	19.9321	19.9343	19.9446	19.9446	19.9465	19.9406	19.9343	19.9299	19.9252 (88)
util rest of house	0.9399	0.9030	0.8431	0.7348	0.5945	0.4347	0.3039	0.3478	0.5661	0.7994	0.9106	0.9470 (89)
MIT 2	16.1191	16.7109	17.5538	18.5559	19.2924	19.7324	19.8814	19.8582	19.5344	18.5166	17.1519	16.0316 (90)
Living area fraction	16.3355	16.9113	17.7319	18.7095	19.4315	19.8658	20.0160	19.9914	fLA = Living area / (4) =	18.6679	17.3387	0.1329 (91)
MIT	16.3355	16.9113	17.7319	18.7095	19.4315	19.8658	20.0160	19.9914	19.6671	18.6679	17.3387	16.2500 (92)
Temperature adjustment	16.3355	16.9113	17.7319	18.7095	19.4315	19.8658	20.0160	19.9914	19.6671	18.6679	17.3387	0.0000
adjusted MIT	16.3355	16.9113	17.7319	18.7095	19.4315	19.8658	20.0160	19.9914	19.6671	18.6679	17.3387	16.2500 (93)
8. Space heating requirement												
Utilisation	0.9052	0.8609	0.7974	0.6956	0.5712	0.4296	0.3097	0.3515	0.5483	0.7565	0.8703	0.9148 (94)
Useful gains	988.0324	1187.3986	1328.6313	1391.4631	1269.5671	955.7458	658.3236	678.4562	928.8695	1031.9507	972.9157	935.8766 (95)
Ext temp.	4.9000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2534.7824	2523.0045	2353.1851	2030.0868	1596.3502	1075.5269	697.7035	732.0538	1141.8310	1665.8045	2123.9240	2511.8703 (97)
Space heating kWh	1150.7820	897.5272	762.2680	459.8090	243.1266	0.0000	0.0000	0.0000	0.0000	471.5873	828.7260	1172.5393 (98a)
Space heating requirement - total per year (kWh/year)												5986.3654
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1150.7820	897.5272	762.2680	459.8090	243.1266	0.0000	0.0000	0.0000	0.0000	471.5873	828.7260	1172.5393 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5986.3654
Space heating per m2										(98c) / (4) =		34.2744 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1150.7820	897.5272	762.2680	459.8090	243.1266	0.0000	0.0000	0.0000	0.0000	471.5873	828.7260	1172.5393 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	460.4970	359.1545	305.0292	183.9972	97.2896	0.0000	0.0000	0.0000	0.0000	188.7104	331.6230	469.2034 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	188.3129	166.6117	176.9083	154.9954	149.9452	134.7558	132.5948	137.9665	139.6256	156.1493	166.6378	186.1575 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	37.1305	29.7874	26.8203	19.6497	15.1780	12.4005	13.8459	17.9974	23.3768	30.6717	34.6436	38.1624 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

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Annual totals kWh/year		
Space heating fuel - main system 1	2395.5044	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	175.1000	
Water heating fuel used	1890.6608	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	299.6642	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4585.8293	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2395.5044	0.1547	370.5689	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1890.6608	0.1410	266.4945	(264)
Space and water heating			637.0634	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	299.6642	0.1443	43.2508	(268)
Total CO2, kg/year			680.3142	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2395.5044	1.5727	3767.4119	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1890.6608	1.5212	2876.0661	(278)
Space and water heating			6643.4780	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	299.6642	1.5338	459.6350	(282)
Total Primary energy kWh/year			7103.1130	(286)
Dwelling Primary energy Rate (DPER)			40.6700	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880	(1b) - (3b)
First floor	83.2900 (1c)	x 2.7000 (2c)	= 224.8830	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.1710	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0901 (8)
Pressure Test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3401	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2890 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Adj infilt rate												

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Effective ac	0.3685	0.3613	0.3541	0.3180	0.3107	0.2746	0.2746	0.2674	0.2890	0.3107	0.3252	0.3396 (22b)
	0.5679	0.5653	0.5627	0.5505	0.5483	0.5377	0.5377	0.5357	0.5418	0.5483	0.5529	0.5577 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			41.0400	1.1450	46.9924		(27)
Rooflight S			0.6900	1.5038	1.0376		(27a)
Ground Floor			91.3700	0.1300	11.8781		(28a)
Brick	209.4400	42.9900	166.4500	0.1800	29.9610		(29a)
Ashlar	5.9400		5.9400	0.1800	1.0692		(29a)
Joists FF	77.7400		77.7400	0.1100	8.5514		(30)
Rafters	6.4400	0.6900	5.7500	0.1100	0.6325		(30)
GF Joists	6.5600		6.5600	0.1100	0.7216		(30)
GF Flat	1.0600		1.0600	0.1100	0.1166		(30)
Total net area of external elements Aum(A, m2)			398.5500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 102.9104		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

78.7789 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	13.1600	0.0600	0.7896
E10 Eaves (insulation at ceiling level)	29.4300	0.0600	1.7658
E16 Corner (normal)	45.3000	0.0900	4.0770
E17 Corner (inverted - internal area greater than external area)	24.9000	-0.0900	-2.2410
R6 Flat ceiling	4.9500	0.0600	0.2970
R8 Roof to wall (rafter)	4.9500	0.0600	0.2970
E2 Other lintels (including other steel lintels)	28.9300	0.0500	1.4465
E3 Sill	28.0000	0.0500	1.4000
E4 Jamb	60.5400	0.0500	3.0270
E5 Ground floor (normal)	44.9200	0.1600	7.1872
E6 Intermediate floor within a dwelling	42.5800	0.0000	0.0000
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.9600	0.0800	0.1568
E14 Flat roof	2.9200	0.0800	0.2336

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

18.5457 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 121.4561 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	83.2421	82.8556	82.4767	80.6972	80.3642	78.8143	78.8143	78.5273	79.4113	80.3642	81.0378	81.7419 (38)
Heat transfer coeff	204.6981	204.3116	203.9328	202.1532	201.8203	200.2704	200.2704	199.9834	200.8674	201.8203	202.4938	203.1980 (39)
Average = Sum(39)m / 12 =												202.1516

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1720	1.1698	1.1676	1.1574	1.1555	1.1466	1.1466	1.1450	1.1500	1.1555	1.1594	1.1634 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9688 (42)
Hot water usage for mixer showers												
73.9965	72.8844	71.2640	68.1636	65.8756	63.3240	61.8737	63.4818	65.2447	67.9843	71.1513	73.7129 (42a)	
Hot water usage for baths												
31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361 (42b)	
Hot water usage for other uses												
45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332 (42c)	
Average daily hot water use (litres/day)												138.7788 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy content (annual)	150.9738	147.7498	143.8237	137.8539	133.0059	127.7940	125.7913	129.7004	133.8232	139.2947	145.3565	150.5823 (44)
Energy content (annual)	239.1056	210.3937	221.0517	188.7151	179.0516	157.1377	152.1336	160.5962	165.0173	189.0217	207.0870	235.7755 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2305.0866
	35.8658	31.5591	33.1577	28.3073	26.8577	23.5706	22.8200	24.0894	24.7526	28.3532	31.0630	35.3663 (46)

Water storage loss:

Store volume

300.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):

2.1127 (48)

Temperature factor from Table 2b

0.5400 (49)

Enter (49) or (54) in (55)

1.1409 (55)

Total storage loss

35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664 (56)

If cylinder contains dedicated solar storage

35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664 (57)

Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

297.7344	263.3488	279.6805	245.4527	237.6804	213.8752	210.7624	219.2250	221.7549	247.6505	263.8245	294.4043 (62)

WWHRS	-33.8281	-29.9178	-31.3282	-25.9410	-24.1761	-20.6877	-19.3914	-20.6208	-21.4042	-25.2332	-28.5862	-33.2016 (63a)

PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)

FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

263.9063	233.4309	248.3522	219.5116	213.5043	193.1876	191.3711	198.6042	200.3507	222.4172	235.2383	261.2026 (64)

12Total per year (kWh/year)

Total per year (kWh/year) = Sum(64)m = 2681.0771 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

126.4057	112.3200	120.4027	108.1378	106.4377	97.6383	97.4875	100.3013	100.2583	109.7528	114.2465	125.2984 (65)

5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.6549	193.3679	174.6549	180.4767	174.6549	180.4767	174.6549	174.6549	180.4767	174.6549	180.4767	174.6549	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.2728	349.8660	340.8112	321.5346	297.2013	274.3314	259.0530	255.4597	264.5145	283.7912	308.1245	330.9943	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	(71)
Water heating gains (Table 5)	169.9001	167.1428	161.8316	150.1914	143.0614	135.6088	131.0316	134.8136	139.2477	147.5171	158.6757	168.4118	(72)
Total internal gains	761.3594	780.9084	747.8293	722.7343	685.4492	657.9485	632.2710	632.4598	651.7705	676.4948	717.8085	744.5927	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
North					7.4800	10.6334	0.6300	0.7000			0.7700	24.3078 (74)	
East					15.6900	19.6403	0.6300	0.7000			0.7700	94.1764 (76)	
South					5.7300	46.7521	0.6300	0.7000			0.7700	81.8705 (78)	
West					12.1400	19.6403	0.6300	0.7000			0.7700	72.8682 (80)	
South					0.6900	45.6416	0.6300	0.7000			1.0000	12.4994 (82)	
Solar gains	285.7222	529.8579	821.3964	1149.5741	1386.3774	1414.0340	1348.0225	1169.4047	936.7440	613.3653	350.5326	238.9066	(83)
Total gains	1047.0816	1310.7662	1569.2257	1872.3084	2071.8266	2071.9826	1980.2935	1801.8645	1588.5145	1289.8601	1068.3411	983.4993	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	18.6718	18.7072	18.7419	18.9069	18.9381	19.0847	19.0847	19.1120	19.0279	18.9381	18.8751	18.8097		
alpha	2.2448	2.2471	2.2495	2.2605	2.2625	2.2723	2.2723	2.2741	2.2685	2.2625	2.2583	2.2540		
util living area	0.9502	0.9199	0.8706	0.7796	0.6586	0.5186	0.4028	0.4496	0.6455	0.8390	0.9273	0.9562	(86)	
MIT	17.7845	18.2330	18.8857	19.6838	20.3156	20.7224	20.8880	20.8528	20.5175	19.6422	18.5679	17.7072	(87)	
Th 2	19.9425	19.9443	19.9460	19.9542	19.9558	19.9629	19.9629	19.9643	19.9602	19.9558	19.9526	19.9494	(88)	
util rest of house	0.9438	0.9098	0.8544	0.7520	0.6152	0.4549	0.3202	0.3651	0.5853	0.8120	0.9165	0.9505	(89)	
MIT 2	16.1763	16.7411	17.5576	18.5394	19.2850	19.7368	19.8951	19.8698	19.5357	18.5155	17.1764	16.0816	(90)	
Living area fraction									fLA = Living area / (4) =			0.1329	(91)	
MIT	16.3900	16.9393	17.7341	18.6915	19.4219	19.8678	20.0270	20.0004	19.6661	18.6653	17.3613	16.2976	(92)	
Temperature adjustment												0.0000		
adjusted MIT	16.3900	16.9393	17.7341	18.6915	19.4219	19.8678	20.0270	20.0004	19.6661	18.6653	17.3613	16.2976	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9109	0.8696	0.8099	0.7123	0.5905	0.4486	0.3255	0.3683	0.5662	0.7695	0.8779	0.9198	(94)	
Useful gains	953.7518	1139.8080	1270.9628	1333.7126	1223.3249	929.4907	644.6624	663.5388	899.4058	992.4978	937.8577	904.6597	(95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Heat loss rate W	2474.8011	2459.7782	2291.0069	1979.3785	1558.4457	1054.9777	686.3278	720.0235	1118.0516	1627.7320	2077.8445	2458.2167	(97)	
Space heating kWh	1131.6606	887.0200	758.9128	464.8794	249.3299	0.0000	0.0000	0.0000	0.0000	472.6143	820.7905	1155.8464	(98a)	
Space heating requirement - total per year (kWh/year)												5941.0539		
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)	
Solar heating contribution - total per year (kWh/year)												0.0000		
Space heating kWh	1131.6606	887.0200	758.9128	464.8794	249.3299	0.0000	0.0000	0.0000	0.0000	472.6143	820.7905	1155.8464	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												5941.0539		
Space heating per m2										(98c) / (4) =		34.0150	(99)	

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													92.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1131.6606	887.0200	758.9128	464.8794	249.3299	0.0000	0.0000	0.0000	0.0000	472.6143	820.7905	1155.8464	(98)	
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)	
Space heating fuel (main heating system)	1226.0679	961.0184	822.2240	503.6614	270.1299	0.0000	0.0000	0.0000	0.0000	512.0414	889.2638	1252.2712	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	263.9063	233.4309	248.3522	219.5116	213.5043	193.1876	191.3711	198.6042	200.3507	222.4172	235.2383	261.2026	(64)	
Efficiency of water heater												79.8000	(216)	

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(217)m	86.9457	86.7614	86.3975	85.6999	84.4086	79.8000	79.8000	79.8000	79.8000	85.7067	86.6237	86.9915	(217)
Fuel for water heating, kWh/month	303.5301	269.0493	287.4531	256.1399	252.9415	242.0897	239.8134	248.8775	251.0660	259.5096	271.5633	300.2621	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	36.2898	29.1131	26.2131	19.2048	14.8344	12.1198	13.5324	17.5899	22.8476	29.9772	33.8592	37.2984	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-76.8315	-104.1866	-144.0630	-155.5295	-162.3330	-149.4522	-147.3730	-141.5471	-130.7761	-115.7544	-82.8829	-66.8999	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-56.9521	-117.9380	-231.1379	-342.6225	-448.8725	-449.6913	-444.6030	-378.5109	-280.0768	-167.3716	-75.5853	-45.2001	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												6436.6781	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3182.2955	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												292.8797	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4516.1912	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5481.6622	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6436.6781	0.2100	1351.7024 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3182.2955	0.2100	668.2820 (264)
Space and water heating			2019.9845 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	292.8797	0.1443	42.2716 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1477.6292	0.1355	-200.1669
PV Unit electricity exported	-3038.5620	0.1263	-383.7021
Total			-583.8690 (269)
Total CO2, kg/year			1490.3163 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.5300 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	6436.6781	1.1300	7273.4463 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3182.2955	1.1300	3595.9939 (278)
Space and water heating			10869.4402 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	292.8797	1.5338	449.2287 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1477.6292	1.5007	-2217.4842
PV Unit electricity exported	-3038.5620	0.4635	-1408.5001
Total			-3625.9843 (283)
Total Primary energy kWh/year			7822.7854 (286)
Target Primary Energy Rate (TPER)			44.7900 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880 (1b) - (3b)
First floor	83.2900 (1c)	x 2.7000 (2c)	= 224.8830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.1710 (5)

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2. Ventilation rate

											m3 per hour				
Number of open chimneys	0 * 80 =											0.0000 (6a)			
Number of open flues	0 * 20 =											0.0000 (6b)			
Number of chimneys / flues attached to closed fire	0 * 10 =											0.0000 (6c)			
Number of flues attached to solid fuel boiler	0 * 20 =											0.0000 (6d)			
Number of flues attached to other heater	0 * 35 =											0.0000 (6e)			
Number of blocked chimneys	0 * 20 =											0.0000 (6f)			
Number of intermittent extract fans	4 * 10 =											40.0000 (7a)			
Number of passive vents	0 * 10 =											0.0000 (7b)			
Number of flueless gas fires	0 * 40 =											0.0000 (7c)			
											Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =		0.0901 (8)	
Pressure test												Yes			
Pressure Test Method												Blower Door			
Measured/design AP50												5.0000		(17)	
Infiltration rate												0.3401		(18)	
Number of sides sheltered												2		(19)	
Shelter factor												(20) = 1 - [0.075 x (19)] =		0.8500 (20)	
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =		0.2890 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)		
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)		
Adj infilt rate	0.3685	0.3613	0.3541	0.3180	0.3107	0.2746	0.2746	0.2674	0.2890	0.3107	0.3252	0.3396	(22b)		
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000	(23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000	(23c)	
Effective ac	0.5679	0.5653	0.5627	0.5505	0.5483	0.5377	0.5377	0.5357	0.5418	0.5483	0.5529	0.5577	(25)		

3. Heat losses and heat loss parameter

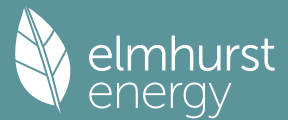
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			45.1200	1.1450	51.6641			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Rooflight S			0.7600	1.1450	0.8702			(27a)
Ground Floor			91.3700	0.1100	10.0507	75.0000	6852.7500	(28a)
Brick	209.4400	47.0700	162.3700	0.1800	29.2266	9.0000	1461.3300	(29a)
Ashlar	5.9400		5.9400	0.1800	1.0692	9.0000	53.4600	(29a)
Joists FF	77.7400		77.7400	0.1100	8.5514	9.0000	699.6600	(30)
Rafters	6.4400	0.7600	5.6800	0.1300	0.7384	9.0000	51.1200	(30)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
GF Flat	1.0600		1.0600	0.1300	0.1378	9.0000	9.5400	(30)
Total net area of external elements Aum(A, m2)			398.5500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	104.9801			(33)
GF			120.0000			9.0000	1080.0000	(32c)
FF			140.0000			9.0000	1260.0000	(32c)
Internal Floor 1			82.3900			18.0000	1483.0200	(32d)
Internal Ceiling 1			83.2900			9.0000	749.6100	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		13759.5300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							78.7789	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E12 Gable (insulation at ceiling level)				13.1600	0.0600		0.7896	
E10 Eaves (insulation at ceiling level)				29.4300	0.0600		1.7658	
E16 Corner (normal)				45.3000	0.0900		4.0770	
E17 Corner (inverted - internal area greater than external area)				24.9000	-0.0900		-2.2410	
R6 Flat ceiling				4.9500	0.0600		0.2970	
R8 Roof to wall (rafter)				4.9500	0.0800		0.3960	
E2 Other lintels (including other steel lintels)				28.9300	0.0500		1.4465	
E3 Sill				28.0000	0.0500		1.4000	
E4 Jamb				60.5400	0.0500		3.0270	
E5 Ground floor (normal)				44.9200	0.1500		6.7380	
E6 Intermediate floor within a dwelling				42.5800	0.0000		0.0000	
R1 Head of roof window				0.7800	0.0600		0.0468	
R2 Sill of roof window				0.7800	0.0800		0.0624	
R3 Jamb of roof window				1.9600	0.0600		0.1176	
E14 Flat roof				2.9200	0.0400		0.1168	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.0395	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		123.0196	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	83.2421	82.8556	82.4767	80.6972	80.3642	78.8143	78.8143	78.5273	79.4113	80.3642	81.0378	81.7419 (38)
Heat transfer coeff	206.2616	205.8751	205.4962	203.7167	203.3838	201.8339	201.8339	201.5468	202.4309	203.3838	204.0573	204.7615 (39)
Average = Sum(39)m / 12 =												203.7151
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1809	1.1787	1.1766	1.1664	1.1645	1.1556	1.1556	1.1539	1.1590	1.1645	1.1683	1.1723 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9688 (42)
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
	31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361 (42b)
Hot water usage for other uses												
	45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332 (42c)
Average daily hot water use (litres/day)												70.5565 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.9773	74.8654	72.5597	69.6903	67.1304	64.4701	63.9176	66.2186	68.5785	71.3104	74.2052	76.8693	(44)
Energy conte	121.9133	106.6073	111.5216	95.4026	90.3704	79.2735	77.3028	81.9924	84.5641	96.7676	105.7189	120.3588	(45)
Energy content (annual)	Total = Sum(45)m = 1171.7932												
Distribution loss	(46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
WWHRS	103.6263	90.6162	94.7933	81.0922	76.8148	67.3824	65.7074	69.6936	71.8795	82.2525	89.8611	102.3050	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.6263	90.6162	94.7933	81.0922	76.8148	67.3824	65.7074	69.6936	71.8795	82.2525	89.8611	102.3050	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 996 (64)												
Electric shower(s)	59.2588	52.8001	57.6557	55.0201	56.0525	53.4687	55.2510	56.0525	55.0201	57.6557	56.5715	59.2588	(64a)
Heat gains from water heating, kWh/month	40.7213	35.8541	38.1123	34.0281	33.2168	30.2128	30.2396	31.4365	31.7249	34.9770	36.6082	40.3910	(65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 674.0657 (64a)													

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.6549	193.3679	174.6549	180.4767	174.6549	180.4767	174.6549	174.6549	180.4767	174.6549	180.4767	174.6549	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.2728	349.8660	340.8112	321.5346	297.2013	274.3314	259.0530	255.4597	264.5145	283.7912	308.1245	330.9943	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	(71)
Water heating gains (Table 5)	54.7329	53.3543	51.2261	47.2612	44.6463	41.9622	40.6446	42.2534	44.0624	47.0121	50.8447	54.2889	(72)
Total internal gains	643.1922	664.1198	634.2239	616.8041	584.0341	564.3019	541.8841	539.8996	556.5852	572.9898	606.9775	627.4698	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				8.2200	10.6334		0.6300		0.7000		0.7700		26.7126 (74)
East				17.2500	19.6403		0.6300		0.7000		0.7700		103.5400 (76)
South				6.3000	46.7521		0.6300		0.7000		0.7700		90.0146 (78)
West				13.3500	19.6403		0.6300		0.7000		0.7700		80.1310 (80)
South				0.7600	45.6416		0.6300		0.7000		1.0000		13.7675 (82)
Solar gains	314.1657	582.6038	903.1594	1263.9933	1524.3540	1554.7573	1482.1787	1285.7933	1029.9855	674.4231	385.4278		262.6896 (83)
Total gains	957.3579	1246.7236	1537.3832	1880.7974	2108.3881	2119.0593	2024.0628	1825.6930	1586.5707	1247.4129	992.4052		890.1594 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.5303	18.5651	18.5993	18.7618	18.7925	18.9368	18.9368	18.9638	18.8810	18.7925	18.7305	18.6661
alpha	2.2354	2.2377	2.2400	2.2508	2.2528	2.2625	2.2625	2.2643	2.2587	2.2528	2.2487	2.2444
util living area	0.9581	0.9270	0.8755	0.7796	0.6542	0.5126	0.3978	0.4473	0.6479	0.8478	0.9366	0.9639 (86)
MIT	17.6585	18.1431	18.8362	19.6720	20.3185	20.7257	20.8892	20.8524	20.5082	19.5926	18.4663	17.5747 (87)
Th 2	19.9353	19.9371	19.9388	19.9470	19.9485	19.9557	19.9557	19.9570	19.9529	19.9485	19.9454	19.9422 (88)
util rest of house	0.9525	0.9176	0.8596	0.7518	0.6105	0.4488	0.3154	0.3625	0.5875	0.8217	0.9269	0.9591 (89)
MIT 2	16.8771	17.3544	18.0315	18.8348	19.4289	19.7822	19.9037	19.8835	19.6159	18.7823	17.6849	16.7985 (90)
Living area fraction	FLA = Living area / (4) = 0.1329 (91)											
MIT	16.9809	17.4592	18.1384	18.9460	19.5471	19.9076	20.0346	20.0122	19.7345	18.8900	17.7887	16.9017 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.9809	17.4592	18.1384	18.9460	19.5471	19.9076	20.0346	20.0122	19.7345	18.8900	17.7887	16.9017 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9303	0.8882	0.8256	0.7211	0.5920	0.4457	0.3219	0.3673	0.5734	0.7888	0.8995	0.9388	(94)
Useful gains	890.5891	1107.3869	1269.2507	1356.1816	1248.2696	944.3593	651.6062	670.5834	909.6776	983.9361	892.6204	835.7039	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2615.5862	2585.6209	2391.6515	2046.5431	1595.9739	1071.2441	693.2282	728.0324	1140.5888	1686.0437	2181.1064	2600.8166	(97)
Space heating kWh	1283.3979	993.3732	835.0662	497.0603	258.6920	0.0000	0.0000	0.0000	0.0000	522.3681	927.7099	1313.2439	(98a)
Space heating requirement - total per year (kWh/year)	6630.9114												
Solar heating kWh													

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Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	1283.3979	993.3732	835.0662	497.0603	258.6920	0.0000	0.0000	0.0000	0.0000	522.3681	927.7099	1313.2439 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6630.9114
Space heating per m2										(98c) / (4) =		37.9647 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1897.2383	1493.5706	1531.7560	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7688	0.8232	0.7877	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1458.6417	1229.5574	1206.6256	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	2389.2531	2281.9417	2054.6560	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	670.0402	782.9740	630.9346	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	167.5100	195.7435	157.7336	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												520.9872 (107)
Energy for space heating												37.9647 (99)
Energy for space cooling												2.9829 (108)
Total												40.9475 (109)
Fabric Energy Efficiency (DFEE)												40.9 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880 (1b) - (3b)
First floor	83.2900 (1c)	x 2.7000 (2c)	= 224.8830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	444.1710 (5)

2. Ventilation rate

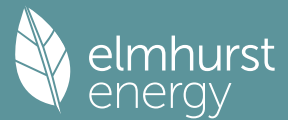
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0901 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3401 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2890 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3685	0.3613	0.3541	0.3180	0.3107	0.2746	0.2746	0.2674	0.2890	0.3107	0.3252	0.3396 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5679	0.5653	0.5627	0.5505	0.5483	0.5377	0.5377	0.5357	0.5418	0.5483	0.5529	0.5577 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			41.0400	1.1450	46.9924		(27)
Rooflight S			0.6900	1.5038	1.0376		(27a)
Ground Floor			91.3700	0.1300	11.8781		(28a)
Brick	209.4400	42.9900	166.4500	0.1800	29.9610		(29a)
Ashlar	5.9400		5.9400	0.1800	1.0692		(29a)
Joists FF	77.7400		77.7400	0.1100	8.5514		(30)
Rafters	6.4400	0.6900	5.7500	0.1100	0.6325		(30)

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GF Joists	6.5600	6.5600	0.1100	0.7216	(30)
GF Flat	1.0600	1.0600	0.1100	0.1166	(30)
Total net area of external elements Aum(A, m2)		398.5500			(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	102.9104		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 78.7789 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	13.1600	0.0600	0.7896
E10 Eaves (insulation at ceiling level)	29.4300	0.0600	1.7658
E16 Corner (normal)	45.3000	0.0900	4.0770
E17 Corner (inverted - internal area greater than external area)	24.9000	-0.0900	-2.2410
R6 Flat ceiling	4.9500	0.0600	0.2970
R8 Roof to wall (rafter)	4.9500	0.0600	0.2970
E2 Other lintels (including other steel lintels)	28.9300	0.0500	1.4465
E3 Sill	28.0000	0.0500	1.4000
E4 Jamb	60.5400	0.0500	3.0270
E5 Ground floor (normal)	44.9200	0.1600	7.1872
E6 Intermediate floor within a dwelling	42.5800	0.0000	0.0000
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.9600	0.0800	0.1568
E14 Flat roof	2.9200	0.0800	0.2336

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.5457 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 121.4561 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	83.2421	82.8556	82.4767	80.6972	80.3642	78.8143	78.8143	78.5273	79.4113	80.3642	81.0378	81.7419	(38)
Average = Sum(39)m / 12 =	204.6981	204.3116	203.9328	202.1532	201.8203	200.2704	200.2704	199.9834	200.8674	201.8203	202.4938	203.1980	(39)
												202.1516	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	1.1720	1.1698	1.1676	1.1574	1.1555	1.1466	1.1466	1.1450	1.1500	1.1555	1.1594	1.1634	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9688 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361	(42b)
Hot water usage for other uses	45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332	(42c)
Average daily hot water use (litres/day)												70.5565	(43)
Daily hot water use	76.9773	74.8654	72.5597	69.6903	67.1304	64.4701	63.9176	66.2186	68.5785	71.3104	74.2052	76.8693	(44)
Energy content (annual)	121.9133	106.6073	111.5216	95.4026	90.3704	79.2735	77.3028	81.9924	84.5641	96.7676	105.7189	120.3588	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	103.6263	90.6162	94.7933	81.0922	76.8148	67.3824	65.7074	69.6936	71.8795	82.2525	89.8611	102.3050	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.6263	90.6162	94.7933	81.0922	76.8148	67.3824	65.7074	69.6936	71.8795	82.2525	89.8611	102.3050	(64)
12Total per year (kWh/year)												996.0243	(64)
Electric shower(s)	59.2588	52.8001	57.6557	55.0201	56.0525	53.4687	55.2510	56.0525	55.0201	57.6557	56.5715	59.2588	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												674.0657	(64a)
Heat gains from water heating, kWh/month	40.7213	35.8541	38.1123	34.0281	33.2168	30.2128	30.2396	31.4365	31.7249	34.9770	36.6082	40.3910	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.6549	193.3679	174.6549	180.4767	174.6549	180.4767	174.6549	174.6549	180.4767	174.6549	180.4767	174.6549	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.2728	349.8660	340.8112	321.5346	297.2013	274.3314	259.0530	255.4597	264.5145	283.7912	308.1245	330.9943	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	(71)
Water heating gains (Table 5)	54.7329	53.3543	51.2261	47.2612	44.6463	41.9622	40.6446	42.2534	44.0624	47.0121	50.8447	54.2889	(72)
Total internal gains	643.1922	664.1198	634.2239	616.8041	584.0341	564.3019	541.8841	539.8996	556.5852	572.9898	606.9775	627.4698	(73)

6. Solar gains

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[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.4800	10.6334	0.6300	0.7000	0.7700	24.3078 (74)
East	15.6900	19.6403	0.6300	0.7000	0.7700	94.1764 (76)
South	5.7300	46.7521	0.6300	0.7000	0.7700	81.8705 (78)
West	12.1400	19.6403	0.6300	0.7000	0.7700	72.8682 (80)
South	0.6900	45.6416	0.6300	0.7000	1.0000	12.4994 (82)

Solar gains	285.7222	529.8579	821.3964	1149.5741	1386.3774	1414.0340	1348.0225	1169.4047	936.7440	613.3653	350.5326	238.9066 (83)
Total gains	928.9145	1193.9777	1455.6202	1766.3782	1970.4115	1978.3360	1889.9065	1709.3044	1493.3292	1186.3551	957.5101	866.3764 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.6718	18.7072	18.7419	18.9069	18.9381	19.0847	19.0847	19.1120	19.0279	18.9381	18.8751	18.8097
alpha	2.2448	2.2471	2.2495	2.2605	2.2625	2.2723	2.2723	2.2741	2.2685	2.2625	2.2583	2.2540
util living area	0.9603	0.9321	0.8855	0.7965	0.6765	0.5357	0.4184	0.4682	0.6678	0.8584	0.9404	0.9657 (86)
MIT	17.6480	18.1097	18.7829	19.6132	20.2735	20.7025	20.8787	20.8397	20.4797	19.5570	18.4476	17.5691 (87)
Th 2	19.9425	19.9443	19.9460	19.9542	19.9558	19.9629	19.9629	19.9643	19.9602	19.9558	19.9526	19.9494 (88)
util rest of house	0.9551	0.9234	0.8706	0.7700	0.6336	0.4713	0.3336	0.3817	0.6083	0.8336	0.9313	0.9611 (89)
MIT 2	16.8712	17.3266	17.9858	18.7872	19.3979	19.7730	19.9053	19.8834	19.6005	18.7548	17.6713	16.7974 (90)
Living area fraction	16.9744	17.4307	18.0917	18.8970	19.5143	19.8965	20.0346	20.0105	fLA = Living area / (4) =			0.1329 (91)
MIT	16.9744	17.4307	18.0917	18.8970	19.5143	19.8965	20.0346	20.0105	19.7173	18.8614	17.7745	16.9000 (92)
Temperature adjustment												0.0000
adjusted MIT	16.9744	17.4307	18.0917	18.8970	19.5143	19.8965	20.0346	20.0105	19.7173	18.8614	17.7745	16.9000 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9336	0.8951	0.8372	0.7385	0.6134	0.4668	0.3398	0.3859	0.5926	0.8008	0.9047	0.9416	(94)
Useful gains	867.2628	1068.6831	1218.7018	1304.4525	1208.7057	923.5261	642.1679	659.5609	884.9072	950.0570	866.2771	815.7625	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2594.4259	2560.1591	2363.9318	2020.9217	1577.0796	1060.7349	687.8511	722.0352	1128.3303	1667.3240	2161.5144	2580.6093	(97)
Space heating kWh	1285.0093	1002.2719	852.0511	515.8578	274.0702	0.0000	0.0000	0.0000	0.0000	533.6466	932.5709	1313.0460	(98a)
Space heating requirement - total per year (kWh/year)												6708.5238	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1285.0093	1002.2719	852.0511	515.8578	274.0702	0.0000	0.0000	0.0000	0.0000	533.6466	932.5709	1313.0460	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6708.5238	
Space heating per m2										(98c) / (4) =		38.4090	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1882.5415	1482.0008	1519.8735	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7502	0.8075	0.7708	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1412.2582	1196.6692	1171.5899	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2225.6782	2126.0047	1919.3889	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	585.6625	691.4256	556.3624	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	146.4156	172.8564	139.0906	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												458.3626 (107)
Energy for space heating												38.4090 (99)
Energy for space cooling												2.6243 (108)
Total												41.0334 (109)
Fabric Energy Efficiency (TFEE)												41.0 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	91.3700 (1b)	x	2.4000 (2b) =
First floor	83.2900 (1c)	x	2.7000 (2c) =
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	444.1710 (5)

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2. Ventilation rate

										m3 per hour			
Number of open chimneys										0 * 80 =	0.0000 (6a)		
Number of open flues										0 * 20 =	0.0000 (6b)		
Number of chimneys / flues attached to closed fire										1 * 10 =	10.0000 (6c)		
Number of flues attached to solid fuel boiler										0 * 20 =	0.0000 (6d)		
Number of flues attached to other heater										0 * 35 =	0.0000 (6e)		
Number of blocked chimneys										0 * 20 =	0.0000 (6f)		
Number of intermittent extract fans										6 * 10 =	60.0000 (7a)		
Number of passive vents										0 * 10 =	0.0000 (7b)		
Number of flueless gas fires										0 * 40 =	0.0000 (7c)		
										Air changes per hour			
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =									70.0000 / (5) =	0.1576 (8)		
Pressure test											Yes		
Pressure Test Method											Blower Door		
Measured/design AP50											5.0000 (17)		
Infiltration rate											0.4076 (18)		
Number of sides sheltered											2 (19)		
										(20) = 1 - [0.075 x (19)] =		0.8500 (20)	
Shelter factor											(21) = (18) x (20) =		0.3465 (21)
Infiltration rate adjusted to include shelter factor													

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Effective ac	0.4417	0.4331	0.4244	0.3811	0.3724	0.3291	0.3291	0.3205	0.3465	0.3724	0.3898	0.4071	(22b)
	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			45.1200	1.1450	51.6641			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Rooflight S			0.7600	1.1450	0.8702			(27a)
Ground Floor			91.3700	0.1100	10.0507	75.0000	6852.7500	(28a)
Brick	209.4400	47.0700	162.3700	0.1800	29.2266	9.0000	1461.3300	(29a)
Ashlar	5.9400		5.9400	0.1800	1.0692	9.0000	53.4600	(29a)
Joists FF	77.7400		77.7400	0.1100	8.5514	9.0000	699.6600	(30)
Rafters	6.4400	0.7600	5.6800	0.1300	0.7384	9.0000	51.1200	(30)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
GF Flat	1.0600		1.0600	0.1300	0.1378	9.0000	9.5400	(30)
Total net area of external elements Aum(A, m2)			398.5500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	104.9801			(33)
GF			120.0000			9.0000	1080.0000	(32c)
FF			140.0000			9.0000	1260.0000	(32c)
Internal Floor 1			82.3900			18.0000	1483.0200	(32d)
Internal Ceiling 1			83.2900			9.0000	749.6100	(32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13759.5300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							78.7789	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E12 Gable (insulation at ceiling level)				13.1600	0.0600	0.7896		
E10 Eaves (insulation at ceiling level)				29.4300	0.0600	1.7658		
E16 Corner (normal)				45.3000	0.0900	4.0770		
E17 Corner (inverted - internal area greater than external area)				24.9000	-0.0900	-2.2410		
R6 Flat ceiling				4.9500	0.0600	0.2970		
R8 Roof to wall (rafter)				4.9500	0.0800	0.3960		
E2 Other lintels (including other steel lintels)				28.9300	0.0500	1.4465		
E3 Sill				28.0000	0.0500	1.4000		
E4 Jamb				60.5400	0.0500	3.0270		
E5 Ground floor (normal)				44.9200	0.1500	6.7380		
E6 Intermediate floor within a dwelling				42.5800	0.0000	0.0000		
R1 Head of roof window				0.7800	0.0600	0.0468		
R2 Sill of roof window				0.7800	0.0800	0.0624		
R3 Jamb of roof window				1.9600	0.0600	0.1176		
E14 Flat roof				2.9200	0.0400	0.1168		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.0395	(36)
Point Thermal bridges							(36a) = 0.0000	
Total fabric heat loss							(33) + (36) + (36a) =	123.0196 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	87.5888	87.0335	86.4892	83.9326	83.4542	81.2275	81.2275	80.8151	82.0852	83.4542	84.4219	85.4336 (38)
Average = Sum(39)m / 12 =	210.6084	210.0531	209.5087	206.9521	206.4738	204.2470	204.2470	203.8347	205.1048	206.4738	207.4415	208.4531 (39)
												206.9498
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2058	1.2026	1.1995	1.1849	1.1821	1.1694	1.1694	1.1670	1.1743	1.1821	1.1877	1.1935 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

												2.9688 (42)
Assumed occupancy												
Hot water usage for mixer showers												
	92.4956	91.1055	89.0800	85.2045	82.3444	79.1550	77.3421	79.3523	81.5558	84.9804	88.9391	92.1412 (42a)
Hot water usage for baths												
	31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361 (42b)
Hot water usage for other uses												
	45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332 (42c)
Average daily hot water use (litres/day)												155.8343 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Energy conte	169.4729	165.9709	161.6397	154.8948	149.4748	143.6250	141.2597	145.5709	150.1343	156.2908	163.1443	169.0105 (44)
Energy content (annual)	268.4037	236.3403	248.4342	212.0432	201.2219	176.6037	170.8413	180.2471	185.1306	212.0852	232.4290	264.6296 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2588.4099
Water storage loss:	40.2605	35.4510	37.2651	31.8065	30.1833	26.4906	25.6262	27.0371	27.7696	31.8128	34.8644	39.6944 (46)
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7368 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss												
	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (56)
If cylinder contains dedicated solar storage												
	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	138.3100	122.9006	131.6701	117.9874	115.9720	106.2037	105.8705	108.9979	109.0389	119.5841	124.7656	137.0551 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	42.4206	37.6776	30.6415	23.1976	17.3404	14.6395	15.8185	20.5615	27.5976	35.0415	40.8987	43.5996 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	516.8251	522.1881	508.6735	479.9024	453.5840	409.4499	386.6462	381.2832	394.7978	423.5689	459.8873	494.0214 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510 (71)
Water heating gains (Table 5)												
	185.9005	182.8878	176.9760	163.8713	155.8764	147.5052	142.2991	146.5026	151.4429	160.7313	173.2856	184.2138 (72)
Total internal gains												
	863.3031	860.9104	834.4478	785.1282	734.9578	686.7515	659.9207	663.5042	688.9953	737.4987	792.2285	839.9917 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					8.2200	10.6334	0.6300	0.7000	0.7700		26.7126 (74)	
East					17.2500	19.6403	0.6300	0.7000	0.7700		103.5400 (76)	
South					6.3000	46.7521	0.6300	0.7000	0.7700		90.0146 (78)	
West					13.3500	19.6403	0.6300	0.7000	0.7700		80.1310 (80)	
South					0.7600	45.6416	0.6300	0.7000	1.0000		13.7675 (82)	
Solar gains	314.1657	582.6038	903.1594	1263.9933	1524.3540	1554.7573	1482.1787	1285.7933	1029.9855	674.4231	385.4278	262.6896 (83)
Total gains	1177.4688	1443.5142	1737.6072	2049.1214	2259.3117	2241.5088	2142.0995	1949.2976	1718.9808	1411.9218	1177.6562	1102.6814 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.1479	18.1958	18.2431	18.4685	18.5113	18.7131	18.7131	18.7509	18.6348	18.5113	18.4249	18.3355
alpha	2.2099	2.2131	2.2162	2.2312	2.2341	2.2475	2.2475	2.2501	2.2423	2.2341	2.2283	2.2224
util living area												
	0.9389	0.9069	0.8512	0.7564	0.6330	0.4956	0.3828	0.4280	0.6221	0.8192	0.9148	0.9462 (86)
MIT												
	17.8423	18.2826	18.9540	19.7405	20.3525	20.7394	20.8954	20.8626	20.5416	19.6908	18.6184	17.7652 (87)
Th 2												
	19.9153	19.9179	19.9204	19.9321	19.9343	19.9446	19.9446	19.9465	19.9406	19.9343	19.9299	19.9252 (88)
util rest of house												
	0.9311	0.8954	0.8330	0.7269	0.5884	0.4321	0.3018	0.3448	0.5607	0.7897	0.9024	0.9392 (89)
MIT 2												
	16.2373	16.7898	17.6257	18.5893	19.3062	19.7350	19.8823	19.8598	19.5426	18.5581	17.2275	16.1442 (90)
Living area fraction												
	16.4506	16.9882	17.8022	18.7423	19.4453	19.8685	20.0169	19.9931	19.6753	18.7086	17.4124	16.3596 (92)
MIT												
	16.4506	16.9882	17.8022	18.7423	19.4453	19.8685	20.0169	19.9931	19.6753	18.7086	17.4124	16.3596 (93)
Temperature adjustment												
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8941	0.8523	0.7874	0.6884	0.5658	0.4272	0.3077	0.3487	0.5435	0.7473	0.8609	0.9046 (94)
Useful gains	1052.7966	1230.2923	1368.1093	1410.7169	1278.3463	957.6221	659.0442	679.6739	934.2325	1055.1104	1013.8209	997.5057 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	2559.0156	2539.1639	2367.9068	2036.8823	1599.1929	1076.0738	697.8999	732.3922	1143.5291	1674.2235	2139.2093	2534.7128 (97)
Space heating kWh												
	1120.6270	879.5617	743.8493	450.8391	238.7099	0.0000	0.0000	0.0000	0.0000	460.6201	810.2797	1143.6821 (98a)

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Space heating requirement - total per year (kWh/year)	5848.1690										
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000										
Space heating kWh	1120.6270	879.5617	743.8493	450.8391	238.7099	0.0000	0.0000	0.0000	0.0000	460.6201	810.2797
Space heating requirement after solar contribution - total per year (kWh/year)											1143.6821 (98c)
Space heating per m2	(98c) / (4) =										33.4832 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1120.6270	879.5617	743.8493	450.8391	238.7099	0.0000	0.0000	0.0000	0.0000	460.6201	810.2797	1143.6821 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	448.4302	351.9655	297.6588	180.4078	95.5222	0.0000	0.0000	0.0000	0.0000	184.3218	324.2416	457.6559 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	188.3129	166.6117	176.9083	154.9954	149.9452	134.7558	132.5948	137.9665	139.6256	156.1493	166.6378	186.1575 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	37.1305	29.7874	26.8203	19.6497	15.1780	12.4005	13.8459	17.9974	23.3768	30.6717	34.6436	38.1624 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												2340.2037 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1890.6608 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												299.6642 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												4530.5286 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2340.2037	16.4900	385.8996 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1890.6608	16.4900	311.7700 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	299.6642	16.4900	49.4146 (250)
Additional standing charges			0.0000 (251)
Total energy cost			747.0842 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =		1.2244 (257)
SAP value			80.1526
SAP rating (Section 12)			80 (258)
SAP band			C

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12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2340.2037	0.1547	361.9838 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1890.6608	0.1410	266.4945 (264)
Space and water heating			628.4783 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	299.6642	0.1443	43.2508 (268)
Total CO2, kg/year			671.7291 (272)
CO2 emissions per m2			3.8500 (273)
EI value			95.9022
EI rating			96 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880 (1b) - (3b)
First floor	83.2900 (1c)	x 2.7000 (2c)	= 224.8830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600		(4)
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	444.1710 (5)

2. Ventilation rate

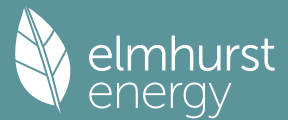
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1576 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4076 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3465 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3118	0.2858	0.2772	0.2772	0.2858	0.2512	0.2685	0.2425	0.2425	0.2598	0.2425	0.2772 (22b)
Effective ac	0.5486	0.5408	0.5384	0.5384	0.5408	0.5315	0.5360	0.5294	0.5294	0.5338	0.5294	0.5384 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			45.1200	1.1450	51.6641		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Rooflight S			0.7600	1.1450	0.8702		(27a)
Ground Floor			91.3700	0.1100	10.0507	75.0000	6852.7500 (28a)
Brick	209.4400	47.0700	162.3700	0.1800	29.2266	9.0000	1461.3300 (29a)
Ashlar	5.9400		5.9400	0.1800	1.0692	9.0000	53.4600 (29a)
Joists FF	77.7400		77.7400	0.1100	8.5514	9.0000	699.6600 (30)
Rafters	6.4400	0.7600	5.6800	0.1300	0.7384	9.0000	51.1200 (30)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400 (30)
GF Flat	1.0600		1.0600	0.1300	0.1378	9.0000	9.5400 (30)
Total net area of external elements Aum(A, m2)			398.5500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	104.9801		(33)
GF			120.0000			9.0000	1080.0000 (32c)
FF			140.0000			9.0000	1260.0000 (32c)
Internal Floor 1			82.3900			18.0000	1483.0200 (32d)
Internal Ceiling 1			83.2900			9.0000	749.6100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13759.5300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							78.7789 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				13.1600	0.0600	0.7896	
E10 Eaves (insulation at ceiling level)				29.4300	0.0600	1.7658	
E16 Corner (normal)				45.3000	0.0900	4.0770	
E17 Corner (inverted - internal area greater than external area)				24.9000	-0.0900	-2.2410	

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R6 Flat ceiling								4.9500	0.0600	0.2970			
R8 Roof to wall (rafter)								4.9500	0.0800	0.3960			
E2 Other lintels (including other steel lintels)								28.9300	0.0500	1.4465			
E3 Sill								28.0000	0.0500	1.4000			
E4 Jamb								60.5400	0.0500	3.0270			
E5 Ground floor (normal)								44.9200	0.1500	6.7380			
E6 Intermediate floor within a dwelling								42.5800	0.0000	0.0000			
R1 Head of roof window								0.7800	0.0600	0.0468			
R2 Sill of roof window								0.7800	0.0800	0.0624			
R3 Jamb of roof window								1.9600	0.0600	0.1176			
E14 Flat roof								2.9200	0.0400	0.1168			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											18.0395	(36)	
Point Thermal bridges											0.0000		
Total fabric heat loss										(33) + (36) + (36a) =	123.0196	(37)	
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	80.4138	79.2757	78.9183	78.9183	79.2757	77.9121	78.5719	77.5987	77.5987	78.2365	77.5987	78.9183	(38)
Average = Sum(39)m / 12 =	203.4333	202.2952	201.9378	201.9378	202.2952	200.9317	201.5915	200.6183	200.6183	201.2561	200.6183	201.9378	(39)
												201.6226	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1647	1.1582	1.1562	1.1562	1.1582	1.1504	1.1542	1.1486	1.1486	1.1523	1.1486	1.1562	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												1.1544	
												31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy												2.9688	(42)
Hot water usage for mixer showers													
	92.4956	91.1055	89.0800	85.2045	82.3444	79.1550	77.3421	79.3523	81.5558	84.9804	88.9391	92.1412	(42a)
Hot water usage for baths													
	31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361	(42b)
Hot water usage for other uses													
	45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332	(42c)
Average daily hot water use (litres/day)												155.8343	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	169.4729	165.9709	161.6397	154.8948	149.4748	143.6250	141.2597	145.5709	150.1343	156.2908	163.1443	169.0105	(44)
Energy conte	268.4037	236.3403	248.4342	212.0432	201.2219	176.6037	170.8413	180.2471	185.1306	212.0852	232.4290	264.6296	(45)
Energy content (annual)										Total = Sum(45)m =		2588.4099	
Distribution loss (46)m = 0.15 x (45)m													
	40.2605	35.4510	37.2651	31.8065	30.1833	26.4906	25.6262	27.0371	27.7696	31.8128	34.8644	39.6944	(46)
Water storage loss:													
Store volume												300.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7368	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.2281	(55)
Total storage loss													
	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)
If cylinder contains dedicated solar storage													
	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618	(64)
												3310.5470	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month													
	138.3100	122.9006	131.6701	117.9874	115.9720	106.2037	105.8705	108.9979	109.0389	119.5841	124.7656	137.0551	(65)

5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	(66)
	42.4206	37.6776	30.6415	23.1976	17.3404	14.6395	15.8185	20.5615	27.5976	35.0415	40.8987	43.5996	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	516.8251	522.1881	508.6735	479.9024	443.5840	409.4499	386.6462	381.2832	394.7978	423.5689	459.8873	494.0214	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	(71)
Water heating gains (Table 5)													
	185.9005	182.8878	176.9760	163.8713	155.8764	147.5052	142.2991	146.5026	151.4429	160.7313	173.2856	184.2138	(72)
Total internal gains													
	863.3031	860.9104	834.4478	785.1282	734.9578	686.7515	659.9207	663.5042	688.9953	737.4987	792.2285	839.9917	(73)

6. Solar gains													

[Jan]				Area	Solar flux	g	FF			Access		Gains	
				m2	Table 6a	Specific data	Specific data			factor		W	
					W/m2	or Table 6b	or Table 6c			Table 6d			
North				8.2200	13.0723	0.6300	0.7000			0.7700		32.8394	(74)
East				17.2500	24.4329	0.6300	0.7000			0.7700		128.8058	(76)
South				6.3000	54.9219	0.6300	0.7000			0.7700		105.7446	(78)

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West			13.3500		24.4329		0.6300		0.7000		0.7700		99.6845 (80)
South			0.7600		55.2632		0.6300		0.7000		1.0000		16.6698 (82)

Solar gains	383.7440	625.1607	960.5959	1388.3659	1629.6116	1799.7659	1681.8265	1473.9231	1171.0365	771.5437	472.4961	312.7642 (83)
Total gains	1247.0471	1486.0711	1795.0437	2173.4941	2364.5693	2486.5174	2341.7472	2137.4273	1860.0318	1509.0423	1264.7246	1152.7559 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.7879	18.8936	18.9271	18.9271	18.8936	19.0218	18.9596	19.0516	19.0516	18.9912	19.0516	18.9271
alpha	2.2525	2.2596	2.2618	2.2618	2.2596	2.2681	2.2640	2.2701	2.2701	2.2661	2.2701	2.2618
util living area	0.9240	0.8933	0.8254	0.7101	0.5643	0.3962	0.2945	0.3104	0.5412	0.7612	0.8872	0.9337 (86)
MIT	18.2563	18.5880	19.2845	20.0141	20.5672	20.8663	20.9518	20.9482	20.7094	20.0601	19.0638	18.1773 (87)
Th 2	19.9483	19.9536	19.9552	19.9552	19.9536	19.9599	19.9568	19.9613	19.9613	19.9584	19.9613	19.9552 (88)
util rest of house	0.9142	0.8802	0.8043	0.6765	0.5139	0.3302	0.2145	0.2246	0.4731	0.7225	0.8705	0.9250 (89)
MIT 2	16.7741	17.1891	18.0515	18.9269	19.5567	19.8654	19.9343	19.9377	19.7288	19.0124	17.7995	16.6790 (90)
Living area fraction									fLA = Living area / (4) =			0.1329 (91)
MIT	16.9711	17.3750	18.2153	19.0713	19.6910	19.9984	20.0695	20.0720	19.8591	19.1516	17.9675	16.8781 (92)
Temperature adjustment												0.0000
adjusted MIT	16.9711	17.3750	18.2153	19.0713	19.6910	19.9984	20.0695	20.0720	19.8591	19.1516	17.9675	16.8781 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8748	0.8371	0.7610	0.6442	0.5003	0.3327	0.2234	0.2341	0.4658	0.6869	0.8276	0.8879 (94)
Useful gains	1090.8867	1244.0144	1366.0624	1400.1487	1182.9302	827.3197	523.1759	500.2964	866.4899	1036.6339	1046.6656	1023.4971 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	2394.6265	2402.2590	2204.2188	1892.4274	1394.0203	883.7733	538.1461	515.9856	994.8825	1479.5533	1959.5400	2358.2527 (97)
Space heating kWh	969.9824	778.3404	623.5884	354.4407	157.0510	0.0000	0.0000	0.0000	0.0000	329.5320	657.2696	993.0581 (98a)
Space heating requirement - total per year (kWh/year)												4863.2627
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	969.9824	778.3404	623.5884	354.4407	157.0510	0.0000	0.0000	0.0000	0.0000	329.5320	657.2696	993.0581 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4863.2627
Space heating per m2										(98c) / (4) =		27.8442 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	969.9824	778.3404	623.5884	354.4407	157.0510	0.0000	0.0000	0.0000	0.0000	329.5320	657.2696	993.0581 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	388.1482	311.4608	249.5352	141.8330	62.8455	0.0000	0.0000	0.0000	0.0000	131.8656	263.0131	397.3822 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	188.3129	166.6117	176.9083	154.9954	149.9452	134.7558	132.5948	137.9665	139.6256	156.1493	166.6378	186.1575 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	37.1305	29.7874	26.8203	19.6497	15.1780	12.4005	13.8459	17.9974	23.3768	30.6717	34.6436	38.1624 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1946.0835 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1890.6608 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	299.6642 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4136.4085 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1946.0835	26.0600	507.1494 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1890.6608	26.0600	492.7062 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	299.6642	26.0600	78.0925 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1077.9481 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1946.0835	0.1553	302.2805 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1890.6608	0.1410	266.4945 (264)
Space and water heating			568.7750 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	299.6642	0.1443	43.2508 (268)
Total CO2, kg/year			612.0258 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1946.0835	1.5751	3065.1986 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1890.6608	1.5212	2876.0661 (278)
Space and water heating			5941.2647 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	299.6642	1.5338	459.6350 (282)
Total Primary energy kWh/year			6400.8997 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:	C 80
Current environmental impact rating:	A 96

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 103	-50 kg (8.1%)
U Solar photovoltaic panels	+ 4.3	-£ 273	-141 kg (25.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£103	0.28 kg/m²	B 82 A 96
Solar photovoltaic panels	£273	0.81 kg/m²	B 86 A 97
Total Savings	£376	1.09 kg/m²	

Potential energy efficiency rating:	B 86
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£1078	£975	£103
Space heating	£507	£528	-£21
Water heating	£493	£368	£124
Lighting	£78	£78	£0
Generated (PV)	-£0	-£273	£273
Total cost of fuels	£1078	£702	£376
Total cost of uses	£1078	£701	£376
Delivered energy	24 kWh/m²	15 kWh/m²	8 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	2 kg/m²	1 kg/m²

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Primary energy 37 kWh/m² 24 kWh/m² 12 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880 (1b) - (3b)
First floor	83.2900 (1c)	x 2.7000 (2c)	= 224.8830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.1710 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1576 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4076 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3465 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4417	0.4331	0.4244	0.3811	0.3724	0.3291	0.3291	0.3205	0.3465	0.3724	0.3898	0.4071 (22b)
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			45.1200	1.1450	51.6641		(27)
Solid Doors			1.9500	1.9500	1.9500		(26)
Rooflight S			0.7600	1.1450	0.8702		(27a)
Ground Floor			91.3700	0.1100	10.0507	75.0000	6852.7500 (28a)
Brick	209.4400	47.0700	162.3700	0.1800	29.2266	9.0000	1461.3300 (29a)
Ashlar	5.9400		5.9400	0.1800	1.0692	9.0000	53.4600 (29a)
Joists FF	77.7400		77.7400	0.1100	8.5514	9.0000	699.6600 (30)
Rafters	6.4400	0.7600	5.6800	0.1300	0.7384	9.0000	51.1200 (30)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400 (30)
GF Flat	1.0600		1.0600	0.1300	0.1378	9.0000	9.5400 (30)
Total net area of external elements Aum(A, m2)			398.5500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	104.9801		(33)
GF			120.0000			9.0000	1080.0000 (32c)
FF			140.0000			9.0000	1260.0000 (32c)
Internal Floor 1			82.3900			18.0000	1483.0200 (32d)
Internal Ceiling 1			83.2900			9.0000	749.6100 (32e)

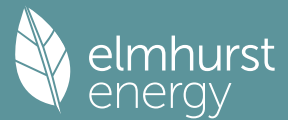
Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 13759.5300 (34)
78.7789 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	13.1600	0.0600	0.7896
E10 Eaves (insulation at ceiling level)	29.4300	0.0600	1.7658
E16 Corner (normal)	45.3000	0.0900	4.0770
E17 Corner (inverted - internal area greater than external area)	24.9000	-0.0900	-2.2410
R6 Flat ceiling	4.9500	0.0600	0.2970
R8 Roof to wall (rafter)	4.9500	0.0800	0.3960
E2 Other lintels (including other steel lintels)	28.9300	0.0500	1.4465
E3 Sill	28.0000	0.0500	1.4000
E4 Jamb	60.5400	0.0500	3.0270
E5 Ground floor (normal)	44.9200	0.1500	6.7380
E6 Intermediate floor within a dwelling	42.5800	0.0000	0.0000
R1 Head of roof window	0.7800	0.0600	0.0468
R2 Sill of roof window	0.7800	0.0800	0.0624
R3 Jamb of roof window	1.9600	0.0600	0.1176
E14 Flat roof	2.9200	0.0400	0.1168

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
(36a) = 18.0395 (36)
Total fabric heat loss
(33) + (36) + (36a) = 123.0196 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	87.5888	87.0335	86.4892	83.9326	83.4542	81.2275	81.2275	80.8151	82.0852	83.4542	84.4219	85.4336	(38)
Heat transfer coeff	210.6084	210.0531	209.5087	206.9521	206.4738	204.2470	204.2470	203.8347	205.1048	206.4738	207.4415	208.4531	(39)
Average = Sum(39)m / 12 =												206.9498	
HLP	1.2058	1.2026	1.1995	1.1849	1.1821	1.1694	1.1694	1.1670	1.1743	1.1821	1.1877	1.1935	(40)
HLP (average)												1.1849	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9688	(42)
Hot water usage for mixer showers														
92.4956	91.1055	89.0800	85.2045	82.3444	79.1550	77.3421	79.3523	81.5558	84.9804	88.9391	92.1412		(42a)	
Hot water usage for baths														
31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361		(42b)	
Hot water usage for other uses														
45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332		(42c)	
Average daily hot water use (litres/day)													155.8343	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	169.4729	165.9709	161.6397	154.8948	149.4748	143.6250	141.2597	145.5709	150.1343	156.2908	163.1443	169.0105		(44)
Energy conte	268.4037	236.3403	248.4342	212.0432	201.2219	176.6037	170.8413	180.2471	185.1306	212.0852	232.4290	264.6296		(45)
Energy content (annual)										Total = Sum(45)m =		2588.4099		
Distribution loss (46)m = 0.15 x (45)m														
40.2605	35.4510	37.2651	31.8065	30.1833	26.4906	25.6262	27.0371	27.7696	31.8128	34.8644	39.6944		(46)	
Water storage loss:														
Store volume													300.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.7368	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													1.2281	(55)
Total storage loss														
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698		(56)	
If cylinder contains dedicated solar storage														
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698		(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624		(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(61)
Total heat required for water heating calculated for each month														
329.7358	291.7371	308.3706	264.6434	249.7597	223.3507	219.1466	229.4829	239.0815	272.0216	291.7827	325.9618		(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000		(63b)
Aperture area of solar collector													3.0000	(H1)
Zero-loss collector efficiency													0.8000	(H2)
Collector linear heat loss coefficient													1.8000	(H3)
Collector 2nd order heat loss coefficient													0.0000	(H4)
Collector loop efficiency													0.9000	(H5)
Incidence angle modifier													1.0000	(H6)
Overshading factor													0.8000	(H8)
Overall heat loss coefficient of system													6.5000	(H10)
Heat loss coefficient of collector loop													3.9667	(H11)
Dedicated solar storage volume													75.0000	(H12)
Effective solar volume													75.0000	(H14)
Reference volume													225.0000	(H15)
Storage tank correction coefficient													1.3161	(H16)
Heat delivered to hot water													648.6020	(H24)
Heat delivered to space heating													0.0000	(H29)
Solar input													648.6020	
Solar input	-0.0000	-16.1712	-59.6488	-83.1473	-110.2470	-101.9358	-101.3589	-87.7091	-59.5157	-28.8682	-0.0000	-0.0000		(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(63d)
Output from w/h	329.7358	275.5659	248.7219	181.4960	139.5127	121.4149	117.7877	141.7738	179.5658	243.1535	291.7827	325.9618		(64)
								Total per year (kWh/year) = Sum(64)m =				2596.4726		(64)
Electric shower(s)														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(64a)
													0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =														
Heat gains from water heating, kWh/month														
138.3100	122.9006	130.5535	112.5845	105.7366	96.1183	95.4489	99.3208	104.7166	118.4675	124.7656	137.0551		(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	42.4206	37.6776	30.6415	23.1976	17.3404	14.6395	15.8185	20.5615	27.5976	35.0415	40.8987	43.5996	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	516.8251	522.1881	508.6735	479.9024	443.5840	409.4499	386.6462	381.2832	394.7978	423.5689	459.8873	494.0214	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	(71)
Water heating gains (Table 5)													
	185.9005	182.8878	175.4752	156.3673	142.1190	133.4977	128.2916	133.4957	145.4397	159.2305	173.2856	184.2138	(72)
Total internal gains													
	863.3031	860.9104	832.9470	777.6242	721.2004	672.7441	645.9132	650.4973	682.9921	735.9979	792.2285	839.9917	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.2200	10.6334	0.6300	0.7000	0.7700	26.7126	(74)
East	17.2500	19.6403	0.6300	0.7000	0.7700	103.5400	(76)

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South	6.3000	46.7521	0.6300	0.7000	0.7700	90.0146 (78)
West	13.3500	19.6403	0.6300	0.7000	0.7700	80.1310 (80)
South	0.7600	45.6416	0.6300	0.7000	1.0000	13.7675 (82)

Solar gains	314.1657	582.6038	903.1594	1263.9933	1524.3540	1554.7573	1482.1787	1285.7933	1029.9855	674.4231	385.4278	262.6896 (83)
Total gains	1177.4688	1443.5142	1736.1064	2041.6174	2245.5544	2227.5014	2128.0920	1936.2906	1712.9776	1410.4210	1177.6562	1102.6814 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.1479	18.1958	18.2431	18.4685	18.5113	18.7131	18.7131	18.7509	18.6348	18.5113	18.4249	18.3355
alpha	2.2099	2.2131	2.2162	2.2312	2.2341	2.2475	2.2475	2.2501	2.2423	2.2341	2.2283	2.2224
util living area	0.9389	0.9069	0.8514	0.7576	0.6352	0.4979	0.3849	0.4303	0.6234	0.8195	0.9148	0.9462 (86)
MIT	17.8423	18.2826	18.9528	19.7360	20.3475	20.7369	20.8942	20.8611	20.5396	19.6897	18.6184	17.7652 (87)
Th 2	19.9153	19.9179	19.9204	19.9321	19.9343	19.9446	19.9446	19.9465	19.9406	19.9343	19.9299	19.9252 (88)
util rest of house	0.9311	0.8954	0.8332	0.7281	0.5907	0.4343	0.3036	0.3468	0.5619	0.7900	0.9024	0.9392 (89)
MIT 2	16.2373	16.7898	17.6242	18.5842	19.3011	19.7328	19.8815	19.8588	19.5406	18.5569	17.2275	16.1442 (90)
Living area fraction	16.4506	16.9882	17.8007	18.7373	19.4401	19.8663	20.0161	19.9920	19.6734	18.7074	17.4124	16.3596 (92)
MIT	16.4506	16.9882	17.8007	18.7373	19.4401	19.8663	20.0161	19.9920	19.6734	18.7074	17.4124	16.3596 (93)
Temperature adjustment												0.0000
adjusted MIT	16.4506	16.9882	17.8007	18.7373	19.4401	19.8663	20.0161	19.9920	19.6734	18.7074	17.4124	16.3596 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8941	0.8523	0.7876	0.6895	0.5678	0.4292	0.3094	0.3506	0.5446	0.7476	0.8609	0.9046 (94)
Useful gains	1052.7966	1230.2923	1367.2928	1407.7831	1275.0802	956.0696	658.4289	678.8587	932.9577	1054.3936	1013.8209	997.5057 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2559.0156	2539.1639	2367.6027	2035.8487	1598.1366	1075.6213	697.7323	732.1657	1143.1260	1673.9635	2139.2093	2534.7128 (97)
Space heating kWh	1120.6270	879.5617	744.2306	452.2072	240.3540	0.0000	0.0000	0.0000	0.0000	460.9600	810.2797	1143.6821 (98a)
Space heating requirement - total per year (kWh/year)												5851.9023
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1120.6270	879.5617	744.2306	452.2072	240.3540	0.0000	0.0000	0.0000	0.0000	460.9600	810.2797	1143.6821 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5851.9023
Space heating per m2										(98c) / (4) =		33.5045 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1120.6270	879.5617	744.2306	452.2072	240.3540	0.0000	0.0000	0.0000	0.0000	460.9600	810.2797	1143.6821 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	448.4302	351.9655	297.8114	180.9553	96.1801	0.0000	0.0000	0.0000	0.0000	184.4578	324.2416	457.6559 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	329.7358	275.5659	248.7219	181.4960	139.5127	121.4149	117.7877	141.7738	179.5658	243.1535	291.7827	325.9618 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	188.3129	157.3763	142.0456	103.6528	79.6760	69.3403	67.2688	80.9673	102.5504	138.8655	166.6378	186.1575 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	37.1305	29.7874	26.8203	19.6497	15.1780	12.4005	13.8459	17.9974	23.3768	30.6717	34.6436	38.1624 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-40.4592	-61.7508	-94.7396	-111.3136	-120.8111	-106.6624	-105.0799	-97.9283	-85.0824	-72.0070	-45.8591	-34.4639 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												2341.6976 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1482.8513 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	80.0000 (231)
Electricity for lighting (calculated in Appendix L)	299.6642 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-976.1572 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3228.0560 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2341.6976	16.4900	386.1459 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1482.8513	16.4900	244.5222 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	299.6642	16.4900	49.4146 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-976.1572	16.4900	-160.9683
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-160.9683 (252)
Total energy cost			532.3064 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8724 (257)
SAP value		85.8585
SAP rating (Section 12)		86 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2341.6976	0.1547	362.1908 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1482.8513	0.1448	214.7066 (264)
Space and water heating			576.8974 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	299.6642	0.1443	43.2508 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-976.1572	0.1342	-130.9817
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-130.9817 (269)
Total CO2, kg/year			500.2635 (272)
CO2 emissions per m2			2.8600 (273)
EI value			96.9482
EI rating			97 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880 (1b) - (3b)
First floor	83.2900 (1c)	x 2.7000 (2c)	= 224.8830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	444.1710 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)

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Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6f)
6 * 10 = 60.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
70.0000 / (5) = 0.1576 (8)
Yes
Blower Door
5.0000 (17)
0.4076 (18)
2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3465 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate													
Effective ac	0.3118	0.2858	0.2772	0.2772	0.2858	0.2512	0.2685	0.2425	0.2425	0.2598	0.2425	0.2772	(22b)
	0.5486	0.5408	0.5384	0.5384	0.5408	0.5315	0.5360	0.5294	0.5294	0.5338	0.5294	0.5384	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			45.1200	1.1450	51.6641			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Rooflight S			0.7600	1.1450	0.8702			(27a)
Ground Floor			91.3700	0.1100	10.0507	75.0000	6852.7500	(28a)
Brick	209.4400	47.0700	162.3700	0.1800	29.2266	9.0000	1461.3300	(29a)
Ashlar	5.9400		5.9400	0.1800	1.0692	9.0000	53.4600	(29a)
Joists FF	77.7400		77.7400	0.1100	8.5514	9.0000	699.6600	(30)
Rafters	6.4400	0.7600	5.6800	0.1300	0.7384	9.0000	51.1200	(30)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
GF Flat	1.0600		1.0600	0.1300	0.1378	9.0000	9.5400	(30)
Total net area of external elements Aum(A, m2)			398.5500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	104.9801			(33)
GF			120.0000			9.0000	1080.0000	(32c)
FF			140.0000			9.0000	1260.0000	(32c)
Internal Floor 1			82.3900			18.0000	1483.0200	(32d)
Internal Ceiling 1			83.2900			9.0000	749.6100	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 13759.5300 (34)
List of Thermal Bridges 78.7789 (35)

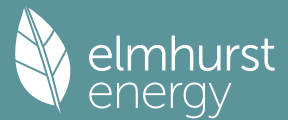
Element	Length	Psi-value	Total	
K1 Element				
E12 Gable (insulation at ceiling level)	13.1600	0.0600	0.7896	
E10 Eaves (insulation at ceiling level)	29.4300	0.0600	1.7658	
E16 Corner (normal)	45.3000	0.0900	4.0770	
E17 Corner (inverted - internal area greater than external area)	24.9000	-0.0900	-2.2410	
R6 Flat ceiling	4.9500	0.0600	0.2970	
R8 Roof to wall (rafter)	4.9500	0.0800	0.3960	
E2 Other lintels (including other steel lintels)	28.9300	0.0500	1.4465	
E3 Sill	28.0000	0.0500	1.4000	
E4 Jamb	60.5400	0.0500	3.0270	
E5 Ground floor (normal)	44.9200	0.1500	6.7380	
E6 Intermediate floor within a dwelling	42.5800	0.0000	0.0000	
R1 Head of roof window	0.7800	0.0600	0.0468	
R2 Sill of roof window	0.7800	0.0800	0.0624	
R3 Jamb of roof window	1.9600	0.0600	0.1176	
E14 Flat roof	2.9200	0.0400	0.1168	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			18.0395	(36)
Point Thermal Bridges			0.0000	(36a) =
Total fabric heat loss			123.0196	(33) + (36) + (36a) =

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	80.4138	79.2757	78.9183	78.9183	79.2757	77.9121	78.5719	77.5987	77.5987	78.2365	77.5987	78.9183	(38)
Average = Sum(39)m / 12 =	203.4333	202.2952	201.9378	201.9378	202.2952	200.9317	201.5915	200.6183	200.6183	201.2561	200.6183	201.9378	(39)
												201.6226	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1647	1.1582	1.1562	1.1562	1.1582	1.1504	1.1542	1.1486	1.1486	1.1523	1.1486	1.1562	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9688	(42)
Hot water usage for mixer showers														
	92.4956	91.1055	89.0800	85.2045	82.3444	79.1550	77.3421	79.3523	81.5558	84.9804	88.9391	92.1412	(42a)	
Hot water usage for baths														
	31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361	(42b)	
Hot water usage for other uses														
	45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332	(42c)	
Average daily hot water use (litres/day)													155.8343	(43)
Daily hot water use														
	169.4729	165.9709	161.6397	154.8948	149.4748	143.6250	141.2597	145.5709	150.1343	156.2908	163.1443	169.0105	(44)	
Energy conte	268.4037	236.3403	248.4342	212.0432	201.2219	176.6037	170.8413	180.2471	185.1306	212.0852	232.4290	264.6296	(45)	
Energy content (annual)										Total =	Sum(45)m =	2588.4099		
Distribution loss (46)m = 0.15 x (45)m														
	40.2605	35.4510	37.2651	31.8065	30.1833	26.4906	25.6262	27.0371	27.7696	31.8128	34.8644	39.6944	(46)	
Water storage loss:														
Store volume													300.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.7368	(52)
Temperature factor from Table 2b													0.5400	(53)

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Enter (49) or (54) in (55)													1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	329.7358	291.7371	308.3706	264.6434	249.7597	223.3507	219.1466	229.4829	239.0815	272.0216	291.7827	325.9618	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector													(H1)
Zero-loss collector efficiency													(H2)
Collector linear heat loss coefficient													(H3)
Collector 2nd order heat loss coefficient													(H4)
Collector loop efficiency													(H5)
Incidence angle modifier													(H6)
Overshading factor													(H8)
Overall heat loss coefficient of system													(H10)
Heat loss coefficient of collector loop													(H11)
Dedicated solar storage volume													(H12)
Effective solar volume													(H14)
Reference volume													(H15)
Storage tank correction coefficient													(H16)
Heat delivered to hot water													(H24)
Heat delivered to space heating													(H29)
Solar input													(64a)
Solar input	-1.7171	-20.9239	-66.6992	-94.9882	-120.2707	-121.3453	-117.9262	-105.1511	-73.2651	-41.0342	-7.5162	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	328.0188	270.8133	241.6715	169.6552	129.4890	102.0054	101.2204	124.3318	165.8164	230.9874	284.2665	325.9618	(64)
													(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													(64a)
Heat gains from water heating, kWh/month	138.3100	122.9006	130.5535	112.5845	105.7366	96.1183	95.4489	99.3208	104.7166	118.4675	124.7656	137.0551	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.4206	37.6776	30.6415	23.1976	17.3404	14.6395	15.8185	20.5615	27.5976	35.0415	40.8987	43.5996	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	516.8251	522.1881	508.6735	479.9024	443.5840	409.4499	386.6462	381.2832	394.7978	423.5689	459.8873	494.0214	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	(71)
Water heating gains (Table 5)	185.9005	182.8878	175.4752	156.3673	142.1190	133.4977	128.2916	133.4957	145.4397	159.2305	173.2856	184.2138	(72)
Total internal gains	863.3031	860.9104	832.9470	777.6242	721.2004	672.7441	645.9132	650.4973	682.9921	735.9979	792.2285	839.9917	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					8.2200	13.0723		0.6300	0.7000	0.7700		32.8394 (74)	
East					17.2500	24.4329		0.6300	0.7000	0.7700		128.8058 (76)	
South					6.3000	54.9219		0.6300	0.7000	0.7700		105.7446 (78)	
West					13.3500	24.4329		0.6300	0.7000	0.7700		99.6845 (80)	
South					0.7600	55.2632		0.6300	0.7000	1.0000		16.6698 (82)	
Solar gains	383.7440	625.1607	960.5959	1388.3659	1629.6116	1799.7659	1681.8265	1473.9231	1171.0365	771.5437	472.4961	312.7642 (83)	
Total gains	1247.0471	1486.0711	1793.5429	2165.9901	2350.8120	2472.5099	2327.7397	2124.4204	1854.0286	1507.5415	1264.7246	1152.7559 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.7879	18.8936	18.9271	18.9271	18.8936	19.0218	18.9596	19.0516	19.0516	18.9912	19.0516	18.9271	
alpha	2.2525	2.2596	2.2618	2.2618	2.2596	2.2681	2.2640	2.2701	2.2701	2.2661	2.2701	2.2618	
util living area	0.9240	0.8933	0.8256	0.7113	0.5665	0.3980	0.2961	0.3121	0.5424	0.7615	0.8872	0.9337	(86)
MIT	18.2563	18.5880	19.2834	20.0103	20.5637	20.8650	20.9512	20.9476	20.7080	20.0592	19.0638	18.1773	(87)
Th 2	19.9483	19.9536	19.9552	19.9552	19.9536	19.9599	19.9568	19.9613	19.9613	19.9584	19.9613	19.9552	(88)
util rest of house	0.9142	0.8802	0.8046	0.6777	0.5161	0.3318	0.2157	0.2259	0.4743	0.7229	0.8705	0.9250	(89)
MIT 2	16.7741	17.1891	18.0501	18.9227	19.5532	19.8644	19.9340	19.9374	19.7276	19.0114	17.7995	16.6790	(90)
Living area fraction	16.9711	17.3750	18.2140	19.0672	19.6875	19.9973	20.0692	20.0716	19.8579	19.1506	17.9675	16.8781	(91)
MIT	16.9711	17.3750	18.2140	19.0672	19.6875	19.9973	20.0692	20.0716	19.8579	19.1506	17.9675	16.8781	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9711	17.3750	18.2140	19.0672	19.6875	19.9973	20.0692	20.0716	19.8579	19.1506	17.9675	16.8781	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1090.8867	1244.0144	1365.3166	1397.6882	1180.6015	826.5641	522.9388	500.0453	865.6598	1036.0564	1046.6656	1023.4971	(95)

elmhurst
energy

10a. Fuel costs - using BEDF prices (552)			
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1947.2903	26.0600	507.4639 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1413.0426	26.0600	368.2389 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	299.6642	26.0600	78.0925 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1046.5006	26.0600	-272.7181
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-272.7181 (252)
Total energy cost			701.9252 (255)

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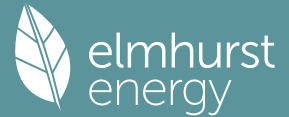
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1947.2903	0.1553	302.4484 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1413.0426	0.1456	205.7266 (264)
Space and water heating			508.1750 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	299.6642	0.1443	43.2508 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1046.5006	0.1344	-140.6024
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-140.6024 (269)
Total CO2, kg/year			421.9204 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1947.2903	1.5750	3067.0267 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1413.0426	1.5386	2174.0432 (278)
Space and water heating			5241.0699 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	299.6642	1.5338	459.6350 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1046.5006	1.4965	-1566.1309
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1566.1309 (283)
Total Primary energy kWh/year			4255.5980 (286)

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Property Reference	FURNERS LANE 2				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 2, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	4.19	TER	9.23	
Environmental	96 A	% DER < TER				54.60
CO ₂ Emissions (t/year)	0.51	DFEE	37.30	TFEE	37.73	
Compliance Check	See BREL	% DFEE < TFEE				1.14
% DPER < TPER	8.61	DPER	44.01	TPER	48.16	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.7500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.1809 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4309 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3662 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4669	0.4578	0.4486	0.4029	0.3937	0.3479	0.3479	0.3388	0.3662	0.3937	0.4120	0.4303 (22b)
Effective ac	0.6090	0.6048	0.6006	0.5811	0.5775	0.5605	0.5605	0.5574	0.5671	0.5775	0.5849	0.5926 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			21.7800	1.1450	24.9389		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			66.3500	0.1100	7.2985	75.0000	4976.2500 (28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	9.0000	1282.2300 (29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	9.0000	597.1500 (30)
Total net area of external elements A _{um} (A, m ²)			298.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	67.1305			(33)
GF			80.0000			9.0000	720.0000 (32c)
FF			120.0000			9.0000	1080.0000 (32c)
Internal Floor 1			66.3500			18.0000	1194.3000 (32d)
Internal Ceiling 1			66.3500			9.0000	597.1500 (32e)
Heat capacity C _m = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	10447.0800 (34)	
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							78.7271 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				4.2500	0.0600	0.2550	
E10 Eaves (insulation at ceiling level)				28.9900	0.0600	1.7394	
E16 Corner (normal)				25.0000	0.0900	2.2500	

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E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500										
E2 Other lintels (including other steel lintels)	17.5100	0.0500	0.8755										
E3 Sill	16.5800	0.0500	0.8290										
E4 Jamb	36.0000	0.0500	1.8000										
E5 Ground floor (normal)	33.2400	0.1600	5.3184										
E6 Intermediate floor within a dwelling	33.2400	0.0000	0.0000										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												12.6173	(36)
Point Thermal bridges												0.0000	
Total fabric heat loss												(33) + (36) + (36a) =	79.7478 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	66.6738	66.2103	65.7561	63.6223	63.2231	61.3647	61.3647	61.0206	62.0806	63.2231	64.0307	64.8750	(38)
Average = Sum(39)m / 12 =	146.4216	145.9582	145.5039	143.3702	142.9710	141.1126	141.1126	140.7684	141.8284	142.9710	143.7786	144.6229	(39)
												143.3683	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1034	1.0999	1.0965	1.0804	1.0774	1.0634	1.0634	1.0608	1.0688	1.0774	1.0835	1.0898	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.9017 (42)
Hot water usage for mixer showers													
	91.0890	89.7201	87.7254	83.9088	81.0923	77.9513	76.1660	78.1456	80.3157	83.6881	87.5867	90.7400	(42a)
Hot water usage for baths													
	31.4602	30.9930	30.3350	29.1219	28.2135	27.2062	26.6622	27.3155	28.0269	29.1047	30.3428	31.3539	(42b)
Hot water usage for other uses													
	44.3460	42.7334	41.1208	39.5082	37.8956	36.2831	36.2831	37.8956	39.5082	41.1208	42.7334	44.3460	(42c)
Average daily hot water use (litres/day)													153.4641 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	166.8952	163.4465	159.1812	152.5389	147.2014	141.4406	139.1112	143.3567	147.8508	153.9136	160.6629	166.4399	(44)
Energy conte	264.3212	232.7456	244.6556	208.8182	198.1614	173.9177	168.2429	177.5056	182.3148	208.8593	228.8937	260.6046	(45)
Energy content (annual)													
Distribution loss	(46)m = 0.15 x (45)m												
	39.6482	34.9118	36.6983	31.3227	29.7242	26.0877	25.2364	26.6258	27.3472	31.3289	34.3341	39.0907	(46)
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796	(64)
12Total per year (kWh/year)													3219.8760 (64)
Electric shower(s)													3220 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
	133.4668	118.5570	126.9280	113.5418	111.4687	101.9374	101.5208	104.6007	104.7294	115.0258	120.2169	132.2311	(65)

5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	157.5805	174.4642	157.5805	162.8332	157.5805	162.8332	157.5805	157.5805	162.8332	157.5805	162.8332	157.5805	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	300.9461	304.0690	296.1995	279.4461	258.2980	238.4218	225.1432	222.0204	229.8899	246.6433	267.7914	287.6676	(68)
Pumps, fans	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	(71)
Total internal gains	179.3909	176.4241	170.6022	157.6969	149.8235	141.5797	136.4527	140.5923	145.4575	154.6045	166.9679	177.7299	(72)
	707.4426	724.4822	693.9072	669.5012	635.2270	609.3596	585.7014	586.7181	604.7056	628.3533	667.1175	692.5030	(73)

6. Solar gains													

[Jan]													
	Area												
	m2												
	Solar flux												
	Table 6a												
	W/m2												
	Specific data												
	or Table 6b												
	Specific data												
	or Table 6c												
	Access												
	factor												
	Table 6d												
	Gains												
	W												
North	1.4200												4.6146 (74)
East	11.5200												69.1467 (76)
South	2.2000												31.4337 (78)
West	6.6400												39.8554 (80)
Solar gains	145.0504	273.5303	431.7234	610.3341	737.3147	751.5564	716.7329	621.6814	494.9350	319.0407	178.8652	120.6466	(83)

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Total gains 852.4929 998.0125 1125.6306 1279.8353 1372.5417 1360.9160 1302.4343 1208.3995 1099.6406 947.3940 845.9826 813.1496 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.8193	19.8822	19.9443	20.2411	20.2976	20.5649	20.5649	20.6152	20.4611	20.2976	20.1836	20.0658
alpha	2.3213	2.3255	2.3296	2.3494	2.3532	2.3710	2.3710	2.3743	2.3641	2.3532	2.3456	2.3377
util living area	0.9418	0.9166	0.8769	0.7991	0.6906	0.5509	0.4298	0.4715	0.6608	0.8388	0.9186	0.9471 (86)
MIT	18.0512	18.4197	18.9784	19.7096	20.3072	20.7200	20.8884	20.8579	20.5412	19.7439	18.7893	18.0040 (87)
Th 2	19.9981	20.0009	20.0037	20.0169	20.0193	20.0308	20.0308	20.0330	20.0264	20.0193	20.0143	20.0091 (88)
util rest of house	0.9347	0.9066	0.8617	0.7739	0.6501	0.4894	0.3485	0.3897	0.6040	0.8128	0.9072	0.9406 (89)
MIT 2	16.5382	17.0032	17.7051	18.6138	19.3275	19.7960	19.9601	19.9380	19.6143	18.6768	17.4842	16.4844 (90)
Living area fraction	fLA = Living area / (4) =											0.1462 (91)
MIT	16.7594	17.2103	17.8913	18.7740	19.4708	19.9311	20.0959	20.0725	19.7498	18.8328	17.6750	16.7066 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.7594	17.2103	17.8913	18.7740	19.4708	19.9311	20.0959	20.0725	19.7498	18.8328	17.6750	16.7066 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9010	0.8681	0.8201	0.7359	0.6247	0.4826	0.3543	0.3932	0.5859	0.7736	0.8695	0.9087 (94)
Useful gains	768.0873	866.3404	923.1763	941.8808	857.4911	656.8395	461.4335	475.1893	644.2896	732.8708	735.5809	738.9456 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1824.3260	1796.7913	1657.4751	1415.6372	1110.9922	752.2872	493.3094	516.9672	801.3073	1177.0481	1520.4572	1808.7372 (97)
Space heating kWh	785.8416	625.2630	546.3183	341.1046	188.6048	0.0000	0.0000	0.0000	0.0000	330.4679	565.1109	795.9250 (98a)
Space heating requirement - total per year (kWh/year)												4178.6361
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	785.8416	625.2630	546.3183	341.1046	188.6048	0.0000	0.0000	0.0000	0.0000	330.4679	565.1109	795.9250 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4178.6361
Space heating per m2												(98c) / (4) = 31.4893 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	785.8416	625.2630	546.3183	341.1046	188.6048	0.0000	0.0000	0.0000	0.0000	330.4679	565.1109	795.9250 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	314.4624	250.2053	218.6148	136.4964	75.4721	0.0000	0.0000	0.0000	0.0000	132.2401	226.1348	318.4974 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	183.4930	162.3112	172.2620	150.7455	145.7090	130.8137	128.6225	133.9124	135.6093	151.8186	162.2107	181.3704 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	33.5006	26.8754	24.1983	17.7287	13.6942	11.1883	12.4923	16.2380	21.0915	27.6732	31.2568	34.4317 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1672.1233 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1838.8784 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												270.3689 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3781.3705 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1672.1233	0.1545	258.2657	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1838.8784	0.1410	259.2472	(264)
Space and water heating			517.5129	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	270.3689	0.1443	39.0226	(268)
Total CO2, kg/year			556.5355	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.1900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1672.1233	1.5718	2628.2773	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1838.8784	1.5213	2797.4882	(278)
Space and water heating			5425.7655	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	270.3689	1.5338	414.7009	(282)
Total Primary energy kWh/year			5840.4664	(286)
Dwelling Primary energy Rate (DPER)			44.0100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.7500 (5)

2. Ventilation rate

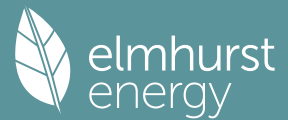
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1206 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3706 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3150 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4016	0.3937	0.3859	0.3465	0.3386	0.2992	0.2992	0.2914	0.3150	0.3386	0.3544	0.3701 (22b)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5448	0.5448	0.5424	0.5496	0.5573	0.5628	0.5685 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)

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TER Opening Type (Uw = 1.20)			21.7800	1.1450	24.9389	(27)
Ground Floor			66.3500	0.1300	8.6255	(28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	(29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	(30)
Total net area of external elements Aum(A, m2)			298.9000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	68.4575		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	4.2500	0.0600	0.2550
E10 Eaves (insulation at ceiling level)	28.9900	0.0600	1.7394
E16 Corner (normal)	25.0000	0.0900	2.2500
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500
E2 Other lintels (including other steel lintels)	17.5100	0.0500	0.8755
E3 Sill	16.5800	0.0500	0.8290
E4 Jamb	36.0000	0.0500	1.8000
E5 Ground floor (normal)	33.2400	0.1600	5.3184
E6 Intermediate floor within a dwelling	33.2400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	63.5675	63.2247	62.8886	61.3103	61.0149	59.6402	59.6402	59.3856	60.1697	61.0149	61.6124	62.2369
Average = Sum(39)m / 12 =	144.6423	144.2995	143.9635	142.3851	142.0898	140.7151	140.7151	140.4605	141.2446	142.0898	142.6872	143.3118

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0900	1.0874	1.0849	1.0730	1.0708	1.0604	1.0604	1.0585	1.0644	1.0708	1.0753	1.0800
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9017
Hot water usage for mixer showers												
Hot water usage for baths	72.8712	71.7761	70.1803	67.1270	64.8738	62.3610	60.9328	62.5165	64.2525	66.9505	70.0693	72.5920
Hot water usage for other uses	31.4602	30.9930	30.3350	29.1219	28.2135	27.2062	26.6622	27.3155	28.0269	29.1047	30.3428	31.3539
Average daily hot water use (litres/day)	44.3460	42.7334	41.1208	39.5082	37.8956	36.2831	36.2831	37.8956	39.5082	41.1208	42.7334	44.3460
Daily hot water use	148.6774	145.5025	141.6361	135.7572	130.9829	125.8503	123.8780	127.7276	131.7876	137.1760	143.1456	148.2918
Energy content (annual)	235.4687	207.1936	217.6895	185.8448	176.3282	154.7477	149.8197	158.1535	162.5073	186.1465	203.9371	232.1892
Distribution loss (46)m = 0.15 x (45)m	35.3203	31.0790	32.6534	27.8767	26.4492	23.2121	22.4730	23.7230	24.3761	27.9220	30.5906	34.8284
Water storage loss:												
Store volume												250.0000
a) If manufacturer declared loss factor is known (kWh/day):												1.8903
Temperature factor from Table 2b												0.5400
Enter (49) or (54) in (55)												1.0208
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month	290.3755	256.7868	272.5963	238.9804	231.2350	207.8833	204.7265	213.0603	215.6429	241.0533	257.0727	287.0960
WWHRS	-33.3137	-29.4629	-30.8518	-25.5465	-23.8085	-20.3731	-19.0965	-20.3072	-21.0788	-24.8495	-28.1515	-32.6968
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	257.0618	227.3239	241.7444	213.4338	207.4266	187.5102	185.6300	192.7531	194.5642	216.2038	228.9212	254.3992
12Total per year (kWh/year)												2606.9721
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Heat gains from water heating, kWh/month	122.2188	108.5665	116.3072	104.3019	102.5546	93.9621	93.7405	96.5115	96.5422	105.8192	110.3176	121.1283

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	157.5805	174.4642	157.5805	162.8332	157.5805	162.8332	157.5805	157.5805	162.8332	157.5805	162.8332	157.5805
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	300.9461	304.0690	296.1995	279.4461	258.2980	238.4218	225.1432	222.0204	229.8899	246.6433	267.7914	287.6676
Pumps, fans	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000
Water heating gains (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666
Total internal gains	164.2725	161.5572	156.3269	144.8637	137.8422	130.5029	125.9953	129.7197	134.0864	142.2300	153.2188	162.8069

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		FF	Access factor Table 6d		Gains W
North	1.4200				10.6334		0.6300		0.7000			0.7700		4.6146 (74)
East	11.5200				19.6403		0.6300		0.7000			0.7700		69.1467 (76)
South	2.2000				46.7521		0.6300		0.7000			0.7700		31.4337 (78)
West	6.6400				19.6403		0.6300		0.7000			0.7700		39.8554 (80)
Solar gains	145.0504	273.5303	431.7234	610.3341	737.3147	751.5564	716.7329	621.6814	494.9350	319.0407	178.8652	120.6466	(83)	
Total gains	837.3746	983.1456	1111.3552	1267.0021	1360.5603	1349.8393	1291.9769	1197.5269	1088.2695	935.0195	832.2335	798.2266	(84)	
7. Mean internal temperature (heating season)														
Temperature during heating periods in the living area from Table 9, Th1 (C)														
Utilisation factor for gains for living area, nil,m (see Table 9a)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	20.0631	20.1107	20.1577	20.3811	20.4235	20.6230	20.6230	20.6604	20.5457	20.4235	20.3380	20.2493		
alpha	2.3375	2.3407	2.3438	2.3587	2.3616	2.3749	2.3749	2.3774	2.3697	2.3616	2.3559	2.3500		
util living area	0.9434	0.9183	0.8785	0.8009	0.6922	0.5532	0.4318	0.4741	0.6636	0.8413	0.9207	0.9488	(86)	
MIT	18.0655	18.4331	18.9900	19.7128	20.3092	20.7188	20.8879	20.8567	20.5395	19.7426	18.7895	18.0086	(87)	
Th 2	20.0090	20.0111	20.0132	20.0230	20.0248	20.0333	20.0333	20.0349	20.0300	20.0248	20.0211	20.0172	(88)	
util rest of house	0.9365	0.9085	0.8636	0.7760	0.6520	0.4918	0.3504	0.3922	0.6070	0.8157	0.9095	0.9425	(89)	
MIT 2	16.5621	17.0259	17.7252	18.6220	19.3342	19.7971	19.9621	19.9389	19.6157	18.6789	17.4884	16.4946	(90)	
Living area fraction	fLA = Living area / (4) =													
MIT	16.7819	17.2316	17.9101	18.7815	19.4767	19.9319	20.0975	20.0731	19.7508	18.8344	17.6787	16.7160	(92)	
Temperature adjustment	0.0000													
adjusted MIT	16.7819	17.2316	17.9101	18.7815	19.4767	19.9319	20.0975	20.0731	19.7508	18.8344	17.6787	16.7160	(93)	
8. Space heating requirement														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9036	0.8706	0.8225	0.7381	0.6266	0.4848	0.3561	0.3957	0.5887	0.7766	0.8723	0.9113	(94)	
Useful gains	756.6339	855.8923	914.0946	935.1925	852.5923	654.4612	460.1283	473.8069	640.7054	726.0996	725.9953	727.4408	(95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Heat loss rate W	1805.4124	1779.4498	1642.6436	1406.9730	1104.9945	750.2728	492.1500	515.9259	798.1383	1170.0233	1509.4386	1793.6841	(97)	
Space heating kWh	780.2912	620.6306	542.0405	339.6820	187.7873	0.0000	0.0000	0.0000	0.0000	330.2793	564.0792	793.2850	(98a)	
Space heating requirement - total per year (kWh/year)	4158.0750													
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)	
Solar heating contribution - total per year (kWh/year)	0.0000													
Space heating kWh	780.2912	620.6306	542.0405	339.6820	187.7873	0.0000	0.0000	0.0000	0.0000	330.2793	564.0792	793.2850	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)	4158.0750													
Space heating per m2	(98c) / (4) =												31.3344 (99)	
9a. Energy requirements - Individual heating systems, including micro-CHP														
Fraction of space heat from secondary/supplementary system (Table 11)														
Fraction of space heat from main system(s)														
Efficiency of main space heating system 1 (in %)														
Efficiency of main space heating system 2 (in %)														
Efficiency of secondary/supplementary heating system, %														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	780.2912	620.6306	542.0405	339.6820	187.7873	0.0000	0.0000	0.0000	0.0000	330.2793	564.0792	793.2850	(98)	
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)	
Space heating fuel (main heating system)	845.3860	672.4059	587.2594	368.0195	203.4532	0.0000	0.0000	0.0000	0.0000	357.8323	611.1367	859.4637	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	257.0618	227.3239	241.7444	213.4338	207.4266	187.5102	185.6300	192.7531	194.5642	216.2038	228.9212	254.3992	(64)	
Efficiency of water heater														
(217)m	86.3857	86.1939	85.8149	85.0966	83.8374	79.8000	79.8000	79.8000	79.8000	85.0070	86.0000	86.4330	(217)	
Fuel for water heating, kWh/month	297.5745	263.7355	281.7046	250.8135	247.4153	234.9752	232.6190	241.5452	243.8148	254.3364	266.1873	294.3312	(219)	
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)	
Lighting	32.7421	26.2669	23.6505	17.3273	13.3841	10.9350	12.2095	15.8703	20.6140	27.0467	30.5491	33.6521	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-58.7468	-81.1679	-114.3340	-125.8377	-133.3666	-123.5571	-121.9162	-116.1542	-105.7506	-91.4140	-63.9488	-50.9767	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-38.4026	-80.1319	-158.1250	-235.9045	-310.4714	-311.5219	-307.9580	-261.4954	-192.5978	-114.1832	-51.1258	-30.4268	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														

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Space heating fuel - main system 1	4504.9567	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3109.0524	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	264.2477	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3279.5150	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4684.7418	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4504.9567	0.2100	946.0409 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3109.0524	0.2100	652.9010 (264)
Space and water heating			1598.9419 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	264.2477	0.1443	38.1391 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1187.1707	0.1350	-160.3231
PV Unit electricity exported	-2092.3443	0.1261	-263.8180
Total			-424.1410 (269)
Total CO2, kg/year			1224.8693 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.2300 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4504.9567	1.1300	5090.6011 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3109.0524	1.1300	3513.2292 (278)
Space and water heating			8603.8303 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	264.2477	1.5338	405.3119 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1187.1707	1.4991	-1779.7281
PV Unit electricity exported	-2092.3443	0.4628	-968.4101
Total			-2748.1382 (283)
Total Primary energy kWh/year			6391.1047 (286)
Target Primary Energy Rate (TPER)			48.1600 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

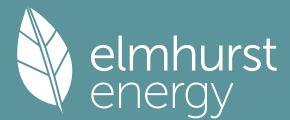
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	132.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 331.7500 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1206 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3706 (18)
Number of sides sheltered	2 (19)

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Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3150 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4016	0.3937	0.3859	0.3465	0.3386	0.2992	0.2992	0.2914	0.3150	0.3386	0.3544	0.3701	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5448	0.5448	0.5424	0.5496	0.5573	0.5628	0.5685	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			21.7800	1.1450	24.9389			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			66.3500	0.1100	7.2985	75.0000	4976.2500	(28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	9.0000	1282.2300	(29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	9.0000	597.1500	(30)
Total net area of external elements Aum(A, m2)			298.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.1305			(33)
GF			80.0000			9.0000	720.0000	(32c)
FF			120.0000			9.0000	1080.0000	(32c)
Internal Floor 1			66.3500			18.0000	1194.3000	(32d)
Internal Ceiling 1			66.3500			9.0000	597.1500	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 10447.0800 (34)
List of Thermal Bridges 78.7271 (35)

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	4.2500	0.0600	0.2550	
E10 Eaves (insulation at ceiling level)	28.9900	0.0600	1.7394	
E16 Corner (normal)	25.0000	0.0900	2.2500	
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500	
E2 Other lintels (including other steel lintels)	17.5100	0.0500	0.8755	
E3 Sill	16.5800	0.0500	0.8290	
E4 Jamb	36.0000	0.0500	1.8000	
E5 Ground floor (normal)	33.2400	0.1600	5.3184	
E6 Intermediate floor within a dwelling	33.2400	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				12.6173 (36)
Point Thermal Bridges				0.0000 (36a) =
Total fabric heat loss				(33) + (36) + (36a) = 79.7478 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 63.5675	Feb 63.2247	Mar 62.8886	Apr 61.3103	May 61.0149	Jun 59.6402	Jul 59.6402	Aug 59.3856	Sep 60.1697	Oct 61.0149	Nov 61.6124	Dec 62.2369 (38)
Heat transfer coeff	143.3153	142.9725	142.6365	141.0581	140.7628	139.3881	139.3881	139.1335	139.9176	140.7628	141.3602	141.9848 (39)
Average = Sum(39)m / 12 =												141.0567
HLP	Jan 1.0800	Feb 1.0774	Mar 1.0749	Apr 1.0630	May 1.0608	Jun 1.0504	Jul 1.0504	Aug 1.0485	Sep 1.0544	Oct 1.0608	Nov 1.0653	Dec 1.0700 (40)
HLP (average)												1.0630
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9017 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths													31.4602 30.9930 30.3350 29.1219 28.2135 27.2062 26.6622 27.3155 28.0269 29.1047 30.3428 31.3539 (42b)
Hot water usage for other uses													44.3460 42.7334 41.1208 39.5082 37.8956 36.2831 36.2831 37.8956 39.5082 41.1208 42.7334 44.3460 (42c)
Average daily hot water use (litres/day)													69.4831 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	75.8062	73.7264	71.4558	68.6301	66.1091	63.4893	62.9452	65.2111	67.5351	70.2255	73.0762	75.6998	(44)
Energy content (annual)	120.0585	104.9854	109.8250	93.9512	88.9956	78.0675	76.1268	80.7450	83.2775	95.2953	104.1105	118.5276	(45)
Distribution loss (46)m = 0.15 x (45)m													1153.9658
Water storage loss:													0.0000 (46)
Total storage loss													0.0000 (56)
If cylinder contains dedicated solar storage													0.0000 (57)
Primary loss													0.0000 (59)
Combi loss													0.0000 (61)
Total heat required for water heating calculated for each month													
WWHRS	102.0497	89.2376	93.3512	79.8585	75.6463	66.3574	64.7078	68.6333	70.7859	81.0010	88.4939	100.7485	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	102.0497	89.2376	93.3512	79.8585	75.6463	66.3574	64.7078	68.6333	70.7859	81.0010	88.4939	100.7485	(64)
Total per year (kWh/year)													980.8710 (64)
Electric shower(s)													981 (64)
Heat gains from water heating, kWh/month													
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													663.8154 (64a)
Heat gains from water heating, kWh/month													39.7765 (65)

5. Internal gains (see Table 5 and 5a)

6. Solar gains

7. Mean internal temperature (heating season)

8. Space heating requirement

8c. Space cooling requirement

SAP 10 Online 2.15.14

Full SAP Calculation Printout



SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.7500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1206 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3706 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3150 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.4016	0.3937	0.3859	0.3465	0.3386	0.2992	0.2992	0.2914	0.3150	0.3386	0.3544	0.3701 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5448	0.5448	0.5424	0.5496	0.5573	0.5628	0.5685 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			21.7800	1.1450	24.9389		(27)
Ground Floor			66.3500	0.1300	8.6255		(28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446		(29a)
Joists FF	66.3500		66.3500	0.1100	7.2985		(30)
Total net area of external elements Aum(A, m ²)			298.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4575		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							78.7271 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				4.2500	0.0600	0.2550	
E10 Eaves (insulation at ceiling level)				28.9900	0.0600	1.7394	
E16 Corner (normal)				25.0000	0.0900	2.2500	
E17 Corner (inverted - internal area greater than external area)				5.0000	-0.0900	-0.4500	
E2 Other lintels (including other steel lintels)				17.5100	0.0500	0.8755	
E3 Sill				16.5800	0.0500	0.8290	
E4 Jamb				36.0000	0.0500	1.8000	
E5 Ground floor (normal)				33.2400	0.1600	5.3184	
E6 Intermediate floor within a dwelling				33.2400	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6173 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	81.0748 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	63.5675	63.2247	62.8886	61.3103	61.0149	59.6402	59.6402	59.3856	60.1697	61.0149	61.6124	62.2369 (38)
Average = Sum(39)m / 12 =	144.6423	144.2995	143.9635	142.3851	142.0898	140.7151	140.7151	140.4605	141.2446	142.0898	142.6872	143.3118 (39)
												142.3837
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0900	1.0874	1.0849	1.0730	1.0708	1.0604	1.0604	1.0585	1.0644	1.0708	1.0753	1.0800 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9017 (42)
Hot water usage for mixer showers	

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Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for other uses	31.4602	30.9930	30.3350	29.1219	28.2135	27.2062	26.6622	27.3155	28.0269	29.1047	30.3428	31.3539 (42b)
Average daily hot water use (litres/day)	44.3460	42.7334	41.1208	39.5082	37.8956	36.2831	36.2831	37.8956	39.5082	41.1208	42.7334	44.3460 (42c)
												69.4831 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	75.8062	73.7264	71.4558	68.6301	66.1091	63.4893	62.9452	65.2111	67.5351	70.2255	73.0762	75.6998 (44)
Distribution loss (46)m = 0.15 x (45)m	120.0585	104.9854	109.8250	93.9512	88.9956	78.0675	76.1268	80.7450	83.2775	95.2953	104.1105	118.5276 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	102.0497	89.2376	93.3512	79.8585	75.6463	66.3574	64.7078	68.6333	70.7859	81.0010	88.4939	100.7485 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.0497	89.2376	93.3512	79.8585	75.6463	66.3574	64.7078	68.6333	70.7859	81.0010	88.4939	100.7485 (64)
12Total per year (kWh/year)												981 (64)
Electric shower(s)	58.3577	51.9972	56.7789	54.1834	55.2002	52.6556	54.4108	55.2002	54.1834	56.7789	55.7113	58.3577 (64a)
												980.8710 (64b)
Heat gains from water heating, kWh/month	40.1018	35.3087	37.5325	33.5105	32.7116	29.7532	29.7796	30.9584	31.2423	34.4450	36.0513	39.7765 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	157.5805	174.4642	157.5805	162.8332	157.5805	162.8332	157.5805	157.5805	162.8332	157.5805	162.8332	157.5805 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.9461	304.0690	296.1995	279.4461	258.2980	238.4218	225.1432	222.0204	229.8899	246.6433	267.7914	287.6676 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666 (71)
Water heating gains (Table 5)	53.9003	52.5427	50.4470	46.5423	43.9672	41.3240	40.0264	41.6107	43.3921	46.2970	50.0712	53.4631 (72)
Total internal gains	578.9520	597.6008	570.7519	555.3466	526.3707	509.1039	489.2751	487.7366	502.6402	517.0458	547.2208	565.2362 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.4200	10.6334	0.6300		0.7000		0.7700		4.6146 (74)
East				11.5200	19.6403	0.6300		0.7000		0.7700		69.1467 (76)
South				2.2000	46.7521	0.6300		0.7000		0.7700		31.4337 (78)
West				6.6400	19.6403	0.6300		0.7000		0.7700		39.8554 (80)
Solar gains	145.0504	273.5303	431.7234	610.3341	737.3147	751.5564	716.7329	621.6814	494.9350	319.0407	178.8652	120.6466 (83)
Total gains	724.0024	871.1311	1002.4753	1165.6807	1263.6854	1260.6603	1206.0080	1109.4179	997.5753	836.0865	726.0859	685.8828 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.0631	20.1107	20.1577	20.3811	20.4235	20.6230	20.6230	20.6604	20.5457	20.4235	20.3380	20.2493
alpha	2.3375	2.3407	2.3438	2.3587	2.3616	2.3749	2.3749	2.3774	2.3697	2.3616	2.3559	2.3500
util living area	0.9573	0.9346	0.8981	0.8239	0.7181	0.5791	0.4561	0.5022	0.6950	0.8673	0.9385	0.9620 (86)
MIT	17.8906	18.2729	18.8524	19.6140	20.2466	20.6884	20.8737	20.8373	20.4869	19.6307	18.6355	17.8319 (87)
Th 2	20.0090	20.0111	20.0132	20.0230	20.0248	20.0333	20.0333	20.0349	20.0300	20.0248	20.0211	20.0172 (88)
util rest of house	0.9519	0.9265	0.8850	0.8007	0.6790	0.5172	0.3719	0.4179	0.6397	0.8446	0.9294	0.9572 (89)
MIT 2	17.1513	17.5291	18.0989	18.8406	19.4337	19.8276	19.9702	19.9490	19.6662	18.8730	17.8983	17.0984 (90)
Living area fraction	17.2594	17.6378	18.2090	18.9537	19.5526	19.9535	20.1022	20.0789	19.7862	18.9838	18.0061	17.2056 (91)
MIT	17.2594	17.6378	18.2090	18.9537	19.5526	19.9535	20.1022	20.0789	19.7862	18.9838	18.0061	17.2056 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2594	17.6378	18.2090	18.9537	19.5526	19.9535	20.1022	20.0789	19.7862	18.9838	18.0061	17.2056 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9307	0.9001	0.8545	0.7705	0.6577	0.5116	0.3783	0.4220	0.6240	0.8143	0.9040	0.9375 (94)
Ext temp.	673.8202	784.1359	856.6380	898.1497	831.1192	645.0112	456.2393	468.1698	622.4769	680.8141	656.4054	643.0044 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)

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Space heating kWh	1874.4750	1838.0600	1685.6722	1431.4963	1115.7681	753.3136	492.8192	516.7352	803.1442	1191.2517	1556.1584	1863.8543	(97)
Space heating requirement - total per year (kWh/year)	893.2872	708.2370	616.8014	384.0096	211.7788	0.0000	0.0000	0.0000	0.0000	379.7656	647.8221	908.3124	(98a)
Solar heating kWh												4750.0141	
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating kWh	893.2872	708.2370	616.8014	384.0096	211.7788	0.0000	0.0000	0.0000	0.0000	379.7656	647.8221	908.3124	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4750.0141	
Space heating per m2										(98c) / (4) =		35.7951	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1322.7215	1041.2914	1067.4996	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7241	0.7868	0.7526	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	957.7419	819.2455	803.3872	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1402.7526	1342.0438	1232.3350	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	320.4077	388.9619	319.1371	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	80.1019	97.2405	79.7843	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												257.1267	(107)
Energy for space heating												35.7951	(99)
Energy for space cooling												1.9377	(108)
Total												37.7328	(109)
Fabric Energy Efficiency (TFEE)												37.7	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)	
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.7500 (5)	

2. Ventilation rate

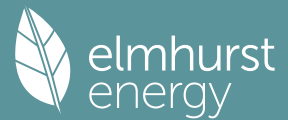
	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	60.0000 / (5) =	0.1809 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4309	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3662 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4669	0.4578	0.4486	0.4029	0.3937	0.3479	0.3479	0.3388	0.3662	0.3937	0.4120	0.4303	(22b)
Effective ac	0.6090	0.6048	0.6006	0.5811	0.5775	0.5605	0.5605	0.5574	0.5671	0.5775	0.5849	0.5926	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			21.7800	1.1450	24.9389			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			66.3500	0.1100	7.2985	75.0000	4976.2500	(28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	9.0000	1282.2300	(29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	9.0000	597.1500	(30)

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Total net area of external elements Aum(A, m2)	298.9000			(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	67.1305		(33)
GF	80.0000		9.0000	720.0000 (32c)
FF	120.0000		9.0000	1080.0000 (32c)
Internal Floor 1	66.3500		18.0000	1194.3000 (32d)
Internal Ceiling 1	66.3500		9.0000	597.1500 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 10447.0800 (34)
78.7271 (35)

List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	4.2500	0.0600	0.2550	
E10 Eaves (insulation at ceiling level)	28.9900	0.0600	1.7394	
E16 Corner (normal)	25.0000	0.0900	2.2500	
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500	
E2 Other lintels (including other steel lintels)	17.5100	0.0500	0.8755	
E3 Sill	16.5800	0.0500	0.8290	
E4 Jamb	36.0000	0.0500	1.8000	
E5 Ground floor (normal)	33.2400	0.1600	5.3184	
E6 Intermediate floor within a dwelling	33.2400	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(36a) = 12.6173 (36)
(33) + (36) + (36a) = 79.7478 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	66.6738	66.2103	65.7561	63.6223	63.2231	61.3647	61.3647	61.0206	62.0806	63.2231	64.0307	64.8750 (38)
Heat transfer coeff	146.4216	145.9582	145.5039	143.3702	142.9710	141.1126	141.1126	140.7684	141.8284	142.9710	143.7786	144.6229 (39)
Average = Sum(39)m / 12 =												143.3683
HLP	1.1034	1.0999	1.0965	1.0804	1.0774	1.0634	1.0634	1.0608	1.0688	1.0774	1.0835	1.0898 (40)
HLP (average)												1.0804
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9017 (42)
Hot water usage for mixer showers												
91.0890	89.7201	87.7254	83.9088	81.0923	77.9513	76.1660	78.1456	80.3157	83.6881	87.5867	90.7400 (42a)	
Hot water usage for baths												
31.4602	30.9930	30.3350	29.1219	28.2135	27.2062	26.6622	27.3155	28.0269	29.1047	30.3428	31.3539 (42b)	
Hot water usage for other uses												
44.3460	42.7334	41.1208	39.5082	37.8956	36.2831	36.2831	37.8956	39.5082	41.1208	42.7334	44.3460 (42c)	
Average daily hot water use (litres/day)												153.4641 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	166.8952	163.4465	159.1812	152.5389	147.2014	141.4406	139.1112	143.3567	147.8508	153.9136	160.6629	166.4399 (44)
Energy conte	264.3212	232.7456	244.6556	208.8182	198.1614	173.9177	168.2429	177.5056	182.3148	208.8593	228.8937	260.6046 (45)
Energy content (annual)										Total = Sum(45)m =		2549.0406
Distribution loss (46)m = 0.15 x (45)m												
39.6482	34.9118	36.6983	31.3227	29.7242	26.0877	25.2364	26.6258	27.3472	31.3289	34.3341	39.0907 (46)	
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)	
If cylinder contains dedicated solar storage												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month												
321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h												
321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796 (64)	
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
133.4668	118.5570	126.9280	113.5418	111.4687	101.9374	101.5208	104.6007	104.7294	115.0258	120.2169	132.2311 (65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.2735	33.9942	27.6459	20.9298	15.6452	13.2084	14.2721	18.5514	24.8997	31.6159	36.9004	39.3373 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.1733	453.8343	442.0887	417.0837	385.5194	355.8534	336.0347	331.3737	343.1193	368.1243	399.6886	429.3546 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666 (71)
Water heating gains (Table 5)	179.3909	176.4241	170.6022	157.6969	149.8235	141.5797	136.4527	140.5923	145.4575	154.6045	166.9679	177.7299 (72)
Total internal gains	783.1827	780.5976	756.6818	712.0553	667.3331	623.9864	600.1045	603.8623	626.8214	670.6896	719.9018	762.7668 (73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North	1.4200				10.6334	0.6300	0.7000	0.7700	4.6146 (74)			
East	11.5200				19.6403	0.6300	0.7000	0.7700	69.1467 (76)			
South	2.2000				46.7521	0.6300	0.7000	0.7700	31.4337 (78)			
West	6.6400				19.6403	0.6300	0.7000	0.7700	39.8554 (80)			

Solar gains	145.0504	273.5303	431.7234	610.3341	737.3147	751.5564	716.7329	621.6814	494.9350	319.0407	178.8652	120.6466 (83)
Total gains	928.2331	1054.1279	1188.4053	1322.3894	1404.6478	1375.5428	1316.8373	1225.5437	1121.7564	989.7303	898.7670	883.4133 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.8193	19.8822	19.9443	20.2411	20.2976	20.5649	20.5649	20.6152	20.4611	20.2976	20.1836	20.0658
alpha	2.3213	2.3255	2.3296	2.3494	2.3532	2.3710	2.3710	2.3743	2.3641	2.3532	2.3456	2.3377
util living area	0.9318	0.9081	0.8654	0.7896	0.6823	0.5468	0.4260	0.4664	0.6535	0.8277	0.9093	0.9381 (86)
MIT	18.1626	18.4960	19.0530	19.7484	20.3263	20.7246	20.8906	20.8612	20.5528	19.7884	18.8618	18.1097 (87)
Th 2	19.9981	20.0009	20.0037	20.0169	20.0193	20.0308	20.0308	20.0330	20.0264	20.0193	20.0143	20.0091 (88)
util rest of house	0.9236	0.8973	0.8493	0.7638	0.6416	0.4855	0.3452	0.3851	0.5965	0.8006	0.8968	0.9307 (89)
MIT 2	16.6776	17.0980	17.7960	18.6591	19.3481	19.8001	19.9616	19.9404	19.6258	18.7286	17.5738	16.6171 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	16.8947	17.3023	17.9797	18.8183	19.4912	19.9353	20.0974	20.0750	19.7613	18.8836	17.7621	16.8353 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.8947	17.3023	17.9797	18.8183	19.4912	19.9353	20.0974	20.0750	19.7613	18.8836	17.7621	16.8353 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8876	0.8577	0.8075	0.7265	0.6171	0.4790	0.3510	0.3888	0.5791	0.7618	0.8580	0.8964 (94)
Useful gains	823.8777	904.0737	959.6066	960.6729	866.7506	658.9191	462.2720	476.5356	649.6434	754.0100	771.0980	791.8848 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1844.1400	1810.2242	1670.3461	1421.9952	1113.9088	752.8770	493.5304	517.3284	802.9378	1184.3074	1532.9787	1827.3571 (97)
Space heating kWh	759.0752	608.9331	528.7903	332.1521	183.8857	0.0000	0.0000	0.0000	0.0000	320.1413	548.5541	770.3914 (98a)
Space heating requirement - total per year (kWh/year)	4051.9230											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	759.0752	608.9331	528.7903	332.1521	183.8857	0.0000	0.0000	0.0000	0.0000	320.1413	548.5541	770.3914 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4051.9230											
Space heating per m2	(98c) / (4) = 30.5345 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	759.0752	608.9331	528.7903	332.1521	183.8857	0.0000	0.0000	0.0000	0.0000	320.1413	548.5541	770.3914 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	303.7516	243.6707	211.6007	132.9140	73.5837	0.0000	0.0000	0.0000	0.0000	128.1077	219.5095	308.2799 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	183.4930	162.3112	172.2620	150.7455	145.7090	130.8137	128.6225	133.9124	135.6093	151.8186	162.2107	181.3704 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa (231)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting (232)m	33.5006	26.8754	24.1983	17.7287	13.6942	11.1883	12.4923	16.2380	21.0915	27.6732	31.2568	34.4317 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1621.4178	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1838.8784	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												270.3689	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3730.6650	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1621.4178	16.4900	267.3718	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1838.8784	16.4900	303.2310	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	270.3689	16.4900	44.5838	(250)
Additional standing charges			0.0000	(251)
Total energy cost			615.1867	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2463	(257)
SAP value		79.7975	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1621.4178	0.1544	250.4117	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1838.8784	0.1410	259.2472	(264)
Space and water heating			509.6589	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	270.3689	0.1443	39.0226	(268)
Total CO2, kg/year			548.6815	(272)
CO2 emissions per m2			4.1300	(273)
EI value			95.8625	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400	(1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	331.7500	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 60.0000 / (5) = 0.1809 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.4309 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3662 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Adj infilt rate	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Effective ac	0.3296	0.3021	0.2930	0.2930	0.3021	0.2655	0.2838	0.2564	0.2564	0.2747	0.2564	0.2930	(22b)
	0.5543	0.5456	0.5429	0.5429	0.5456	0.5352	0.5403	0.5329	0.5329	0.5377	0.5329	0.5429	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			21.7800	1.1450	24.9389			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			66.3500	0.1100	7.2985	75.0000	4976.2500	(28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	9.0000	1282.2300	(29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	9.0000	597.1500	(30)
Total net area of external elements Aum(A, m2)			298.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.1305			(33)
GF			80.0000			9.0000	720.0000	(32c)
FF			120.0000			9.0000	1080.0000	(32c)
Internal Floor 1			66.3500			18.0000	1194.3000	(32d)
Internal Ceiling 1			66.3500			9.0000	597.1500	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 10447.0800 (34)
List of Thermal Bridges 78.7271 (35)

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	4.2500	0.0600	0.2550	
E10 Eaves (insulation at ceiling level)	28.9900	0.0600	1.7394	
E16 Corner (normal)	25.0000	0.0900	2.2500	
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500	
E2 Other lintels (including other steel lintels)	17.5100	0.0500	0.8755	
E3 Sill	16.5800	0.0500	0.8290	
E4 Jamb	36.0000	0.0500	1.8000	
E5 Ground floor (normal)	33.2400	0.1600	5.3184	
E6 Intermediate floor within a dwelling	33.2400	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				12.6173 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	79.7478 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m Jan 60.6856 Feb 59.7358 Mar 59.4375 Apr 59.4375 May 59.7358 Jun 58.5978 Jul 59.1484 Aug 58.3362 Sep 58.3362 Oct 58.8685 Nov 58.3362 Dec 59.4375 (38)
Heat transfer coeff 140.4334 139.4836 139.1853 139.1853 139.4836 138.3456 138.8963 138.0841 138.0841 138.6164 138.0841 139.1853 (39)
Average = Sum(39)m / 12 = 138.9223

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0583	1.0511	1.0489	1.0489	1.0511	1.0425	1.0467	1.0406	1.0406	1.0446	1.0406	1.0489	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9017 (42)
Hot water usage for mixer showers													
91.0890	89.7201	87.7254	83.9088	81.0923	77.9513	76.1660	78.1456	80.3157	83.6881	87.5867	90.7400		(42a)
Hot water usage for baths													
31.4602	30.9930	30.3350	29.1219	28.2135	27.2062	26.6622	27.3155	28.0269	29.1047	30.3428	31.3539		(42b)
Hot water usage for other uses													
44.3460	42.7334	41.1208	39.5082	37.8956	36.2831	36.2831	37.8956	39.5082	41.1208	42.7334	44.3460		(42c)
Average daily hot water use (litres/day)													153.4641 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
166.8952	163.4465	159.1812	152.5389	147.2014	141.4406	139.1112	143.3567	147.8508	153.9136	160.6629	166.4399		(44)
Energy conte	264.3212	232.7456	244.6556	208.8182	198.1614	173.9177	168.2429	177.5056	182.3148	208.8593	228.8937	260.6046	(45)
Energy content (annual)										Total = Sum(45)m =	2549.0406		
Distribution loss (46)m = 0.15 x (45)m													
39.6482	34.9118	36.6983	31.3227	29.7242	26.0877	25.2364	26.6258	27.3472	31.3289	34.3341	39.0907		(46)
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796	(64)
Total per year (kWh/year) = Sum(64)m =													3219.8760 (64)

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Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	133.4668	118.5570	126.9280	113.5418	111.4687	101.9374	101.5208	104.6007	104.7294	115.0258	120.2169	132.2311 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.2735	33.9942	27.6459	20.9298	15.6452	13.2084	14.2721	18.5514	24.8997	31.6159	36.9004	39.3373 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.1733	453.8343	442.0887	417.0837	385.5194	355.8534	336.0347	331.3737	343.1193	368.1243	399.6886	429.3546 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666 (71)
Water heating gains (Table 5)	179.3909	176.4241	170.6022	157.6969	149.8235	141.5797	136.4527	140.5923	145.4575	154.6045	166.9679	177.7299 (72)
Total internal gains	783.1827	780.5976	756.6818	712.0553	667.3331	623.9864	600.1045	603.8623	626.8214	670.6896	719.9018	762.7668 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.4200	13.0723		0.6300		0.7000		0.7700		5.6730 (74)
East				11.5200	24.4329		0.6300		0.7000		0.7700		86.0199 (76)
South				2.2000	54.9219		0.6300		0.7000		0.7700		36.9267 (78)
West				6.6400	24.4329		0.6300		0.7000		0.7700		49.5809 (80)
Solar gains	178.2004	294.9518	460.6015	671.0509	788.0014	869.3936	812.8462	712.9079	563.9647	366.5531	220.4939	144.5011	(83)
Total gains	961.3831	1075.5494	1217.2833	1383.1062	1455.3345	1493.3799	1412.9507	1316.7702	1190.7861	1037.2427	940.3957	907.2678	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.6644	20.8051	20.8497	20.8497	20.8051	20.9762	20.8931	21.0159	21.0159	20.9352	21.0159	20.8497	
alpha	2.3776	2.3870	2.3900	2.3900	2.3870	2.3984	2.3929	2.4011	2.4011	2.3957	2.4011	2.3900	
util living area	0.9175	0.8952	0.8417	0.7488	0.6162	0.4478	0.3343	0.3454	0.5771	0.7743	0.8835	0.9255 (86)	
MIT	18.5553	18.8005	19.3803	20.0139	20.5469	20.8558	20.9491	20.9475	20.7142	20.1317	19.2745	18.5041 (87)	
Th 2	20.0351	20.0410	20.0428	20.0428	20.0410	20.0480	20.0446	20.0497	20.0497	20.0463	20.0497	20.0428 (88)	
util rest of house	0.9076	0.8830	0.8230	0.7190	0.5689	0.3817	0.2522	0.2590	0.5128	0.7389	0.8673	0.9164 (89)	
MIT 2	17.1936	17.5025	18.2246	18.9941	19.6124	19.9408	20.0188	20.0237	19.8122	19.1575	18.1097	17.1344 (90)	
Living area fraction	17.3926	17.6922	18.3935	19.1432	19.7490	20.0746	20.1548	20.1587	19.9440	19.2999	18.2800	17.3347 (92)	
MIT	17.3926	17.6922	18.3935	19.1432	19.7490	20.0746	20.1548	20.1587	19.9440	19.2999	18.2800	17.3347 (93)	
Temperature adjustment												0.0000	
adjusted MIT	17.3926	17.6922	18.3935	19.1432	19.7490	20.0746	20.1548	20.1587	19.9440	19.2999	18.2800	17.3347 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8704	0.8438	0.7834	0.6868	0.5532	0.3836	0.2620	0.2693	0.5050	0.7063	0.8282	0.8807 (94)	
Useful gains	836.7667	907.5161	953.5809	949.9680	805.1506	572.8775	370.2387	354.6354	601.3821	732.6174	778.8435	799.0093 (95)	
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)	
Heat loss rate W	1712.2538	1700.6163	1544.0555	1314.3532	969.2778	619.0409	382.6335	367.1293	696.5001	1039.6108	1391.8872	1688.9696 (97)	
Space heating kWh	651.3624	532.9634	439.3131	262.3573	122.1106	0.0000	0.0000	0.0000	0.0000	228.4031	441.3914	662.1305 (98a)	
Space heating requirement - total per year (kWh/year)												3340.0318	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)	
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	651.3624	532.9634	439.3131	262.3573	122.1106	0.0000	0.0000	0.0000	0.0000	228.4031	441.3914	662.1305 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												3340.0318	
Space heating per m ²												(98c) / (4) =	25.1698 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	651.3624	532.9634	439.3131	262.3573	122.1106	0.0000	0.0000	0.0000	0.0000	228.4031	441.3914	662.1305 (98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)	
Space heating fuel (main heating system)	260.6492	213.2707	175.7956	104.9849	48.8638	0.0000	0.0000	0.0000	0.0000	91.3978	176.6272	264.9582 (211)	
Space heating efficiency (main heating system 2)													

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	183.4930	162.3112	172.2620	150.7455	145.7090	130.8137	128.6225	133.9124	135.6093	151.8186	162.2107	181.3704	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	33.5006	26.8754	24.1983	17.7287	13.6942	11.1883	12.4923	16.2380	21.0915	27.6732	31.2568	34.4317	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1336.5474	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1838.8784	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												270.3689	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3445.7946	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1336.5474	26.0600	348.3042	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1838.8784	26.0600	479.2117	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	270.3689	26.0600	70.4581	(250)
Additional standing charges			0.0000	(251)
Total energy cost			897.9741	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1336.5474	0.1551	207.2577	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1838.8784	0.1410	259.2472	(264)
Space and water heating			466.5049	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	270.3689	0.1443	39.0226	(268)
Total CO2, kg/year			505.5275	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1336.5474	1.5741	2103.8755	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1838.8784	1.5213	2797.4882	(278)
Space and water heating			4901.3637	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	270.3689	1.5338	414.7009	(282)
Total Primary energy kWh/year			5316.0646	(286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:

C 80

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Current environmental impact rating:

A 96

N Solar water heating
U Solar photovoltaic panels
V2 Wind turbine
Recommended
Recommended
Not applicable

Recommended measures:
N Solar water heating
U Solar photovoltaic panels
SAP change
Cost change
CO2 change
+ 1.8
-£ 103
-49 kg (9.7%)
+ 5.1
-£ 261
-135 kg (29.6%)

Recommended measures
Solar water heating
Solar photovoltaic panels
Typical annual savings
£103
£261
£364
0.37 kg/m²
1.02 kg/m²
1.39 kg/m²
Energy efficiency
B 82
B 87
Environmental impact
A 96
A 97

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£898	£795	£103
Space heating	£348	£370	-£21
Water heating	£479	£355	£124
Lighting	£70	£70	£0
Generated (PV)	-£0	-£261	£261
Total cost of fuels	£898	£534	£364
Total cost of uses	£897	£534	£364
Delivered energy	26 kWh/m²	15 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	2 kg/m²	1 kg/m²
Primary energy	40 kWh/m²	24 kWh/m²	16 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.7500 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

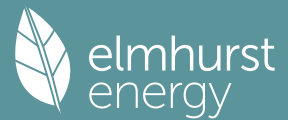
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 60.0000 / (5) = 0.1809 (8)
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered
Blower Door
5.0000 (17)
0.4309 (18)
2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3662 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4669	0.4578	0.4486	0.4029	0.3937	0.3479	0.3479	0.3388	0.3662	0.3937	0.4120	0.4303 (22b)
Effective ac	0.6090	0.6048	0.6006	0.5811	0.5775	0.5605	0.5605	0.5574	0.5671	0.5775	0.5849	0.5926 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K

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Windows (Uw = 1.20)			21.7800	1.1450	24.9389			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			66.3500	0.1100	7.2985	75.0000	4976.2500	(28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	9.0000	1282.2300	(29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	9.0000	597.1500	(30)
Total net area of external elements Aum(A, m2)			298.9000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	67.1305				(33)
GF			80.0000			9.0000	720.0000	(32c)
FF			120.0000			9.0000	1080.0000	(32c)
Internal Floor 1			66.3500			18.0000	1194.3000	(32d)
Internal Ceiling 1			66.3500			9.0000	597.1500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10447.0800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 78.7271 (35)

List of Thermal Bridges													
K1 Element													
E12 Gable (insulation at ceiling level)													
E10 Eaves (insulation at ceiling level)													
E16 Corner (normal)													
E17 Corner (inverted - internal area greater than external area)													
E2 Other lintels (including other steel lintels)													
E3 Sill													
E4 Jamb													
E5 Ground floor (normal)													
E6 Intermediate floor within a dwelling													
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													
Point Thermal bridges													
Total fabric heat loss													

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	66.6738	66.2103	65.7561	63.6223	63.2231	61.3647	61.3647	61.0206	62.0806	63.2231	64.0307	64.8750	(38)
Average = Sum(39)m / 12 =	146.4216	145.9582	145.5039	143.3702	142.9710	141.1126	141.1126	140.7684	141.8284	142.9710	143.7786	144.6229	(39)
													143.3683
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1034	1.0999	1.0965	1.0804	1.0774	1.0634	1.0634	1.0608	1.0688	1.0774	1.0835	1.0898	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9017 (42)
Hot water usage for mixer showers													
Hot water usage for baths													
Hot water usage for other uses													
Average daily hot water use (litres/day)													
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	166.8952	163.4465	159.1812	152.5389	147.2014	141.4406	139.1112	143.3567	147.8508	153.9136	160.6629	166.4399	(44)
Energy content (annual)	264.3212	232.7456	244.6556	208.8182	198.1614	173.9177	168.2429	177.5056	182.3148	208.8593	228.8937	260.6046	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	39.6482	34.9118	36.6983	31.3227	29.7242	26.0877	25.2364	26.6258	27.3472	31.3289	34.3341	39.0907	(46)
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	321.2963	284.2070	300.2349	257.2017	242.3421	216.4481	212.1910	222.3842	232.0491	264.4386	284.0309	317.5796	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.8000 (H2)
Collector linear heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0000 (H4)
Collector loop efficiency													0.9000 (H5)
Incidence angle modifier													1.0000 (H6)
Overshading factor													0.8000 (H8)
Overall heat loss coefficient of system													6.5000 (H10)
Heat loss coefficient of collector loop													3.9667 (H11)
Dedicated solar storage volume													75.0000 (H12)
Effective solar volume													75.0000 (H14)
Reference volume													225.0000 (H15)
Storage tank correction coefficient													1.3161 (H16)
Heat delivered to hot water													644.8508 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													644.8508
Solar input	-0.0000	-16.1755	-59.4857	-82.7576	-109.4877	-101.1574	-100.5336	-87.1389	-59.2730	-28.8414	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	321.2963	268.0315	240.7492	174.4441	132.8544	115.2907	111.6574	135.2453	172.7761	235.5972	284.0309	317.5796	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	133.4668	118.5570	125.8114	108.1389	101.2332	91.8520	91.0993	94.9235	100.4071	113.9092	120.2169	132.2311	(65)

5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.2735	33.9942	27.6459	20.9298	15.6452	13.2084	14.2721	18.5514	24.8997	31.6159	36.9004	39.3373	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.1733	453.8343	442.0887	417.0837	385.5194	355.8534	336.0347	331.3737	343.1193	368.1243	399.6886	429.3546	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	(71)
Water heating gains (Table 5)	179.3909	176.4241	169.1014	150.1929	136.0662	127.5722	122.4452	127.5853	139.4543	153.1037	166.9679	177.7299	(72)
Total internal gains	783.1827	780.5976	755.1810	704.5513	653.5758	609.9789	586.0970	590.8554	620.8182	669.1888	719.9018	762.7668	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.4200	10.6334	0.6300		0.7000		0.7700		4.6146 (74)
East				11.5200	19.6403	0.6300		0.7000		0.7700		69.1467 (76)
South				2.2000	46.7521	0.6300		0.7000		0.7700		31.4337 (78)
West				6.6400	19.6403	0.6300		0.7000		0.7700		39.8554 (80)
Solar gains	145.0504	273.5303	431.7234	610.3341	737.3147	751.5564	716.7329	621.6814	494.9350	319.0407	178.8652	120.6466 (83)
Total gains	928.2331	1054.1279	1186.9045	1314.8854	1390.8905	1361.5353	1302.8299	1212.5368	1115.7532	988.2295	898.7670	883.4133 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.8193	19.8822	19.9443	20.2411	20.2976	20.5649	20.5649	20.6152	20.4611	20.2976	20.1836	20.0658	
alpha	2.3213	2.3255	2.3296	2.3494	2.3532	2.3710	2.3710	2.3743	2.3641	2.3532	2.3456	2.3377	
util living area	0.9318	0.9081	0.8657	0.7913	0.6858	0.5507	0.4297	0.4702	0.6554	0.8281	0.9093	0.9381	(86)
MIT	18.1626	18.4960	19.0513	19.7416	20.3182	20.7202	20.8885	20.8587	20.5497	19.7868	18.8618	18.1097	(87)
Th 2	19.9981	20.0009	20.0037	20.0169	20.0193	20.0308	20.0308	20.0330	20.0264	20.0193	20.0143	20.0091	(88)
util rest of house	0.9236	0.8973	0.8496	0.7655	0.6452	0.4893	0.3484	0.3886	0.5985	0.8010	0.8968	0.9307	(89)
MIT 2	16.6776	17.0980	17.7938	18.6512	19.3394	19.7962	19.9602	19.9386	19.6227	18.7268	17.5738	16.6171	(90)
Living area fraction	16.8947	17.3023	17.9777	18.8106	19.4825	19.9313	20.0959	20.0731	19.7583	18.8818	17.7621	16.8353	(91)
MIT	16.8947	17.3023	17.9777	18.8106	19.4825	19.9313	20.0959	20.0731	19.7583	18.8818	17.7621	16.8353	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.8947	17.3023	17.9777	18.8106	19.4825	19.9313	20.0959	20.0731	19.7583	18.8818	17.7621	16.8353	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8876	0.8577	0.8078	0.7281	0.6203	0.4825	0.3542	0.3922	0.5810	0.7622	0.8580	0.8964	(94)
Useful gains	823.8777	904.0737	958.7521	957.4040	862.8201	656.9285	461.4568	475.5182	648.2067	753.2745	771.0980	791.8848	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1844.1400	1810.2242	1670.0447	1420.8915	1112.6726	752.3125	493.3155	517.0556	802.5010	1184.0554	1532.9787	1827.3571	(97)
Space heating kWh	759.0752	608.9331	529.2017	333.7110	185.8903	0.0000	0.0000	0.0000	0.0000	320.5010	548.5541	770.3914	(98a)
Space heating requirement - total per year (kWh/year)												4056.2578	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	759.0752	608.9331	529.2017	333.7110	185.8903	0.0000	0.0000	0.0000	0.0000	320.5010	548.5541	770.3914	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4056.2578	
Space heating per m2										(98c) / (4) =		30.5671	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement	759.0752	608.9331	529.2017	333.7110	185.8903	0.0000	0.0000	0.0000	0.0000	320.5010	548.5541	770.3914	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	303.7516	243.6707	211.7654	133.5378	74.3859	0.0000	0.0000	0.0000	0.0000	128.2517	219.5095	308.2799	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	321.2963	268.0315	240.7492	174.4441	132.8544	115.2907	111.6574	135.2453	172.7761	235.5972	284.0309	317.5796	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
(217)m													(217)

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Fuel for water heating, kWh/month	183.4930	153.0734	137.4924	99.6254	75.8734	65.8428	63.7678	77.2389	98.6728	134.5501	162.2107	181.3704	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	33.5006	26.8754	24.1983	17.7287	13.6942	11.1883	12.4923	16.2380	21.0915	27.6732	31.2568	34.4317	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.5019	-59.8256	-91.1100	-106.3745	-115.0561	-101.7863	-100.2702	-93.9479	-82.2608	-69.5692	-44.6328	-33.6973	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1623.1524	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1433.2112	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												270.3689	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-938.0326	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2468.6999	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1623.1524	16.4900	267.6578	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1433.2112	16.4900	236.3365	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	270.3689	16.4900	44.5838	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-938.0326	16.4900	-154.6816	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-154.6816	(252)
Total energy cost			407.0886	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.8247	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	86.6314	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1623.1524	0.1544	250.6515	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1433.2112	0.1449	207.7234	(264)
Space and water heating			458.3749	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	270.3689	0.1443	39.0226	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-938.0326	0.1343	-125.9456	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-125.9456	(269)
Total CO2, kg/year			382.5488	(272)
CO2 emissions per m2			2.8800	(273)
EI value			97.1153	
EI rating			97	(274)
EI band			A	

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.7500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.1809 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4309 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3662 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3296	0.3021	0.2930	0.2930	0.3021	0.2655	0.2838	0.2564	0.2564	0.2747	0.2564	0.2930 (22b)
Effective ac	0.5543	0.5456	0.5429	0.5429	0.5456	0.5352	0.5403	0.5329	0.5329	0.5377	0.5329	0.5429 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			21.7800	1.1450	24.9389		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			66.3500	0.1100	7.2985	75.0000	4976.2500 (28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	9.0000	1282.2300 (29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	9.0000	597.1500 (30)
Total net area of external elements Aum(A, m ²)			298.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.1305		(33)
GF			80.0000			9.0000	720.0000 (32c)
FF			120.0000			9.0000	1080.0000 (32c)
Internal Floor 1			66.3500			18.0000	1194.3000 (32d)
Internal Ceiling 1			66.3500			9.0000	597.1500 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 10447.0800 (34)
78.7271 (35)

List of Thermal Bridges

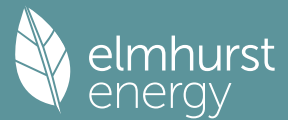
K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	4.2500	0.0600	0.2550
E10 Eaves (insulation at ceiling level)	28.9900	0.0600	1.7394
E16 Corner (normal)	25.0000	0.0900	2.2500
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500
E2 Other lintels (including other steel lintels)	17.5100	0.0500	0.8755
E3 Sill	16.5800	0.0500	0.8290
E4 Jamb	36.0000	0.0500	1.8000
E5 Ground floor (normal)	33.2400	0.1600	5.3184
E6 Intermediate floor within a dwelling	33.2400	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.6173 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	79.7478 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	60.6856	59.7358	59.4375	59.4375	59.7358	58.5978	59.1484	58.3362	58.3362	58.8685	58.3362	59.4375 (38)
Average = Sum(39)m / 12 =	140.4334	139.4836	139.1853	139.1853	139.4836	138.3456	138.8963	138.0841	138.0841	138.6164	138.0841	139.1853 (39)
												138.9223
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0583	1.0511	1.0489	1.0489	1.0511	1.0425	1.0467	1.0406	1.0406	1.0446	1.0406	1.0489 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9017 (42)
Hot water usage for mixer showers	91.0890	89.7201	87.7254	83.9088	81.0923	77.9513	76.1660	78.1456	80.3157	83.6881	87.5867	90.7400 (42a)
Hot water usage for baths	31.4602	30.9930	30.3350	29.1219	28.2135	27.2062	26.6622	27.3155	28.0269	29.1047	30.3428	31.3539 (42b)

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Hot water usage for other uses	44.3460	42.7334	41.1208	39.5082	37.8956	36.2831	36.2831	37.8956	39.5082	41.1208	42.7334	44.3460 (42c)
Average daily hot water use (litres/day)												153.4641 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	166.8952	163.4465	159.1812	152.5389	147.2014	141.4406	139.1112	143.3567	147.8508	153.9136	160.6629	166.4399 (44)
Distribution loss (46)m = 0.15 x (45)m	264.3212	232.7456	244.6556	208.8182	198.1614	173.9177	168.2429	177.5056	182.3148	208.8593	228.8937	260.6046 (45)
Water storage loss:	39.6482	34.9118	36.6983	31.3227	29.7242	26.0877	25.2364	26.6258	27.3472	31.3289	34.3341	39.0907 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												0.0103 (51)
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.7830 (52)
Volume factor from Table 2a												0.5400 (53)
Temperature factor from Table 2b												1.0875 (55)
Enter (49) or (54) in (55)												
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	321.2963	284.2070	300.2349	257.2017	242.3421	216.4481	212.1910	222.3842	232.0491	264.4386	284.0309	317.5796 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												765.8930 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												765.8930
Solar input	-1.7572	-20.9137	-66.4993	-94.4927	-119.3843	-120.2656	-116.8265	-104.3534	-72.9024	-40.9450	-7.5531	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	319.5391	263.2933	233.7356	162.7090	122.9578	96.1825	95.3645	118.0309	159.1467	223.4936	276.4778	317.5796 (64)
												Total per year (kWh/year) = Sum(64)m = 2388.5106 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	133.4668	118.5570	125.8114	108.1389	101.2332	91.8520	91.0993	94.9235	100.4071	113.9092	120.2169	132.2311 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.2735	33.9942	27.6459	20.9298	15.6452	13.2084	14.2721	18.5514	24.8997	31.6159	36.9004	39.3373 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.1733	453.8343	442.0887	417.0837	385.5194	355.8534	336.0347	331.3737	343.1193	368.1243	399.6886	429.3546 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666 (71)
Water heating gains (Table 5)	179.3909	176.4241	169.1014	150.1929	136.0662	127.5722	122.4452	127.5853	139.4543	153.1037	166.9679	177.7299 (72)
Total internal gains	783.1827	780.5976	755.1810	704.5513	653.5758	609.9789	586.0970	590.8554	620.8182	669.1888	719.9018	762.7668 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W
North					1.4200	13.0723	0.6300	0.7000		0.7700		5.6730 (74)
East					11.5200	24.4329	0.6300	0.7000		0.7700		86.0199 (76)
South					2.2000	54.9219	0.6300	0.7000		0.7700		36.9267 (78)
West					6.6400	24.4329	0.6300	0.7000		0.7700		49.5809 (80)
Solar gains	178.2004	294.9518	460.6015	671.0509	788.0014	869.3936	812.8462	712.9079	563.9647	366.5531	220.4939	144.5011 (83)
Total gains	961.3831	1075.5494	1215.7825	1375.6022	1441.5772	1479.3725	1398.9432	1303.7633	1184.7829	1035.7419	940.3957	907.2678 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.6644	20.8051	20.8497	20.8497	20.8051	20.9762	20.8931	21.0159	21.0159	20.9352	21.0159	20.8497
alpha	2.3776	2.3870	2.3900	2.3900	2.3870	2.3984	2.3929	2.4011	2.4011	2.3957	2.4011	2.3900
util living area	0.9175	0.8952	0.8420	0.7506	0.6198	0.4512	0.3372	0.3484	0.5790	0.7748	0.8835	0.9255 (86)
MIT	18.5553	18.8005	19.3786	20.0081	20.5409	20.8534	20.9481	20.9465	20.7120	20.1304	19.2745	18.5041 (87)
Th 2	20.0351	20.0410	20.0428	20.0428	20.0410	20.0480	20.0446	20.0497	20.0497	20.0463	20.0497	20.0428 (88)
util rest of house												

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MIT 2	0.9076	0.8830	0.8233	0.7209	0.5725	0.3847	0.2546	0.2614	0.5147	0.7394	0.8673	0.9164 (89)
Living area fraction	17.1936	17.5025	18.2226	18.9875	19.6063	19.9389	20.0183	20.0231	19.8102	19.1561	18.1097	17.1344 (90)
MIT	17.3926	17.6922	18.3916	19.1367	19.7429	20.0726	20.1542	20.1581	19.9420	19.2985	18.2800	17.3347 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3926	17.6922	18.3916	19.1367	19.7429	20.0726	20.1542	20.1581	19.9420	19.2985	18.2800	17.3347 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8704	0.8438	0.7837	0.6885	0.5565	0.3865	0.2644	0.2718	0.5068	0.7068	0.8282	0.8807	(94)
Useful gains	836.7667	907.5161	952.7964	947.1663	802.2597	571.8438	369.9060	354.3023	600.4131	732.0171	778.8435	799.0093	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1712.2538	1700.6163	1543.7890	1313.4476	968.4221	618.7672	382.5494	367.0450	696.2249	1039.4154	1391.8872	1688.9696	(97)
Space heating kWh	651.3624	532.9634	439.6984	263.7225	123.6249	0.0000	0.0000	0.0000	0.0000	228.7043	441.3914	662.1305	(98a)
Space heating requirement - total per year (kWh/year)												3343.5978	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	651.3624	532.9634	439.6984	263.7225	123.6249	0.0000	0.0000	0.0000	0.0000	228.7043	441.3914	662.1305	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3343.5978	
Space heating per m2												25.1967	(99)

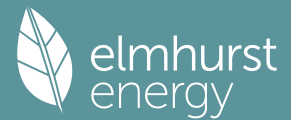
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	651.3624	532.9634	439.6984	263.7225	123.6249	0.0000	0.0000	0.0000	0.0000	228.7043	441.3914	662.1305	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	260.6492	213.2707	175.9498	105.5312	49.4697	0.0000	0.0000	0.0000	0.0000	91.5183	176.6272	264.9582	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	319.5391	263.2933	233.7356	162.7090	122.9578	96.1825	95.3645	118.0309	159.1467	223.4936	276.4778	317.5796	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	182.4895	150.3674	133.4869	92.9235	70.2215	54.9301	54.4629	67.4077	90.8890	127.6377	157.8971	181.3704	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	33.5006	26.8754	24.1983	17.7287	13.6942	11.1883	12.4923	16.2380	21.0915	27.6732	31.2568	34.4317	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-46.6621	-62.8224	-94.0986	-111.1226	-116.7751	-108.8513	-106.2557	-100.6808	-88.7691	-75.6811	-52.3874	-39.0335	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1337.9743	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1364.0837	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												270.3689	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1003.1397	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2049.2872	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year

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Space heating - main system 1	1337.9743	26.0600	348.6761 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1364.0837	26.0600	355.4802 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	270.3689	26.0600	70.4581 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1003.1397	26.0600	-261.4182
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-261.4182 (252)
Total energy cost			534.0442 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1337.9743	0.1551	207.4558 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1364.0837	0.1458	198.8250 (264)
Space and water heating			406.2808 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	270.3689	0.1443	39.0226 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1003.1397	0.1345	-134.8876
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-134.8876 (269)
Total CO2, kg/year			321.5128 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1337.9743	1.5740	2106.0354 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1364.0837	1.5392	2099.5643 (278)
Space and water heating			4205.5997 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	270.3689	1.5338	414.7009 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1003.1397	1.4970	-1501.6549
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1501.6549 (283)
Total Primary energy kWh/year			3239.6697 (286)

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Property Reference	FURNERS LANE 3				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 3, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	4.04	TER	8.98	
Environmental	96 A	% DER < TER				55.01
CO ₂ Emissions (t/year)	0.56	DFEE	39.93	TFEE	40.34	
Compliance Check	See BREL	% DFEE < TFEE				1.03
% DPER < TPER	9.90	DPER	42.29	TPER	46.94	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

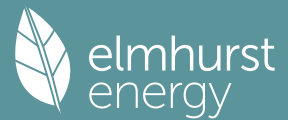
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1577 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4077	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3466 (21)

Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4419	0.4332	0.4246	0.3812	0.3726	0.3292	0.3292	0.3206	0.3466	0.3726	0.3899	0.4072 (22b)
Effective ac	0.5976	0.5938	0.5901	0.5727	0.5694	0.5542	0.5542	0.5514	0.5601	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			35.9200	1.1450	41.1298		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000 (28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600 (29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500 (29a)
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400 (30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900 (30)
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400 (30)
Total net area of external elements Aum(A, m ²)			348.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609		(33)
GF			110.0000			9.0000	990.0000 (32c)
FF			130.0000			9.0000	1170.0000 (32c)
Internal Floor 1			75.1100			18.0000	1351.9800 (32d)
Internal Ceiling 1			75.1100			9.0000	675.9900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.2547 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E12 Gable (insulation at ceiling level)	14.9500	0.0600	0.8970
E10 Eaves (insulation at ceiling level)	26.1800	0.0600	1.5708
E14 Flat roof	2.7200	0.0800	0.2176
E16 Corner (normal)	39.6000	0.0900	3.5640
E17 Corner (inverted - internal area greater than external area)	19.6000	-0.0900	-1.7640
E2 Other lintels (including other steel lintels)	25.4000	0.0500	1.2700
E3 Sill	24.4700	0.0500	1.2235
E4 Jamb	57.9000	0.0500	2.8950
E5 Ground floor (normal)	39.3700	0.1600	6.2992
E6 Intermediate floor within a dwelling	38.4100	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.1731 (36)
 Point Thermal bridges 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 104.3340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	75.0169	74.5410	74.0745	71.8836	71.4737	69.5654	69.5654	69.2120	70.3004	71.4737	72.3029	73.1699 (38)
Heat transfer coeff	179.3508	178.8749	178.4085	176.2175	175.8076	173.8994	173.8994	173.5460	174.6344	175.8076	176.6369	177.5038 (39)
Average = Sum(39)m / 12 =												176.2156

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1782	1.1750	1.1720	1.1576	1.1549	1.1423	1.1423	1.1400	1.1472	1.1549	1.1603	1.1660 (40)
HLP (average)												1.1576
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9376 (42)
Hot water usage for mixer showers												
91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906 (42a)	
Hot water usage for baths												
31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122 (42b)	
Hot water usage for other uses												
44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141 (42c)	
Average daily hot water use (litres/day)												154.7338 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169 (44)
Energy conte	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607 (45)
Energy content (annual)										Total = Sum(45)m =		2570.1301
Distribution loss (46)m = 0.15 x (45)m												
39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141 (46)	
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)	
If cylinder contains dedicated solar storage												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (64)	
									Total per year (kWh/year) = Sum(64)m =			3240.9655 (64)
12Total per year (kWh/year)												3241 (64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000 (64a)
Heat gains from water heating, kWh/month												
134.1940	119.1973	127.6011	114.1162	112.0138	102.4158	101.9836	105.0890	105.2309	115.6003	120.8466	132.9480 (65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.8850	180.3370	162.8850	168.3145	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046 (71)
Water heating gains (Table 5)	180.3683	177.3769	171.5068	158.4947	150.5562	142.2441	137.0748	141.2486	146.1541	155.3768	167.8425	178.6935 (72)
Total internal gains	736.2553	754.0670	722.3003	696.7401	660.6786	633.4673	608.6196	609.4424	628.2220	652.9928	693.5814	720.3317 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.4700	10.6334	0.6300	0.7000	0.7700	21.0256 (74)
East	13.8100	19.6403	0.6300	0.7000	0.7700	82.8920 (76)
South	5.8000	46.7521	0.6300	0.7000	0.7700	82.8706 (78)

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West	9.8400		19.6403		0.6300		0.7000		0.7700		59.0628 (80)	
Solar gains	245.8511	453.5955	698.4836	972.0445	1168.7575	1190.8685	1135.7460	987.3732	794.5739	523.7248	301.1687	205.8726 (83)
Total gains	982.1064	1207.6625	1420.7839	1668.7846	1829.4361	1824.3358	1744.3656	1596.8156	1422.7959	1176.7176	994.7502	926.2043 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.6861	18.7359	18.7848	19.0184	19.0627	19.2719	19.2719	19.3112	19.1908	19.0627	18.9732	18.8806	
alpha	2.2457	2.2491	2.2523	2.2679	2.2708	2.2848	2.2848	2.2874	2.2794	2.2708	2.2649	2.2587	
util living area	0.9435	0.9126	0.8637	0.7738	0.6544	0.5143	0.3985	0.4429	0.6356	0.8284	0.9189	0.9497 (86)	
MIT	17.8689	18.3056	18.9367	19.7166	20.3313	20.7317	20.8925	20.8600	20.5393	19.6960	18.6507	17.8024 (87)	
Th 2	19.9375	19.9400	19.9425	19.9541	19.9563	19.9664	19.9664	19.9683	19.9625	19.9563	19.9519	19.9473 (88)	
util rest of house	0.9363	0.9018	0.8467	0.7457	0.6109	0.4508	0.3167	0.3593	0.5752	0.8002	0.9070	0.9433 (89)	
MIT 2	16.2788	16.8281	17.6168	18.5770	19.3019	19.7482	19.9014	19.8787	19.5587	18.5781	17.2775	16.1992 (90)	
Living area fraction	fLA = Living area / (4) =												0.1378 (91)
MIT	16.4980	17.0318	17.7987	18.7341	19.4437	19.8837	20.0380	20.0139	19.6939	18.7321	17.4668	16.4202 (92)	
Temperature adjustment													0.0000
adjusted MIT	16.4980	17.0318	17.7987	18.7341	19.4437	19.8837	20.0380	20.0139	19.6939	18.7321	17.4668	16.4202 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9015	0.8605	0.8024	0.7070	0.5871	0.4454	0.3226	0.3633	0.5577	0.7586	0.8672	0.9106 (94)
Useful gains	885.3311	1039.2302	1140.0516	1179.7878	1074.0484	812.4993	562.7932	580.0891	793.5177	892.6920	862.6615	843.3887 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2187.7170	2170.0675	2015.7806	1732.9382	1361.4070	918.8344	597.8609	627.1843	976.8847	1429.6934	1831.1582	2169.1245 (97)
Space heating kWh	968.9751	759.9226	651.5424	398.2683	213.7948	0.0000	0.0000	0.0000	0.0000	399.5291	697.3176	986.3474 (98a)
Space heating requirement - total per year (kWh/year)												5075.6974
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	968.9751	759.9226	651.5424	398.2683	213.7948	0.0000	0.0000	0.0000	0.0000	399.5291	697.3176	986.3474 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5075.6974
Space heating per m2												(98c) / (4) = 33.3423 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	968.9751	759.9226	651.5424	398.2683	213.7948	0.0000	0.0000	0.0000	0.0000	399.5291	697.3176	986.3474 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	387.7452	304.0907	260.7212	159.3711	85.5521	0.0000	0.0000	0.0000	0.0000	159.8756	279.0387	394.6969 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	184.7420	163.4110	173.4179	151.7321	146.6453	131.6355	129.4174	134.7511	136.4708	152.8055	163.2922	182.6018 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1	2031.0914 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	175.1000											
Water heating fuel used	1850.9226 (219)											
Space cooling fuel	0.0000 (221)											

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Electricity for pumps and fans:
 Total electricity for the above, kWh/year 0.0000 (231)
 Electricity for lighting (calculated in Appendix L) 279.4701 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV generation 0.0000 (233)
 Wind generation 0.0000 (234)
 Hydro-electric generation (Appendix N) 0.0000 (235a)
 Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
 Appendix Q - special features
 Energy saved or generated -0.0000 (236)
 Energy used 0.0000 (237)
 Total delivered energy for all uses 4161.4841 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2031.0914	0.1546	314.0438 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1850.9226	0.1410	260.9524 (264)
Space and water heating			574.9962 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	279.4701	0.1443	40.3362 (268)
Total CO2, kg/year			615.3324 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.0400 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2031.0914	1.5724	3193.7377 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1850.9226	1.5213	2815.8381 (278)
Space and water heating			6009.5759 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	279.4701	1.5338	428.6606 (282)
Total Primary energy kWh/year			6438.2364 (286)
Dwelling Primary energy Rate (DPER)			42.2900 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
 CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

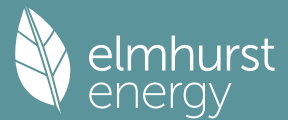
2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1052 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3552 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3019 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3849	0.3774	0.3698	0.3321	0.3245	0.2868	0.2868	0.2792	0.3019	0.3245	0.3396	0.3547 (22b)
Effective ac	0.5741	0.5712	0.5684	0.5551	0.5527	0.5411	0.5411	0.5390	0.5456	0.5527	0.5577	0.5629 (25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			1.9500	1.0000	1.9500			(26)					
TER Opening Type (Uw = 1.20)			35.9200	1.1450	41.1298			(27)					
Ground Floor			77.0400	0.1300	10.0152			(28a)					
Brick	128.3500	32.4100	95.9400	0.1800	17.2692			(29a)					
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450			(29a)					
Joists GF	0.9600		0.9600	0.1100	0.1056			(30)					
Joists FF	75.1100		75.1100	0.1100	8.2621			(30)					
Flat	0.9600		0.9600	0.1100	0.1056			(30)					
Total net area of external elements Aum(A, m2)			348.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	89.6825			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E12 Gable (insulation at ceiling level)				14.9500	0.0600		0.8970						
E10 Eaves (insulation at ceiling level)				26.1800	0.0600		1.5708						
E14 Flat roof				2.7200	0.0800		0.2176						
E16 Corner (normal)				39.6000	0.0900		3.5640						
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900		-1.7640						
E2 Other lintels (including other steel lintels)				25.4000	0.0500		1.2700						
E3 Sill				24.4700	0.0500		1.2235						
E4 Jamb				57.9000	0.0500		2.8950						
E5 Ground floor (normal)				39.3700	0.1600		6.2992						
E6 Intermediate floor within a dwelling				38.4100	0.0000		0.0000						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1731	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss					(33) + (36) + (36a) =		105.8556	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	72.0599	71.6989	71.3450	69.6827	69.3716	67.9238	67.9238	67.6557	68.4815	69.3716	70.0008	70.6586	(38)
Heat transfer coeff	177.9155	177.5544	177.2005	175.5382	175.2272	173.7794	173.7794	173.5113	174.3371	175.2272	175.8564	176.5142	(39)
Average = Sum(39)m / 12 =												175.5367	
HLP	1.1687	1.1664	1.1640	1.1531	1.1511	1.1416	1.1416	1.1398	1.1452	1.1511	1.1552	1.1595	(40)
HLP (average)												1.1531	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.9376 (42)
Hot water usage for mixer showers	73.4740	72.3698	70.7608	67.6823	65.4104	62.8769	61.4368	63.0336	64.7840	67.5043	70.6489	73.1925	(42a)
Hot water usage for baths	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	(42b)
Hot water usage for other uses	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	(42c)
Average daily hot water use (litres/day)												137.7987	(43)
Daily hot water use	149.9075	146.7063	142.8080	136.8804	132.0666	126.8915	124.9029	128.7844	132.8780	138.3110	144.3299	149.5188	(44)
Energy conte	237.4169	208.9078	219.4906	187.3824	177.7871	156.0279	151.0592	159.4620	163.8519	187.6867	205.6244	234.1103	(45)
Energy content (annual)										Total = Sum(45)m =		2288.8072	
Distribution loss (46)m = 0.15 x (45)m	35.6125	31.3362	32.9236	28.1074	26.6681	23.4042	22.6589	23.9193	24.5778	28.1530	30.8437	35.1165	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0208	(55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	292.3237	258.5011	274.3973	240.5180	232.6939	209.1635	205.9660	214.3688	216.9875	242.5935	258.7600	289.0171	(62)
WWHRS	-33.5892	-29.7066	-31.1070	-25.7579	-24.0054	-20.5416	-19.2545	-20.4752	-21.2531	-25.0551	-28.3844	-32.9672	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	258.7345	228.7945	243.2903	214.7601	208.6885	188.6220	186.7116	193.8936	195.7344	217.5384	230.3757	256.0499	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2623.1932	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	122.8666	109.1364	116.9060	104.8131	103.0396	94.3878	94.1526	96.9465	96.9892	106.3313	110.8786	121.7671	(65)

5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
(66)m	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.8850	180.3370	162.8850	168.3145	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	165.1432	162.4054	157.1318	145.5738	138.4941	131.0941	126.5492	130.3045	134.7073	142.9184	153.9981	163.6655	(72)
Total internal gains													

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721.0302 739.0955 707.9253 683.8192 648.6165 622.3173 598.0941 598.4983 616.7752 640.5343 679.7370 705.3036 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.4700	10.6334	0.6300	0.7000	0.7700	21.0256 (74)
East	13.8100	19.6403	0.6300	0.7000	0.7700	82.8920 (76)
South	5.8000	46.7521	0.6300	0.7000	0.7700	82.8706 (78)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628 (80)
Solar gains	245.8511	453.5955	698.4836	972.0445	1168.7575	1190.8685
Total gains	966.8813	1192.6910	1406.4089	1655.8637	1817.3740	1813.1858

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	18.8369	18.8752	18.9129	19.0920	19.1259	19.2852	19.2852	19.3150	19.2235	19.1259	19.0575	18.9864
alpha	2.2558	2.2583	2.2609	2.2728	2.2751	2.2857	2.2857	2.2877	2.2816	2.2751	2.2705	2.2658
util living area	0.9450	0.9141	0.8652	0.7754	0.6560	0.5163	0.4003	0.4452	0.6381	0.8307	0.9207	0.9512 (86)
MIT	17.8740	18.3107	18.9413	19.7159	20.3308	20.7297	20.8916	20.8585	20.5364	19.6915	18.6458	17.7998 (87)
Th 2	19.9451	19.9470	19.9489	19.9577	19.9593	19.9670	19.9670	19.9685	19.9641	19.9593	19.9560	19.9525 (88)
util rest of house	0.9379	0.9035	0.8485	0.7475	0.6126	0.4528	0.3183	0.3614	0.5778	0.8027	0.9090	0.9449 (89)
MIT 2	16.2886	16.8380	17.6261	18.5787	19.3039	19.7470	19.9014	19.8778	19.5573	18.5749	17.2736	16.1983 (90)
Living area fraction									fLA = Living area / (4) =			0.1378 (91)
MIT	16.5071	17.0410	17.8073	18.7354	19.4454	19.8824	20.0379	20.0130	19.6922	18.7288	17.4627	16.4190 (92)
Temperature adjustment												0.0000
adjusted MIT	16.5071	17.0410	17.8073	18.7354	19.4454	19.8824	20.0379	20.0130	19.6922	18.7288	17.4627	16.4190 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	873.7624	1028.9132	1131.3415	1173.7106	1069.9210	810.8972	562.0745	579.2836	790.5381	886.2368	853.0638	831.7136 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2171.8378	2155.6810	2003.6666	1726.4899	1357.2023	917.9783	597.4327	626.8906	974.9270	1424.3846	1822.3500	2156.8251 (97)
Space heating kWh	965.7681	757.1880	649.0099	398.0011	213.7373	0.0000	0.0000	0.0000	0.0000	400.3820	697.8861	985.8830 (98a)
Space heating requirement - total per year (kWh/year)												5067.8555
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	965.7681	757.1880	649.0099	398.0011	213.7373	0.0000	0.0000	0.0000	0.0000	400.3820	697.8861	985.8830 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5067.8555
Space heating per m2										(98c) / (4) =		33.2908 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	965.7681	757.1880	649.0099	398.0011	213.7373	0.0000	0.0000	0.0000	0.0000	400.3820	697.8861	985.8830 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	1046.3360	820.3554	703.1526	431.2038	231.5680	0.0000	0.0000	0.0000	0.0000	433.7833	756.1063	1068.1289 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	258.7345	228.7945	243.2903	214.7601	208.6885	188.6220	186.7116	193.8936	195.7344	217.5384	230.3757	256.0499 (64)
Efficiency of water heater												79.8000 (216)
(217)m	86.7331	86.5353	86.1508	85.4234	84.1135	79.8000	79.8000	79.8000	79.8000	85.4089	86.3821	86.7821 (217)
Fuel for water heating, kWh/month	298.3111	264.3944	282.4005	251.4066	248.1036	236.3684	233.9744	242.9744	245.2812	254.7024	266.6936	295.0491 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	33.8443	27.1511	24.4466	17.9106	13.8347	11.3031	12.6205	16.4046	21.3079	27.9571	31.5775	34.7849 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-66.7341	-91.4457	-127.7690	-139.4456	-146.8080	-135.6370	-133.7868	-127.8989	-117.1848	-102.3589	-72.3488	-57.9947 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233b)m	-46.1847	-96.0365	-188.9159	-281.0150	-369.0743	-370.0645	-365.8650	-311.0512	-229.5918	-136.6110	-61.4048	-36.6223	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												5490.6344	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3119.6596	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												273.1428	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-3811.8492	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5157.5876	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5490.6344	0.2100	1153.0332	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3119.6596	0.2100	655.1285	(264)
Space and water heating			1808.1617	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	273.1428	0.1443	39.4229	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1319.4124	0.1352	-178.4236	
PV Unit electricity exported	-2492.4369	0.1262	-314.4789	
Total			-492.9025	(269)
Total CO2, kg/year			1366.6114	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.9800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5490.6344	1.1300	6204.4168	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3119.6596	1.1300	3525.2154	(278)
Space and water heating			9729.6322	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	273.1428	1.5338	418.9556	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1319.4124	1.4998	-1978.8831	
PV Unit electricity exported	-2492.4369	0.4632	-1154.3831	
Total			-3133.2662	(283)
Total Primary energy kWh/year			7145.4224	(286)
Target Primary Energy Rate (TPER)			46.9400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)	
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 380.3740 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

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Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											
Pressure test	Air changes per hour											
Pressure Test Method	40.0000 / (5) = 0.1052 (8)											
Measured/design AP50	Yes											
Infiltration rate	Blower Door											
Number of sides sheltered	5.0000 (17)											
	0.3552 (18)											
	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3019 (21)											
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.3849	0.3774	0.3698	0.3321	0.3245	0.2868	0.2868	0.2792	0.3019	0.3245	0.3396	0.3547 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.5741	0.5712	0.5684	0.5551	0.5527	0.5411	0.5411	0.5390	0.5456	0.5527	0.5577	0.5629 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)					
Solid Doors			1.9500	1.0000	1.9500			(26)					
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)					
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)					
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)					
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400	(30)					
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)					
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400	(30)					
Total net area of external elements Aum(A, m2)			348.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609			(33)					
GF			110.0000			9.0000	990.0000	(32c)					
FF			130.0000			9.0000	1170.0000	(32c)					
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)					
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E12 Gable (insulation at ceiling level)				14.9500	0.0600	0.8970							
E10 Eaves (insulation at ceiling level)				26.1800	0.0600	1.5708							
E14 Flat roof				2.7200	0.0800	0.2176							
E16 Corner (normal)				39.6000	0.0900	3.5640							
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900	-1.7640							
E2 Other lintels (including other steel lintels)				25.4000	0.0500	1.2700							
E3 Sill				24.4700	0.0500	1.2235							
E4 Jamb				57.9000	0.0500	2.8950							
E5 Ground floor (normal)				39.3700	0.1600	6.2992							
E6 Intermediate floor within a dwelling				38.4100	0.0000	0.0000							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1731	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	104.3340	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 72.0599	Feb 71.6989	Mar 71.3450	Apr 69.6827	May 69.3716	Jun 67.9238	Jul 67.9238	Aug 67.6557	Sep 68.4815	Oct 69.3716	Nov 70.0008	Dec 70.6586	(38)
Heat transfer coeff	176.3939	176.0328	175.6789	174.0166	173.7056	172.2578	172.2578	171.9897	172.8155	173.7056	174.3348	174.9926	(39)
Average = Sum(39)m / 12 =												174.0151	
HLP	Jan 1.1587	Feb 1.1564	Mar 1.1540	Apr 1.1431	May 1.1411	Jun 1.1316	Jul 1.1316	Aug 1.1298	Sep 1.1352	Oct 1.1411	Nov 1.1452	Dec 1.1495	(40)
HLP (average)												1.1431	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9376 (42)											
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	31.6122 (42b)
Hot water usage for other uses												
44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	44.7141 (42c)
Average daily hot water use (litres/day)	70.0581 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
76.4336	74.3365	72.0472	69.1980	66.6562	64.0147	63.4661	65.7508	68.0940	70.8067	73.6810	76.3263	76.3263 (44)
Energy conte	121.0521	105.8542	110.7338	94.7287	89.7321	78.7135	76.7568	81.4132	83.9667	96.0840	104.9721	119.5086 (45)
Energy content (annual)	Total = Sum(45)m = 1163.5157											
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823	101.5823 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823 (64)

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12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =										988.9883 (64)
Electric shower(s)	989 (64)										
58.8404	52.4273	57.2486	54.6316	55.6568	53.0912	54.8609	55.6568	54.6316	57.2486	56.1721	58.8404 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											669.3063 (64a)
Heat gains from water heating, kWh/month											
40.4337	35.6008	37.8431	33.7878	32.9823	29.9994	30.0260	31.2145	31.5008	34.7300	36.3496	40.1057 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.8850	180.3370	162.8850	168.3145	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	54.3463	52.9774	50.8644	46.9274	44.3310	41.6658	40.3576	41.9550	43.7512	46.6801	50.4855	53.9055	(72)
Total internal gains	607.2334	626.6675	598.6579	582.1728	551.4534	532.8891	511.9024	510.1487	525.8191	541.2961	573.2245	592.5436	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				6.4700	10.6334		0.6300	0.7000		0.7700		21.0256 (74)
East				13.8100	19.6403		0.6300	0.7000		0.7700		82.8920 (76)
South				5.8000	46.7521		0.6300	0.7000		0.7700		82.8706 (78)
West				9.8400	19.6403		0.6300	0.7000		0.7700		59.0628 (80)
Solar gains	245.8511	453.5955	698.4836	972.0445	1168.7575	1190.8685	1135.7460	987.3732	794.5739	523.7248	301.1687	205.8726 (83)
Total gains	853.0844	1080.2630	1297.1414	1554.2174	1720.2109	1723.7576	1647.6484	1497.5220	1320.3930	1065.0209	874.3933	798.4162 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.9994	19.0384	19.0767	19.2589	19.2934	19.4556	19.4556	19.4859	19.3928	19.2934	19.2238	19.1515	
alpha	2.2666	2.2692	2.2718	2.2839	2.2862	2.2970	2.2970	2.2991	2.2929	2.2862	2.2816	2.2768	
util living area	0.9564	0.9276	0.8810	0.7926	0.6736	0.5325	0.4148	0.4629	0.6601	0.8511	0.9353	0.9620 (86)	
MIT	17.7513	18.2029	18.8536	19.6590	20.2984	20.7153	20.8851	20.8488	20.5061	19.6175	18.5381	17.6753 (87)	
Th 2	19.9532	19.9551	19.9569	19.9658	19.9674	19.9751	19.9751	19.9766	19.9722	19.9674	19.9641	19.9606 (88)	
util rest of house	0.9507	0.9184	0.8657	0.7660	0.6309	0.4687	0.3313	0.3777	0.6008	0.8256	0.9255	0.9570 (89)	
MIT 2	16.9787	17.4236	18.0604	18.8376	19.4285	19.7932	19.9204	19.9002	19.6311	18.8187	17.7660	16.9082 (90)	
Living area fraction	fLA = Living area / (4) =												0.1378 (91)
MIT	17.0852	17.5310	18.1697	18.9508	19.5484	19.9203	20.0533	20.0309	19.7517	18.9288	17.8724	17.0139 (92)	
Temperature adjustment													0.0000
adjusted MIT	17.0852	17.5310	18.1697	18.9508	19.5484	19.9203	20.0533	20.0309	19.7517	18.9288	17.8724	17.0139 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9284	0.8897	0.8328	0.7354	0.6117	0.4650	0.3380	0.3825	0.5865	0.7936	0.8983	0.9365	(94)
Useful gains	791.9681	961.0580	1080.2065	1142.9773	1052.1982	801.5833	556.9355	572.8618	774.3832	845.1857	785.4769	747.7183	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2255.2284	2223.4678	2050.1200	1748.9999	1363.3148	916.4586	594.8618	624.4826	976.6937	1446.7511	1877.9975	2242.3457	(97)
Space heating kWh	1088.6657	848.3393	721.6156	436.3363	231.4708	0.0000	0.0000	0.0000	0.0000	447.5646	786.6148	1112.0028	(98a)
Space heating requirement - total per year (kWh/year)												5672.6100	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1088.6657	848.3393	721.6156	436.3363	231.4708	0.0000	0.0000	0.0000	0.0000	447.5646	786.6148	1112.0028	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5672.6100	
Space heating per m2											(98c) / (4) =	37.2634	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1619.2232	1274.7076	1307.1215	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7575	0.8143	0.7797	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1226.5339	1037.9601	1019.1438	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1944.0149	1858.1585	1685.9489	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	516.5863	610.2276	496.1030	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction	FC = cooled area / (4) =												1.0000 (105)
Intermittency factor (Table 10b)													

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Space cooling kWh	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	129.1466	152.5569	124.0258	0.0000	0.0000	0.0000 (107)
Energy for space heating											405.7292 (107)
Energy for space cooling											37.2634 (99)
Total											2.6652 (108)
Fabric Energy Efficiency (DFEE)											39.9287 (109)
											39.9 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	Air changes per hour	
Pressure test	40.0000 / (5) =	0.1052 (8)
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	
Infiltration rate		5.0000 (17)
Number of sides sheltered		0.3552 (18)
		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3019 (21)
Wind speed	Jan 5.1000	Feb 5.0000
Wind factor	1.2750	1.2500
Adj infilt rate	0.3849	0.3774
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.3698	0.3321
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.3245	0.2868
Effective ac	0.5741	0.5712
	0.5684	0.5551
	0.5527	0.5411
	0.5411	0.5390
	0.5456	0.5527
	0.5577	0.5629
	0.3547 (22b)	0.0000 (23b)
	0.0000 (23c)	0.0000 (23c)
	0.5629 (25)	

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			35.9200	1.1450	41.1298		(27)
Ground Floor			77.0400	0.1300	10.0152		(28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692		(29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450		(29a)
Joists GF	0.9600		0.9600	0.1100	0.1056		(30)
Joists FF	75.1100		75.1100	0.1100	8.2621		(30)
Flat	0.9600		0.9600	0.1100	0.1056		(30)
Total net area of external elements Aum(A, m ²)			348.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.6825		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.2547 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				14.9500	0.0600	0.8970	
E10 Eaves (insulation at ceiling level)				26.1800	0.0600	1.5708	
E14 Flat roof				2.7200	0.0800	0.2176	
E16 Corner (normal)				39.6000	0.0900	3.5640	
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900	-1.7640	
E2 Other lintels (including other steel lintels)				25.4000	0.0500	1.2700	
E3 Sill				24.4700	0.0500	1.2235	
E4 Jamb				57.9000	0.0500	2.8950	
E5 Ground floor (normal)				39.3700	0.1600	6.2992	
E6 Intermediate floor within a dwelling				38.4100	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						16.1731	(36)
Point Thermal bridges						0.0000	(36a) =
Total fabric heat loss						105.8556	(33) + (36) + (36a) =
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	Jan 72.0599	Feb 71.6989	Mar 71.3450	Apr 69.6827	May 69.3716	Jun 67.9238	Jul 67.9238
Heat transfer coeff						Aug 67.6557	Sep 68.4815
						Oct 69.3716	Nov 70.0008
						Dec 70.6586	(38)

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Average = Sum(39)m / 12 =	177.9155	177.5544	177.2005	175.5382	175.2272	173.7794	173.7794	173.5113	174.3371	175.2272	175.8564	176.5142 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1687	1.1664	1.1640	1.1531	1.1511	1.1416	1.1416	1.1398	1.1452	1.1511	1.1552	1.1595 (40)
HLP (average)												1.1531
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9376 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122 (42b)
Hot water usage for other uses	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141 (42c)
Average daily hot water use (litres/day)												70.0581 (43)
Daily hot water use	76.4336	74.3365	72.0472	69.1980	66.6562	64.0147	63.4661	65.7508	68.0940	70.8067	73.6810	76.3263 (44)
Energy conte	121.0521	105.8542	110.7338	94.7287	89.7321	78.7135	76.7568	81.4132	83.9667	96.0840	104.9721	119.5086 (45)
Energy content (annual)										Total = Sum(45)m =		1163.5157
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823 (64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				988.9883 (64)
Electric shower(s)	58.8404	52.4273	57.2486	54.6316	55.6568	53.0912	54.8609	55.6568	54.6316	57.2486	56.1721	58.8404 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												669.3063 (64a)
Heat gains from water heating, kWh/month	40.4337	35.6008	37.8431	33.7878	32.9823	29.9994	30.0260	31.2145	31.5008	34.7300	36.3496	40.1057 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.8850	180.3370	162.8850	168.3145	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046 (71)
Water heating gains (Table 5)	54.3463	52.9774	50.8644	46.9274	44.3310	41.6658	40.3576	41.9550	43.7512	46.6801	50.4855	53.9055 (72)
Total internal gains	607.2334	626.6675	598.6579	582.1728	551.4534	532.8891	511.9024	510.1487	525.8191	541.2961	573.2245	592.5436 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W

North					6.4700	10.6334	0.6300	0.7000			0.7700	21.0256 (74)
East					13.8100	19.6403	0.6300	0.7000			0.7700	82.8920 (76)
South					5.8000	46.7521	0.6300	0.7000			0.7700	82.8706 (78)
West					9.8400	19.6403	0.6300	0.7000			0.7700	59.0628 (80)

Solar gains	245.8511	453.5955	698.4836	972.0445	1168.7575	1190.8685	1135.7460	987.3732	794.5739	523.7248	301.1687	205.8726 (83)
Total gains	853.0844	1080.2630	1297.1414	1554.2174	1720.2109	1723.7576	1647.6484	1497.5220	1320.3930	1065.0209	874.3933	798.4162 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	18.8369	18.8752	18.9129	19.0920	19.1259	19.2852	19.2852	19.3150	19.2235	19.1259	19.0575	18.9864
alpha	2.2558	2.2583	2.2609	2.2728	2.2751	2.2857	2.2857	2.2877	2.2816	2.2751	2.2705	2.2658
util living area	0.9565	0.9279	0.8817	0.7940	0.6757	0.5350	0.4173	0.4654	0.6623	0.8521	0.9355	0.9621 (86)
MIT	17.7256	18.1771	18.8298	19.6394	20.2850	20.7083	20.8817	20.8446	20.4963	19.6003	18.5158	17.6495 (87)
Th 2	19.9451	19.9470	19.9489	19.9577	19.9593	19.9670	19.9670	19.9685	19.9641	19.9593	19.9560	19.9525 (88)
util rest of house	0.9508	0.9187	0.8664	0.7673	0.6328	0.4707	0.3329	0.3794	0.6026	0.8265	0.9257	0.9571 (89)
MIT 2	16.9485	17.3933	18.0321	18.8135	19.4106	19.7808	19.9108	19.8902	19.6166	18.7970	17.7392	16.8779 (90)

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Living area fraction									fLA = Living area / (4) =		0.1378 (91)
MIT	17.0556	17.5014	18.1421	18.9274	19.5311	19.9086	20.0446	20.0217	19.7378	18.9077	17.8462 (92)
Temperature adjustment											0.0000
adjusted MIT	17.0556	17.5014	18.1421	18.9274	19.5311	19.9086	20.0446	20.0217	19.7378	18.9077	17.8462 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9284	0.8898	0.8332	0.7364	0.6132	0.4668	0.3396	0.3842	0.5880	0.7942	0.8984	0.9365	(94)
Useful gains	791.9831	961.2608	1080.8236	1144.5264	1054.8231	804.6893	559.5277	575.3259	776.3951	845.8806	785.5986	747.7097	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2269.4135	2237.4268	2062.9801	1760.1850	1372.2174	922.5319	598.6003	628.4066	982.8844	1455.7318	1889.7898	2256.5988	(97)
Space heating kWh	1099.2082	857.5835	730.7244	443.2742	236.1413	0.0000	0.0000	0.0000	0.0000	453.7293	795.0177	1122.6135	(98a)
Space heating requirement - total per year (kWh/year)												5738.2921	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1099.2082	857.5835	730.7244	443.2742	236.1413	0.0000	0.0000	0.0000	0.0000	453.7293	795.0177	1122.6135	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5738.2921	
Space heating per m2												(98c) / (4) =	37.6949 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1633.5263	1285.9675	1318.6857	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7536	0.8108	0.7759	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1231.0127	1042.6262	1023.1901	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1944.0149	1858.1585	1685.9489	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	513.3615	606.7560	493.0926	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	128.3404	151.6890	123.2732	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												403.3025	(107)
Energy for space heating												37.6949	(99)
Energy for space cooling												2.6493	(108)
Total												40.3442	(109)
Fabric Energy Efficiency (TFEE)												40.3	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)	
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	380.3740 (5)	

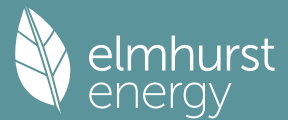
2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1577 (8)
Pressure Test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4077	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3466 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													

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Effective ac	0.4419	0.4332	0.4246	0.3812	0.3726	0.3292	0.3292	0.3206	0.3466	0.3726	0.3899	0.4072 (22b)
	0.5976	0.5938	0.5901	0.5727	0.5694	0.5542	0.5542	0.5514	0.5601	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)					
Solid Doors			1.9500	1.0000	1.9500			(26)					
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)					
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)					
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)					
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400	(30)					
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)					
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400	(30)					
Total net area of external elements Aum(A, m2)			348.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609			(33)					
GF			110.0000			9.0000	990.0000	(32c)					
FF			130.0000			9.0000	1170.0000	(32c)					
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)					
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E12 Gable (insulation at ceiling level)				14.9500	0.0600		0.8970						
E10 Eaves (insulation at ceiling level)				26.1800	0.0600		1.5708						
E14 Flat roof				2.7200	0.0800		0.2176						
E16 Corner (normal)				39.6000	0.0900		3.5640						
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900		-1.7640						
E2 Other lintels (including other steel lintels)				25.4000	0.0500		1.2700						
E3 Sill				24.4700	0.0500		1.2235						
E4 Jamb				57.9000	0.0500		2.8950						
E5 Ground floor (normal)				39.3700	0.1600		6.2992						
E6 Intermediate floor within a dwelling				38.4100	0.0000		0.0000						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.1731 (36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	104.3340	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 75.0169	Feb 74.5410	Mar 74.0745	Apr 71.8836	May 71.4737	Jun 69.5654	Jul 69.5654	Aug 69.2120	Sep 70.3004	Oct 71.4737	Nov 72.3029	Dec 73.1699	(38)
Heat transfer coeff	179.3508	178.8749	178.4085	176.2175	175.8076	173.8994	173.8994	173.5460	174.6344	175.8076	176.6369	177.5038	(39)
Average = Sum(39)m / 12 =												176.2156	
HLP	Jan 1.1782	Feb 1.1750	Mar 1.1720	Apr 1.1576	May 1.1549	Jun 1.1423	Jul 1.1423	Aug 1.1400	Sep 1.1472	Oct 1.1549	Nov 1.1603	Dec 1.1660	(40)
HLP (average)												1.1576	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9376 (42)
Hot water usage for mixer showers													
	91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906	(42a)
Hot water usage for baths													
	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	(42b)
Hot water usage for other uses													
	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	(42c)
Average daily hot water use (litres/day)												154.7338	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169	(44)
Energy conte	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607	(45)
Energy content (annual)										Total = Sum(45)m =		2570.1301	
Distribution loss (46)m = 0.15 x (45)m													
	39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141	(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
	134.1940	119.1973	127.6011	114.1162	112.0138	102.4158	101.9836	105.0890	105.2309	115.6003	120.8466	132.9480	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	180.3683	177.3769	171.5068	158.4947	150.5562	142.2441	137.0748	141.2486	146.1541	155.3768	167.8425	178.6935	(72)
Total internal gains	819.2424	816.8293	791.7934	745.0068	697.7350	652.0701	626.7333	630.3289	654.4003	700.3975	752.1965	797.4003	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North					6.4700	10.6334	0.6300		0.7000		0.7700		21.0256 (74)	
East					13.8100	19.6403	0.6300		0.7000		0.7700		82.8920 (76)	
South					5.8000	46.7521	0.6300		0.7000		0.7700		82.8706 (78)	
West					9.8400	19.6403	0.6300		0.7000		0.7700		59.0628 (80)	
Solar gains	245.8511	453.5955	698.4836	972.0445	1168.7575	1190.8685	1135.7460	987.3732	794.5739	523.7248	301.1687	205.8726	(83)	
Total gains	1065.0935	1270.4248	1490.2769	1717.0513	1866.4924	1842.9386	1762.4793	1617.7021	1448.9742	1224.1224	1053.3652	1003.2729	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.6861	18.7359	18.7848	19.0184	19.0627	19.2719	19.2719	19.3112	19.1908	19.0627	18.9732	18.8806
alpha	2.2457	2.2491	2.2523	2.2679	2.2708	2.2848	2.2848	2.2874	2.2794	2.2708	2.2649	2.2587
util living area	0.9345	0.9046	0.8532	0.7651	0.6472	0.5105	0.3951	0.4384	0.6289	0.8182	0.9104	0.9417 (86)
MIT	17.9729	18.3771	19.0039	19.7509	20.3476	20.7358	20.8944	20.8630	20.5499	19.7369	18.7191	17.9014 (87)
Th 2	19.9375	19.9400	19.9425	19.9541	19.9563	19.9664	19.9664	19.9683	19.9625	19.9563	19.9519	19.9473 (88)
util rest of house	0.9263	0.8930	0.8353	0.7365	0.6034	0.4472	0.3138	0.3554	0.5684	0.7889	0.8975	0.9343 (89)
MIT 2	16.4090	16.9166	17.6981	18.6165	19.3191	19.7518	19.9026	19.8808	19.5690	18.6254	17.3618	16.3235 (90)
Living area fraction	16.6245	17.1179	17.8781	18.7729	19.4608	19.8874	20.0393	20.0161	19.7042	18.7786	17.5489	16.5409 (92)
MIT	16.6245	17.1179	17.8781	18.7729	19.4608	19.8874	20.0393	20.0161	19.7042	18.7786	17.5489	16.5409 (92)
Temperature adjustment												0.0000
adjusted MIT	16.6245	17.1179	17.8781	18.7729	19.4608	19.8874	20.0393	20.0161	19.7042	18.7786	17.5489	16.5409 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8891	0.8508	0.7909	0.6985	0.5805	0.4421	0.3198	0.3595	0.5516	0.7480	0.8565	0.8992	(94)
Useful gains	946.9574	1080.8668	1178.7326	1199.4317	1083.4106	814.7215	563.6573	581.4845	799.2734	915.6102	902.1856	902.1349	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2210.4082	2185.4690	2029.9457	1739.7745	1364.4104	919.4764	598.0939	627.5677	978.6820	1437.8636	1845.6616	2190.5611	(97)
Space heating kWh	940.0074	742.2926	633.3025	389.0468	209.0639	0.0000	0.0000	0.0000	0.0000	388.5565	679.3027	958.5891	(98a)
Space heating requirement - total per year (kWh/year)												4940.1616	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	940.0074	742.2926	633.3025	389.0468	209.0639	0.0000	0.0000	0.0000	0.0000	388.5565	679.3027	958.5891	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4940.1616	
Space heating per m2											(98c) / (4) =	32.4520	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)	
Fraction of space heat from main system(s)												1.0000 (202)	
Efficiency of main space heating system 1 (in %)												249.9000 (206)	
Efficiency of main space heating system 2 (in %)												0.0000 (207)	
Efficiency of secondary/supplementary heating system, %												65.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	940.0074	742.2926	633.3025	389.0468	209.0639	0.0000	0.0000	0.0000	0.0000	388.5565	679.3027	958.5891	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	376.1534	297.0359	253.4224	155.6810	83.6590	0.0000	0.0000	0.0000	0.0000	155.4848	271.8298	383.5891	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(217)
Fuel for water heating, kWh/month													

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	184.7420	163.4110	173.4179	151.7321	146.6453	131.6355	129.4174	134.7511	136.4708	152.8055	163.2922	182.6018	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1976.8554	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1850.9226	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												279.4701	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												4107.2481	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1976.8554	16.4900	325.9835	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1850.9226	16.4900	305.2171	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	279.4701	16.4900	46.0846	(250)
Additional standing charges			0.0000	(251)
Total energy cost			677.2852	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2362	(257)
SAP value		79.9606	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1976.8554	0.1546	305.6350	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1850.9226	0.1410	260.9524	(264)
Space and water heating			566.5874	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	279.4701	0.1443	40.3362	(268)
Total CO2, kg/year			606.9236	(272)
CO2 emissions per m2			3.9900	(273)
EI value			95.8765	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	77.1200 (1b)	x	2.4000 (2b)	=	185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x	2.6000 (2c)	=	195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300				(4)

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Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 380.3740 (5)

2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											5 * 10 =	50.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											60.0000 / (5) =	0.1577 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											5.0000 (17)	
Infiltration rate											0.4077 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3466 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3119	0.2859	0.2773	0.2773	0.2859	0.2513	0.2686	0.2426	0.2426	0.2599	0.2426	0.2773 (22b)
Effective ac	0.5486	0.5409	0.5384	0.5384	0.5409	0.5316	0.5361	0.5294	0.5294	0.5338	0.5294	0.5384 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)					
Solid Doors			1.9500	1.0000	1.9500			(26)					
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)					
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)					
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)					
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400	(30)					
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)					
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400	(30)					
Total net area of external elements Aum(A, m2)			348.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609			(33)					
GF			110.0000			9.0000	990.0000	(32c)					
FF			130.0000			9.0000	1170.0000	(32c)					
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)					
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E12 Gable (insulation at ceiling level)				14.9500	0.0600	0.8970							
E10 Eaves (insulation at ceiling level)				26.1800	0.0600	1.5708							
E14 Flat roof				2.7200	0.0800	0.2176							
E16 Corner (normal)				39.6000	0.0900	3.5640							
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900	-1.7640							
E2 Other lintels (including other steel lintels)				25.4000	0.0500	1.2700							
E3 Sill				24.4700	0.0500	1.2235							
E4 Jamb				57.9000	0.0500	2.8950							
E5 Ground floor (normal)				39.3700	0.1600	6.2992							
E6 Intermediate floor within a dwelling				38.4100	0.0000	0.0000							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1731	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	104.3340	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 68.8681	Feb 67.8928	Mar 67.5865	Apr 67.5865	May 67.8928	Jun 66.7243	Jul 67.2897	Aug 66.4557	Sep 66.4557	Oct 67.0022	Nov 66.4557	Dec 67.5865	(38)
Heat transfer coeff	173.2021	172.2267	171.9205	171.9205	172.2267	171.0582	171.6236	170.7897	170.7897	171.3362	170.7897	171.9205	(39)
Average = Sum(39)m / 12 =												171.6503	
HLP	Jan 1.1378	Feb 1.1314	Mar 1.1293	Apr 1.1293	May 1.1314	Jun 1.1237	Jul 1.1274	Aug 1.1219	Sep 1.1219	Oct 1.1255	Nov 1.1219	Dec 1.1293	(40)
HLP (average)												1.1276	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9376 (42)											
Hot water usage for mixer showers												
Hot water usage for baths	91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906 (42a)
Hot water usage for other uses	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122 (42b)
Average daily hot water use (litres/day)	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141 (42c)
												154.7338 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169 (44)
Energy content (annual)	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607 (45)
										Total = Sum(45)m =		2570.1301

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Distribution loss (46)m = 0.15 x (45)m	39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
134.1940	119.1973	127.6011	114.1162	112.0138	102.4158	101.9836	105.0890	105.2309	115.6003	120.8466	132.9480	(65)

5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts												
(66)m	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)												
180.3683	177.3769	171.5068	158.4947	150.5562	142.2441	137.0748	141.2486	146.1541	155.3768	167.8425	178.6935	(72)
Total internal gains												
819.2424	816.8293	791.7934	745.0068	697.7350	652.0701	626.7333	630.3289	654.4003	700.3975	752.1965	797.4003	(73)

6. Solar gains												

[Jan]			Area		Solar flux		g		FF		Access	Gains
			m2		Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
North			6.4700		13.0723		0.6300		0.7000		0.7700	25.8480 (74)
East			13.8100		24.4329		0.6300		0.7000		0.7700	103.1193 (76)
South			5.8000		54.9219		0.6300		0.7000		0.7700	97.3521 (78)
West			9.8400		24.4329		0.6300		0.7000		0.7700	73.4753 (80)

Solar gains	299.7948	485.9255	741.8494	1066.6283	1248.6618	1377.8596	1288.0169	1130.8920	902.2464	598.1916	368.5813	244.7069 (83)
Total gains	1119.0372	1302.7548	1533.6428	1811.6351	1946.3967	2029.9298	1914.7502	1761.2209	1556.6466	1298.5891	1120.7777	1042.1072 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.3495	19.4591	19.4938	19.4938	19.4591	19.5920	19.5275	19.6228	19.6228	19.5602	19.6228	19.4938
alpha	2.2900	2.2973	2.2996	2.2996	2.2973	2.3061	2.3018	2.3082	2.3082	2.3040	2.3082	2.2996
util living area												
0.9195	0.8913	0.8282	0.7209	0.5796	0.4115	0.3061	0.3204	0.5501	0.7616	0.8829	0.9289	(86)
MIT	18.3736	18.6741	19.3255	20.0174	20.5619	20.8632	20.9510	20.9481	20.7129	20.0923	19.1480	18.3020 (87)
Th 2	19.9701	19.9753	19.9769	19.9769	19.9753	19.9815	19.9785	19.9830	19.9830	19.9801	19.9830	19.9769 (88)
util rest of house												
0.9093	0.8782	0.8076	0.6882	0.5298	0.3449	0.2250	0.2339	0.4827	0.7235	0.8659	0.9198	(89)
MIT 2	16.9301	17.3065	18.1140	18.9471	19.5704	19.8836	19.9552	19.9589	19.7513	19.0638	17.9138	16.8447 (90)
Living area fraction												
MIT	17.1291	17.4950	18.2810	19.0946	19.7071	20.0186	20.0924	20.0952	19.8838	19.2055	18.0839	17.0455 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1291	17.4950	18.2810	19.0946	19.7071	20.0186	20.0924	20.0952	19.8838	19.2055	18.0839	17.0455 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.8702	0.8361	0.7655	0.6560	0.5157	0.3475	0.2343	0.2438	0.4756	0.6892	0.8240	0.8825	(94)
Useful gains	973.7568	1089.2035	1174.0512	1188.4890	1003.6688	705.3071	448.6683	429.3557	740.3868	895.0090	923.5548	919.6731 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W												
2066.1382	2065.8588	1887.8574	1615.1250	1189.5797	755.8425	462.0848	443.2312	851.1855	1268.8360	1688.0636	2036.4911	(97)
Space heating kWh												
812.7318	656.3124	531.0718	307.1780	138.3177	0.0000	0.0000	0.0000	0.0000	278.1273	550.4463	830.9126	(98a)
Space heating requirement - total per year (kWh/year)												4105.0978
Solar heating kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000

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Space heating kWh	812.7318	656.3124	531.0718	307.1780	138.3177	0.0000	0.0000	0.0000	0.0000	278.1273	550.4463	830.9126 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4105.0978
Space heating per m2												(98c) / (4) = 26.9664 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	812.7318	656.3124	531.0718	307.1780	138.3177	0.0000	0.0000	0.0000	0.0000	278.1273	550.4463	830.9126 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	325.2228	262.6300	212.5137	122.9204	55.3492	0.0000	0.0000	0.0000	0.0000	111.2954	220.2666	332.4980 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	184.7420	163.4110	173.4179	151.7321	146.6453	131.6355	129.4174	134.7511	136.4708	152.8055	163.2922	182.6018 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1642.6962 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1850.9226 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												279.4701 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3773.0889 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1642.6962	26.0600	428.0866 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1850.9226	26.0600	482.3504 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	279.4701	26.0600	72.8299 (250)
Additional standing charges			0.0000 (251)
Total energy cost			983.2670 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1642.6962	0.1552	255.0240 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1850.9226	0.1410	260.9524 (264)
Space and water heating			515.9765 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	279.4701	0.1443	40.3362 (268)
Total CO2, kg/year			556.3126 (272)

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13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1642.6962	1.5748	2586.8611 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1850.9226	1.5213	2815.8381 (278)
Space and water heating			5402.6992 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	279.4701	1.5338	428.6606 (282)
Total Primary energy kWh/year			5831.3598 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.6	-£ 103	-49 kg (8.8%)
U Solar photovoltaic panels	+ 4.7	-£ 267	-138 kg (27.2%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£103	0.32 kg/m²	B 82 A 96
Solar photovoltaic panels	£267	0.90 kg/m²	B 86 A 97
Total Savings	£370	1.23 kg/m²	

Potential energy efficiency rating: B 86
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £983	Potential £881	Saving £103
Electricity			
Space heating	£428	£449	-£21
Water heating	£482	£358	£124
Lighting	£73	£73	£0
Generated (PV)	-£0	-£267	£267
Total cost of fuels	£983	£614	£370
Total cost of uses	£983	£613	£370
Delivered energy	25 kWh/m²	15 kWh/m²	9 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	2 kg/m²	1 kg/m²
Primary energy	38 kWh/m²	24 kWh/m²	14 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	380.3740 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.1577 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.4077 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3466 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4419	0.4332	0.4246	0.3812	0.3726	0.3292	0.3292	0.3206	0.3466	0.3726	0.3899	0.4072	(22b)
	0.5976	0.5938	0.5901	0.5727	0.5694	0.5542	0.5542	0.5514	0.5601	0.5694	0.5760	0.5829	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)
Joists GF			0.9600	0.1100	0.1056	9.0000	8.6400	(30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)
Flat			0.9600	0.1300	0.1248	9.0000	8.6400	(30)
Total net area of external elements Aum(A, m2)			348.1300					(31)
Fabric heat loss, W/K = Sum (A x U)					88.1609			(33)
GF			110.0000			9.0000	990.0000	(32c)
FF			130.0000			9.0000	1170.0000	(32c)
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 12064.9500 (34)
79.2547 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	14.9500	0.0600	0.8970	
E10 Eaves (insulation at ceiling level)	26.1800	0.0600	1.5708	
E14 Flat roof	2.7200	0.0800	0.2176	
E16 Corner (normal)	39.6000	0.0900	3.5640	
E17 Corner (inverted - internal area greater than external area)	19.6000	-0.0900	-1.7640	
E2 Other lintels (including other steel lintels)	25.4000	0.0500	1.2700	
E3 Sill	24.4700	0.0500	1.2235	
E4 Jamb	57.9000	0.0500	2.8950	
E5 Ground floor (normal)	39.3700	0.1600	6.2992	
E6 Intermediate floor within a dwelling	38.4100	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 104.3340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	75.0169	74.5410	74.0745	71.8836	71.4737	69.5654	69.5654	69.2120	70.3004	71.4737	72.3029	73.1699	(38)
Heat transfer coeff	179.3508	178.8749	178.4085	176.2175	175.8076	173.8994	173.8994	173.5460	174.6344	175.8076	176.6369	177.5038	(39)
Average = Sum(39)m / 12 =												176.2156	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1782	1.1750	1.1720	1.1576	1.1549	1.1423	1.1423	1.1400	1.1472	1.1549	1.1603	1.1660	(40)
HLP (average)												1.1576	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9376 (42)
Hot water usage for mixer showers													
91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906		(42a)
Hot water usage for baths													
31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122		(42b)
Hot water usage for other uses													
44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141		(42c)
Average daily hot water use (litres/day)												154.7338	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169	(44)
Energy conte	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141		(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
323.4832	286.1326	302.2591	258.9293	243.9816	217.8870	213.5830	223.8528	233.5575	266.1667	285.9247	319.7358		(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)

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Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												645.6697 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												645.6697
Solar input	-0.0000	-16.1744	-59.5270	-82.8499	-109.6591	-101.3233	-100.7026	-87.2595	-59.3262	-28.8476	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	323.4832	269.9582	242.7320	176.0794	134.3224	116.5637	112.8804	136.5933	174.2313	237.3191	285.9247	319.7358 (64)
												Total per year (kWh/year) = Sum(64)m = 2529.8234 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	134.1940	119.1973	126.4845	108.7133	101.7784	92.3304	91.5621	95.4118	100.9086	114.4837	120.8466	132.9480 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	180.3683	177.3769	170.0060	150.9907	136.7989	128.2367	123.0673	128.2417	140.1509	153.8760	167.8425	178.6935	(72)
Total internal gains	819.2424	816.8293	790.2926	737.5028	683.9776	638.0627	612.7259	617.3220	648.3971	698.8967	752.1965	797.4003	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					6.4700	10.6334		0.6300	0.7000	0.7700		21.0256 (74)	
East					13.8100	19.6403		0.6300	0.7000	0.7700		82.8920 (76)	
South					5.8000	46.7521		0.6300	0.7000	0.7700		82.8706 (78)	
West					9.8400	19.6403		0.6300	0.7000	0.7700		59.0628 (80)	
Solar gains	245.8511	453.5955	698.4836	972.0445	1168.7575	1190.8685	1135.7460	987.3732	794.5739	523.7248	301.1687	205.8726 (83)	
Total gains	1065.0935	1270.4248	1488.7761	1709.5473	1852.7351	1828.9312	1748.4718	1604.6952	1442.9710	1222.6216	1053.3652	1003.2729 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.6861	18.7359	18.7848	19.0184	19.0627	19.2719	19.2719	19.3112	19.1908	19.0627	18.9732	18.8806	
alpha	2.2457	2.2491	2.2523	2.2679	2.2708	2.2848	2.2848	2.2874	2.2794	2.2708	2.2649	2.2587	
util living area	0.9345	0.9046	0.8534	0.7664	0.6499	0.5133	0.3977	0.4412	0.6304	0.8185	0.9104	0.9417	(86)
MIT	17.9729	18.3771	19.0025	19.7457	20.3416	20.7327	20.8929	20.8612	20.5475	19.7356	18.7191	17.9014	(87)
Th 2	19.9375	19.9400	19.9425	19.9541	19.9563	19.9664	19.9664	19.9683	19.9625	19.9563	19.9519	19.9473	(88)
util rest of house	0.9263	0.8930	0.8355	0.7379	0.6062	0.4499	0.3160	0.3578	0.5699	0.7893	0.8975	0.9343	(89)
MIT 2	16.4090	16.9166	17.6964	18.6105	19.3127	19.7491	19.9017	19.8795	19.5667	18.6240	17.3618	16.3235	(90)
Living area fraction													(91)
MIT	16.6245	17.1179	17.8764	18.7669	19.4545	19.8846	20.0383	20.0148	19.7018	18.7772	17.5489	16.5409	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.6245	17.1179	17.8764	18.7669	19.4545	19.8846	20.0383	20.0148	19.7018	18.7772	17.5489	16.5409	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8891	0.8508	0.7912	0.6998	0.5829	0.4446	0.3220	0.3618	0.5530	0.7483	0.8565	0.8992	(94)
Useful gains	946.9574	1080.8668	1177.9115	1196.4163	1079.9674	813.0525	562.9910	580.6205	797.9683	914.8969	902.1856	902.1349	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2210.4082	2185.4690	2029.6455	1738.7273	1363.3075	918.9944	597.9143	627.3304	978.2752	1437.6099	1845.6616	2190.5611	(97)
Space heating kWh	940.0074	742.2926	633.6901	390.4639	210.8050	0.0000	0.0000	0.0000	0.0000	388.8985	679.3027	958.5891	(98a)
Space heating requirement - total per year (kWh/year)												4944.0493	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	940.0074	742.2926	633.6901	390.4639	210.8050	0.0000	0.0000	0.0000	0.0000	388.8985	679.3027	958.5891	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4944.0493	
Space heating per m ²												(98c) / (4) = 32.4775	(99)

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	940.0074	742.2926	633.6901	390.4639	210.8050	0.0000	0.0000	0.0000	0.0000	388.8985	679.3027	958.5891	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	376.1534	297.0359	253.5775	156.2480	84.3557	0.0000	0.0000	0.0000	0.0000	155.6216	271.8298	383.5891	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	323.4832	269.9582	242.7320	176.0794	134.3224	116.5637	112.8804	136.5933	174.2313	237.3191	285.9247	319.7358	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	184.7420	154.1737	138.6248	100.5593	76.7118	66.5698	64.4662	78.0087	99.5039	135.5334	163.2922	182.6018	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-40.0034	-60.8149	-92.9390	-108.8081	-117.8106	-104.0971	-102.5408	-95.8168	-83.5804	-70.7814	-45.2676	-34.1020	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1978.4111	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1444.7878	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												279.4701	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-956.5620	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2826.1070	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1978.4111	16.4900	326.2400 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1444.7878	16.4900	238.2455 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	279.4701	16.4900	46.0846 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.5620	16.4900	-157.7371
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-157.7371 (252)
Total energy cost			466.0250 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	0.8506 (257)
SAP value	86.2113
SAP rating (Section 12)	86 (258)
SAP band	B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1978.4111	0.1546	305.8504 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1444.7878	0.1449	209.3706 (264)
Space and water heating			515.2210 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	279.4701	0.1443	40.3362 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.5620	0.1342	-128.4034
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-128.4034 (269)
Total CO2, kg/year			438.2508 (272)
CO2 emissions per m2			2.8800 (273)
EI value			97.0225
EI rating			97 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

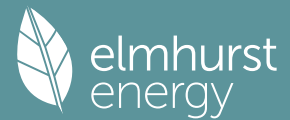
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.1577 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4077 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3466 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3119	0.2859	0.2773	0.2773	0.2859	0.2513	0.2686	0.2426	0.2426	0.2599	0.2426	0.2773 (22b)
Effective ac	0.5486	0.5409	0.5384	0.5384	0.5409	0.5316	0.5361	0.5294	0.5294	0.5338	0.5294	0.5384 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			35.9200	1.1450	41.1298		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000 (28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600 (29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500 (29a)
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400 (30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900 (30)
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400 (30)
Total net area of external elements Aum(A, m2)			348.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609		(33)
GF			110.0000			9.0000	990.0000 (32c)
FF			130.0000			9.0000	1170.0000 (32c)
Internal Floor 1			75.1100			18.0000	1351.9800 (32d)
Internal Ceiling 1			75.1100			9.0000	675.9900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				14.9500	0.0600	0.8970	
E10 Eaves (insulation at ceiling level)				26.1800	0.0600	1.5708	
E14 Flat roof				2.7200	0.0800	0.2176	
E16 Corner (normal)				39.6000	0.0900	3.5640	
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900	-1.7640	

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E2 Other lintels (including other steel lintels)	25.4000	0.0500	1.2700	
E3 Sill	24.4700	0.0500	1.2235	
E4 Jamb	57.9000	0.0500	2.8950	
E5 Ground floor (normal)	39.3700	0.1600	6.2992	
E6 Intermediate floor within a dwelling	38.4100	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.1731	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	104.3340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	68.8681	67.8928	67.5865	67.5865	67.8928	66.7243	67.2897	66.4557	66.4557	67.0022	66.4557	67.5865	(38)
Average = Sum(39)m / 12 =	173.2021	172.2267	171.9205	171.9205	172.2267	171.0582	171.6236	170.7897	170.7897	171.3362	170.7897	171.9205	(39)
												171.6503	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1378	1.1314	1.1293	1.1293	1.1314	1.1237	1.1274	1.1219	1.1219	1.1255	1.1219	1.1293	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9376	(42)
Hot water usage for mixer showers														
Hot water usage for baths	91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906	(42a)	
Hot water usage for other uses	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	(42b)	
Average daily hot water use (litres/day)	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	(42c)	
												154.7338	(43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy content (annual)	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169	(44)	
Distribution loss (46)m = 0.15 x (45)m	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607	(45)	
Water storage loss:														
Store volume	39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141	(46)	
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.7830	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)	
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	323.4832	286.1326	302.2591	258.9293	243.9816	217.8870	213.5830	223.8528	233.5575	266.1667	285.9247	319.7358	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Aperture area of solar collector													3.0000	(H1)
Zero-loss collector efficiency													0.8000	(H2)
Collector linear heat loss coefficient													1.8000	(H3)
Collector 2nd order heat loss coefficient													0.0000	(H4)
Collector loop efficiency													0.9000	(H5)
Incidence angle modifier													1.0000	(H6)
Overshading factor													0.8000	(H8)
Overall heat loss coefficient of system													6.5000	(H10)
Heat loss coefficient of collector loop													3.9667	(H11)
Dedicated solar storage volume													75.0000	(H12)
Effective solar volume													75.0000	(H14)
Reference volume													225.0000	(H15)
Storage tank correction coefficient													1.3161	(H16)
Heat delivered to hot water													766.9681	(H24)
Heat delivered to space heating													0.0000	(H29)
Solar input													766.9681	
Solar input	-1.7466	-20.9163	-66.5500	-94.6101	-119.5844	-120.4956	-117.0516	-104.5221	-72.9819	-40.9657	-7.5439	-0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h	321.7366	265.2163	235.7091	164.3193	124.3972	97.3914	96.5314	119.3307	160.5756	225.2009	278.3808	319.7358	(64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)	
Heat gains from water heating, kWh/month	134.1940	119.1973	126.4845	108.7133	101.7784	92.3304	91.5621	95.4118	100.9086	114.4837	120.8466	132.9480	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)	
Pumps, fans	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)	
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)	
Water heating gains (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)	
Total internal gains	180.3683	177.3769	170.0060	150.9907	136.7989	128.2367	123.0673	128.2417	140.1509	153.8760	167.8425	178.6935	(72)	
	819.2424	816.8293	790.2926	737.5028	683.9776	638.0627	612.7259	617.3220	648.3971	698.8967	752.1965	797.4003	(73)	

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6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W		
North	6.4700				13.0723	0.6300	0.7000	0.7700	0.7700	25.8480 (74)		
East	13.8100				24.4329	0.6300	0.7000	0.7700	0.7700	103.1193 (76)		
South	5.8000				54.9219	0.6300	0.7000	0.7700	0.7700	97.3521 (78)		
West	9.8400				24.4329	0.6300	0.7000	0.7700	0.7700	73.4753 (80)		
Solar gains	299.7948	485.9255	741.8494	1066.6283	1248.6618	1377.8596	1288.0169	1130.8920	902.2464	598.1916	368.5813	244.7069 (83)
Total gains	1119.0372	1302.7548	1532.1420	1804.1311	1932.6394	2015.9223	1900.7428	1748.2140	1550.6434	1297.0883	1120.7777	1042.1072 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.3495	19.4591	19.4938	19.4938	19.4591	19.5920	19.5275	19.6228	19.6228	19.5602	19.6228	19.4938
alpha	2.2900	2.2973	2.2996	2.2996	2.2973	2.3061	2.3018	2.3082	2.3082	2.3040	2.3082	2.2996
util living area	0.9195	0.8913	0.8285	0.7223	0.5822	0.4138	0.3081	0.3225	0.5515	0.7620	0.8829	0.9289 (86)
MIT	18.3736	18.6741	19.3242	20.0130	20.5575	20.8615	20.9503	20.9473	20.7112	20.0913	19.1480	18.3020 (87)
Th 2	19.9701	19.9753	19.9769	19.9769	19.9753	19.9815	19.9785	19.9830	19.9830	19.9801	19.9830	19.9769 (88)
util rest of house	0.9093	0.8782	0.8079	0.6896	0.5324	0.3470	0.2265	0.2355	0.4841	0.7239	0.8659	0.9198 (89)
MIT 2	16.9301	17.3065	18.1125	18.9421	19.5661	19.8824	19.9548	19.9585	19.7499	19.0626	17.9138	16.8447 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.1291	17.4950	18.2794	19.0897	19.7027	20.0173	20.0920	20.0948	19.8824	19.2044	18.0839	17.0455 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.1291	17.4950	18.2794	19.0897	19.7027	20.0173	20.0920	20.0948	19.8824	19.2044	18.0839	17.0455 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8702	0.8361	0.7658	0.6573	0.5180	0.3495	0.2359	0.2454	0.4769	0.6896	0.8240	0.8825 (94)
Useful gains	973.7568	1089.2035	1173.2996	1185.9395	1001.1864	704.4767	448.4065	429.0838	739.5262	894.4324	923.5548	919.6731 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	2066.1382	2065.8588	1887.5916	1614.2771	1188.8302	755.6178	462.0168	443.1604	850.9345	1268.6409	1688.0636	2036.4911 (97)
Space heating kWh	812.7318	656.3124	531.4333	308.4031	139.6070	0.0000	0.0000	0.0000	0.0000	278.4111	550.4463	830.9126 (98a)
Space heating requirement - total per year (kWh/year)												4108.2575
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	812.7318	656.3124	531.4333	308.4031	139.6070	0.0000	0.0000	0.0000	0.0000	278.4111	550.4463	830.9126 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4108.2575
Space heating per m2												(98c) / (4) = 26.9872 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	812.7318	656.3124	531.4333	308.4031	139.6070	0.0000	0.0000	0.0000	0.0000	278.4111	550.4463	830.9126 (98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)	
Space heating fuel (main heating system)	325.2228	262.6300	212.6584	123.4106	55.8651	0.0000	0.0000	0.0000	0.0000	111.4090	220.2666	332.4980 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	321.7366	265.2163	235.7091	164.3193	124.3972	97.3914	96.5314	119.3307	160.5756	225.2009	278.3808	319.7358 (64)	
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)	
Fuel for water heating, kWh/month	183.7445	151.4656	134.6140	93.8431	71.0435	55.6204	55.1293	68.1500	91.7051	128.6128	158.9839	182.6018 (219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)	
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-47.3170	-63.9160	-96.0627	-113.7503	-119.6215	-111.6342	-108.9214	-102.9130	-90.3334	-77.0327	-53.2008	-39.5457 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)	

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1											1643.9606	(211)
Space heating fuel - main system 2											0.0000	(213)
Space heating fuel - secondary											0.0000	(215)
Efficiency of water heater											175.1000	
Water heating fuel used											1375.5140	(219)
Space cooling fuel											0.0000	(221)
Electricity for pumps and fans:												
pump for solar water heating											80.0000	(230g)
Total electricity for the above, kWh/year											80.0000	(231)
Electricity for lighting (calculated in Appendix L)											279.4701	(232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation											-1024.2487	(233)
Wind generation											0.0000	(234)
Hydro-electric generation (Appendix N)											0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)											0.0000	(235)
Appendix Q - special features												
Energy saved or generated											-0.0000	(236)
Energy used											0.0000	(237)
Total delivered energy for all uses											2354.6960	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1643.9606	26.0600	428.4161	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1375.5140	26.0600	358.4589	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	279.4701	26.0600	72.8299	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1024.2487	26.0600	-266.9192	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-266.9192	(252)
Total energy cost			613.6338	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1643.9606	0.1552	255.1998	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1375.5140	0.1457	200.4547	(264)
Space and water heating			455.6545	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	279.4701	0.1443	40.3362	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1024.2487	0.1344	-137.6822	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-137.6822	(269)
Total CO2, kg/year			369.4055	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1643.9606	1.5747	2588.7759	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1375.5140	1.5391	2117.0215	(278)
Space and water heating			4705.7974	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	279.4701	1.5338	428.6606	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1024.2487	1.4968	-1533.0900	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1533.0900	(283)
Total Primary energy kWh/year			3722.3920	(286)

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Property Reference	FURNERS LANE 4				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 4, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	4.07	TER	8.66	
Environmental	96 A	% DER < TER				53.00
CO ₂ Emissions (t/year)	0.57	DFEE	40.22	TFEE	40.57	
Compliance Check	See BREL	% DFEE < TFEE				0.86
% DPER < TPER	6.49	DPER	42.54	TPER	45.49	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	88.6500 (1b)	x 2.4000 (2b)	= 212.7600 (1b) - (3b)
First floor	65.9100 (1c)	x 2.4500 (2c)	= 161.4795 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	154.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.2395 (5)

2. Ventilation rate

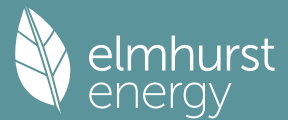
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.1603 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4103 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3488 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4447	0.4360	0.4273	0.3837	0.3749	0.3313	0.3313	0.3226	0.3488	0.3749	0.3924	0.4098 (22b)
Effective ac	0.5989	0.5950	0.5913	0.5736	0.5703	0.5549	0.5549	0.5520	0.5608	0.5703	0.5770	0.5840 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			31.0900	1.1450	35.5992		(27)
Solid Doors			4.2000	1.0000	4.2000		(26)
Rooflight W			0.4300	1.1450	0.4924		(27a)
Ground Floor			88.6500	0.1100	9.7515	75.0000	6648.7500 (28a)
Brick	148.5000	27.1900	121.3100	0.1800	21.8358	9.0000	1091.7900 (29a)
Dormer	12.9200	8.1000	4.8200	0.1800	0.8676	9.0000	43.3800 (29a)
Ashlar	24.5300		24.5300	0.1800	4.4154	9.0000	220.7700 (29a)
Joists GF	22.7400		22.7400	0.1100	2.5014	9.0000	204.6600 (30)
Joists FF	41.6700		41.6700	0.1100	4.5837	9.0000	375.0300 (30)
Rafters	31.5000	0.4300	31.0700	0.1300	4.0391	9.0000	279.6300 (30)
Total net area of external elements Aum(A, m ²)			370.5100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.2861		(33)
GF			120.0000			9.0000	1080.0000 (32c)
FF			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			65.9100			18.0000	1186.3800 (32d)
Internal Ceiling 1			65.9100			9.0000	593.1900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12623.5800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							81.6743 (35)

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[Jan]	Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	10.7100		10.6334		0.6300		0.7000		0.7700		34.8043 (74)	
East	5.1700		19.6403		0.6300		0.7000		0.7700		31.0320 (76)	
South	12.6900		46.7521		0.6300		0.7000		0.7700		181.3152 (78)	
West	2.5200		19.6403		0.6300		0.7000		0.7700		15.1258 (80)	
West	0.4300		25.9287		0.6300		0.7000		1.0000		4.4252 (82)	
Solar gains	266.7025	462.6085	655.0662	848.7391	984.5247	992.3074	950.4882	846.9040	721.7762	517.2393	320.9621	227.2624 (83)
Total gains	1007.6685	1221.6306	1382.0306	1550.0624	1649.5357	1630.0039	1563.1538	1460.3697	1354.1596	1174.4714	1019.0373	952.1930 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	19.1221	19.1717	19.2205	19.4533	19.4975	19.7058	19.7058	19.7449	19.6251	19.4975	19.4083	19.3160
util living area	2.2748	2.2781	2.2814	2.2969	2.2998	2.3137	2.3137	2.3163	2.3083	2.2998	2.2939	2.2877
util living area	0.9450	0.9165	0.8768	0.8046	0.7018	0.5666	0.4447	0.4843	0.6644	0.8374	0.9209	0.9510 (86)
MIT	17.9148	18.3284	18.8990	19.6238	20.2404	20.6809	20.8699	20.8373	20.5071	19.6918	18.6847	17.8505 (87)
Th 2	19.9309	19.9333	19.9357	19.9471	19.9492	19.9592	19.9592	19.9610	19.9553	19.9492	19.9449	19.9404 (88)
util rest of house	0.9378	0.9059	0.8607	0.7783	0.6592	0.5005	0.3558	0.3954	0.6039	0.8096	0.9090	0.9445 (89)
MIT 2	16.3275	16.8482	17.5639	18.4632	19.1995	19.6971	19.8800	19.8563	19.5217	18.5667	17.3116	16.2507 (90)
Living area fraction	16.8411	17.0474	17.7436	18.6194	19.3396	19.8295	20.0132	19.9883	19.6543	18.7181	17.4964	16.4660 (91)
MIT	16.8411	17.0474	17.7436	18.6194	19.3396	19.8295	20.0132	19.9883	19.6543	18.7181	17.4964	16.4660 (92)
Temperature adjustment	16.8411	17.0474	17.7436	18.6194	19.3396	19.8295	20.0132	19.9883	19.6543	18.7181	17.4964	16.4660 (93)
adjusted MIT	16.8411	17.0474	17.7436	18.6194	19.3396	19.8295	20.0132	19.9883	19.6543	18.7181	17.4964	16.4660 (93)
8. Space heating requirement												
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9039	0.8659	0.8175	0.7381	0.6312	0.4915	0.3607	0.3979	0.5841	0.7686	0.8702	0.9127 (94)
Ext temp.	910.8431	1057.7895	1129.8671	1144.0839	1041.1171	801.2196	563.7791	581.0477	791.0126	902.6827	886.7467	869.0520 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating	2244.7276	2221.7798	2051.2495	1751.9598	1373.9494	930.5604	607.3555	637.2516	992.4280	1460.0125	1878.3399	2226.7203 (97)
Space heating	992.4100	782.2015	685.5086	437.6707	247.6272	0.0000	0.0000	0.0000	0.0000	414.6533	713.9471	1010.1052 (98a)
Space heating requirement - total per year (kWh/year)												5284.1237
Solar heating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating	992.4100	782.2015	685.5086	437.6707	247.6272	0.0000	0.0000	0.0000	0.0000	414.6533	713.9471	1010.1052 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5284.1237
Space heating per m2										(98c) / (4) =		34.1882 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating	992.4100	782.2015	685.5086	437.6707	247.6272	0.0000	0.0000	0.0000	0.0000	414.6533	713.9471	1010.1052 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	397.1229	313.0058	274.3131	175.1383	99.0905	0.0000	0.0000	0.0000	0.0000	165.9277	285.6931	404.2038 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating	323.6948	286.3189	303.8506	265.8501	256.9345	230.6329	226.7446	236.0914	239.1063	267.7296	286.1079	319.9444 (64)
Water heating requirement	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (217)
Fuel for water heating, kWh/month	184.8628	163.5174	173.5298	151.8276	146.7359	131.7150	129.4943	134.8323	136.5541	152.9010	163.3969	182.7210 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	35.0666	28.1317	25.3295	18.5575	14.3343	11.7113	13.0763	16.9970	22.0774	28.9668	32.7179	36.0412 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2114.4953	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1852.0880	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												283.0075	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												4249.5907	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2114.4953	0.1544	326.4976 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1852.0880	0.1410	261.1174 (264)
Space and water heating			587.6151 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	283.0075	0.1443	40.8467 (268)
Total CO2, kg/year			628.4618 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.0700 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2114.4953	1.5717	3323.2493 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1852.0880	1.5213	2817.6136 (278)
Space and water heating			6140.8630 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	283.0075	1.5338	434.0863 (282)
Total Primary energy kWh/year			6574.9493 (286)
Dwelling Primary energy Rate (DPER)			42.5400 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	88.6500 (1b)	x 2.4000 (2b)	= 212.7600 (1b) - (3b)
First floor	65.9100 (1c)	x 2.4500 (2c)	= 161.4795 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	154.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.2395 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1069 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3569 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3034 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(22)
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	

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Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3868	0.3792	0.3716	0.3337	0.3261	0.2882	0.2882	0.2806	0.3034	0.3261	0.3413	0.3564 (22b)
	0.5748	0.5719	0.5690	0.5557	0.5532	0.5415	0.5415	0.5394	0.5460	0.5532	0.5582	0.5635 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			4.2000	1.0000	4.2000		(26)
TER Opening Type (Uw = 1.20)			31.0900	1.1450	35.5992		(27)
Rooflight W			0.4300	1.4151	0.6085		(27a)
Ground Floor			88.6500	0.1300	11.5245		(28a)
Brick	148.5000	27.1900	121.3100	0.1800	21.8358		(29a)
Dormer	12.9200	8.1000	4.8200	0.1800	0.8676		(29a)
Ashlar	24.5300		24.5300	0.1800	4.4154		(29a)
Joists GF	22.7400		22.7400	0.1100	2.5014		(30)
Joists FF	41.6700		41.6700	0.1100	4.5837		(30)
Rafters	31.5000	0.4300	31.0700	0.1100	3.4177		(30)
Total net area of external elements Aum(A, m ²)			370.5100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	89.5538	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							81.6743 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	28.0800	0.0900	2.5272
E10 Eaves (insulation at ceiling level)	43.8400	0.0600	2.6304
E17 Corner (inverted - internal area greater than external area)	15.6000	-0.0900	-1.4040
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	44.4000	0.0600	2.6640
E13 Gable (insulation at rafter level)	4.4000	0.0800	0.3520
E12 Gable (insulation at ceiling level)	4.8500	0.0600	0.2910
R7 Flat ceiling (inverted)	6.0000	0.0400	0.2400
R9 Roof to wall (flat ceiling)	6.0000	0.0400	0.2400
E2 Other lintels (including other steel lintels)	24.2900	0.0500	1.2145
E3 Sill	22.2900	0.0500	1.1145
E4 Jamb	50.1000	0.0500	2.5050
E5 Ground floor (normal)	45.0000	0.1600	7.2000
E6 Intermediate floor within a dwelling	47.1100	0.0000	0.0000
R1 Head of roof window	0.5500	0.0800	0.0440
R2 Sill of roof window	0.5500	0.0600	0.0330
R3 Jamb of roof window	1.5600	0.0800	0.1248
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			21.1300 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 110.6838 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	70.9868	70.6281	70.2765	68.6251	68.3161	66.8778	66.8778	66.6114	67.4318	68.3161	68.9412	69.5946 (38)
Heat transfer coeff	181.6706	181.3119	180.9603	179.3089	179.0000	177.5616	177.5616	177.2953	178.1156	179.0000	179.6250	180.2785 (39)
Average = Sum(39)m / 12 =												179.3074

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1754	1.1731	1.1708	1.1601	1.1581	1.1488	1.1488	1.1471	1.1524	1.1581	1.1622	1.1664 (40)
HLP (average)												1.1601
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9411 (42)
Hot water usage for mixer showers												
73.5323	72.4273	70.8170	67.7360	65.4624	62.9268	61.4856	63.0836	64.8354	67.5579	70.7050	73.2506 (42a)	
Hot water usage for baths												
31.7445	31.2731	30.6092	29.3851	28.4685	27.4521	26.9031	27.5624	28.2802	29.3677	30.6170	31.6372 (42b)	
Hot water usage for other uses												
44.7497	43.1225	41.4952	39.8679	38.2407	36.6134	36.6134	38.2407	39.8679	41.4952	43.1225	44.7497 (42c)	
Average daily hot water use (litres/day)												137.9081 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
150.0266	146.8228	142.9214	136.9890	132.1715	126.9923	125.0021	128.8867	132.9835	138.4208	144.4445	149.6375 (44)	
Energy content (annual)	237.6054	209.0737	219.6648	187.5311	177.9282	156.1518	151.1792	159.5886	163.9820	187.8357	205.7877	234.2962 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2290.6245
35.6408	31.3611	32.9497	28.1297	26.6892	23.4228	22.6769	23.9383	24.5973	28.1754	30.8682	35.1444 (46)	
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)	
If cylinder contains dedicated solar storage												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month												
292.5122	258.6669	274.5716	240.6667	232.8350	209.2874	206.0860	214.4954	217.1176	242.7425	258.9233	289.2030 (62)	
WWHRS	-33.6159	-29.7302	-31.1317	-25.7783	-24.0245	-20.5579	-19.2697	-20.4914	-21.2700	-25.0750	-28.4069	-32.9934 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h												
258.8963	228.9368	243.4399	214.8884	208.8106	188.7295	186.8162	194.0040	195.8476	217.6675	230.5164	256.2096 (64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2624.7628 (64)
Electric shower(s)												2625 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
122.9292	109.1916	116.9640	104.8626	103.0866	94.4290	94.1925	96.9886	97.0325	106.3808	110.9329	121.8289 (65)	

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.9467	182.6196	164.9467	170.4449	164.9467	170.4449	164.9467	164.9467	170.4449	164.9467	170.4449	164.9467	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	325.4400	328.8170	320.3070	302.1901	279.3207	257.8268	243.4675	240.0905	248.6005	266.7174	289.5868	311.0807	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	(71)
Water heating gains (Table 5)	165.2275	162.4875	157.2097	145.6425	138.5572	131.1513	126.6028	130.3611	134.7674	142.9850	154.0735	163.7485	(72)
Total internal gains	725.7306	744.0405	712.5797	688.3939	652.9411	626.5395	602.1335	602.5147	620.9292	644.7655	684.2216	709.8924	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					10.7100	10.6334	0.6300	0.7000			0.7700			34.8043 (74)
East					5.1700	19.6403	0.6300	0.7000			0.7700			31.0320 (76)
South					12.6900	46.7521	0.6300	0.7000			0.7700			181.3152 (78)
West					2.5200	19.6403	0.6300	0.7000			0.7700			15.1258 (80)
West					0.4300	25.9287	0.6300	0.7000			1.0000			4.4252 (82)
Solar gains	266.7025	462.6085	655.0662	848.7391	984.5247	992.3074	950.4882	846.9040	721.7762	517.2393	320.9621			227.2624 (83)
Total gains	992.4331	1206.6490	1367.6459	1537.1330	1637.4658	1618.8468	1552.6216	1449.4187	1342.7055	1162.0048	1005.1836			937.1548 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.3017	19.3399	19.3774	19.5559	19.5897	19.7484	19.7484	19.7780	19.6869	19.5897	19.5215	19.4507	
alpha	2.2868	2.2893	2.2918	2.3037	2.3060	2.3166	2.3166	2.3185	2.3125	2.3060	2.3014	2.2967	
util living area	0.9464	0.9179	0.8782	0.8061	0.7032	0.5685	0.4464	0.4865	0.6667	0.8394	0.9226	0.9523	(86)
MIT	17.9244	18.3377	18.9071	19.6256	20.2415	20.6796	20.8693	20.8361	20.5054	19.6901	18.6837	17.8525	(87)
Th 2	19.9397	19.9416	19.9434	19.9520	19.9536	19.9612	19.9612	19.9626	19.9583	19.9536	19.9504	19.9470	(88)
util rest of house	0.9394	0.9075	0.8624	0.7800	0.6609	0.5025	0.3574	0.3975	0.6064	0.8120	0.9110	0.9461	(89)
MIT 2	16.3437	16.8641	17.5782	18.4686	19.2041	19.6977	19.8815	19.8569	19.5225	18.5677	17.3134	16.2564	(90)
Living area fraction	16.5564	17.0624	17.7571	18.6243	19.3437	19.8298	20.0144	19.9887	19.6548	18.7187	17.4978	16.4712	(91)
MIT	16.5564	17.0624	17.7571	18.6243	19.3437	19.8298	20.0144	19.9887	19.6548	18.7187	17.4978	16.4712	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.5564	17.0624	17.7571	18.6243	19.3437	19.8298	20.0144	19.9887	19.6548	18.7187	17.4978	16.4712	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9061	0.8680	0.8195	0.7399	0.6328	0.4934	0.3623	0.3999	0.5865	0.7710	0.8725	0.9148	(94)
Useful gains	899.2099	1047.3177	1120.7985	1137.3767	1036.2353	798.8012	562.4943	579.6553	787.4552	895.9510	877.0620	857.3239	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2226.6293	2205.1912	2037.0820	1743.6600	1368.2305	928.6148	606.2670	636.2556	989.3919	1453.2555	1867.7096	2212.2323	(97)
Space heating kWh	987.6000	778.0910	681.7149	436.5240	247.0045	0.0000	0.0000	0.0000	0.0000	414.6345	713.2662	1008.0518	(98a)
Space heating requirement - total per year (kWh/year)												5266.8870	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	987.6000	778.0910	681.7149	436.5240	247.0045	0.0000	0.0000	0.0000	0.0000	414.6345	713.2662	1008.0518	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5266.8870	
Space heating per m2										(98c) / (4) =		34.0766	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)

Fraction of space heat from main system(s)													0.0000 (201)
Efficiency of main space heating system 1 (in %)													1.0000 (202)
Efficiency of main space heating system 2 (in %)													92.3000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (207)
													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	987.6000	778.0910	681.7149	436.5240	247.0045	0.0000	0.0000	0.0000	0.0000	414.6345	713.2662	1008.0518	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	1069.9892	843.0021	738.5860	472.9404	267.6105	0.0000	0.0000	0.0000	0.0000	449.2249	772.7695	1092.1471	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

1. Overall dwelling characteristics					
	Area (m ²)		Storey height (m)		Volume (m ³)
Ground floor	88.6500 (1b)	x	2.4000 (2b)	=	212.7600 (1b) - (3b)
First floor	65.9100 (1c)	x	2.4500 (2c)	=	161.4795 (1c) - (3c)

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Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)
Dwelling volume

154.5600

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 374.2395 (4)
(5)

2. Ventilation rate

												m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												4 * 10 = 40.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans												40.0000 / (5) = 0.1069 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0000 (17)
Infiltration rate												0.3569 (18)
Number of sides sheltered												2 (19)
												Shelter factor
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3034 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3868	0.3792	0.3716	0.3337	0.3261	0.2882	0.2882	0.2806	0.3034	0.3261	0.3413	0.3564	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5748	0.5719	0.5690	0.5557	0.5532	0.5415	0.5415	0.5394	0.5460	0.5532	0.5582	0.5635	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			31.0900	1.1450	35.5992			(27)
Solid Doors			4.2000	1.0000	4.2000			(26)
Rooflight W			0.4300	1.1450	0.4924			(27a)
Ground Floor			88.6500	0.1100	9.7515	75.0000	6648.7500	(28a)
Brick	148.5000	27.1900	121.3100	0.1800	21.8358	9.0000	1091.7900	(29a)
Dormer	12.9200	8.1000	4.8200	0.1800	0.8676	9.0000	43.3800	(29a)
Ashlar	24.5300		24.5300	0.1800	4.4154	9.0000	220.7700	(29a)
Joists GF	22.7400		22.7400	0.1100	2.5014	9.0000	204.6600	(30)
Joists FF	41.6700		41.6700	0.1100	4.5837	9.0000	375.0300	(30)
Rafters	31.5000	0.4300	31.0700	0.1300	4.0391	9.0000	279.6300	(30)
Total net area of external elements Aum(A, m2)			370.5100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.2861			(33)
GF			120.0000			9.0000	1080.0000	(32c)
FF			100.0000			9.0000	900.0000	(32c)
Internal Floor 1			65.9100			18.0000	1186.3800	(32d)
Internal Ceiling 1			65.9100			9.0000	593.1900	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12623.5800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							81.6743	(35)

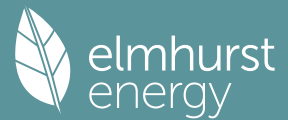
List of Thermal Bridges													
K1 Element													
E16 Corner (normal)						Length	Psi-value	Total					
E10 Eaves (insulation at ceiling level)						28.0800	0.0900	2.5272					
E17 Corner (inverted - internal area greater than external area)						43.8400	0.0600	2.6304					
R8 Roof to wall (rafter)						15.6000	-0.0900	-1.4040					
R6 Flat ceiling						22.5600	0.0600	1.3536					
E13 Gable (insulation at rafter level)						44.4000	0.0600	2.6640					
E12 Gable (insulation at ceiling level)						4.4000	0.0800	0.3520					
R7 Flat ceiling (inverted)						4.8500	0.0600	0.2910					
R9 Roof to wall (flat ceiling)						6.0000	0.0400	0.2400					
E2 Other lintels (including other steel lintels)						6.0000	0.0400	0.2400					
E3 Sill						24.2900	0.0500	1.2145					
E4 Jamb						22.2900	0.0500	1.1145					
E5 Ground floor (normal)						50.1000	0.0500	2.5050					
E6 Intermediate floor within a dwelling						45.0000	0.1600	7.2000					
R1 Head of roof window						47.1100	0.0000	0.0000					
R2 Sill of roof window						0.5500	0.0800	0.0440					
R3 Jamb of roof window						0.5500	0.0600	0.0330					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													21.1300 (36)
Point Thermal bridges													(36a) = 0.0000
Total fabric heat loss													(33) + (36) + (36a) = 109.4161 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	70.9868	70.6281	70.2765	68.6251	68.3161	66.8778	66.8778	66.6114	67.4318	68.3161	68.9412	69.5946	(38)
Average = Sum(39)m / 12 =	180.4029	180.0442	179.6926	178.0412	177.7322	176.2939	176.2939	176.0275	176.8479	177.7322	178.3573	179.0107	(39)
													178.0397
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1672	1.1649	1.1626	1.1519	1.1499	1.1406	1.1406	1.1389	1.1442	1.1499	1.1540	1.1582	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9411 (42)
Hot water usage for mixer showers

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Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for other uses	31.7445	31.2731	30.6092	29.3851	28.4685	27.4521	26.9031	27.5624	28.2802	29.3677	30.6170	31.6372 (42b)
Average daily hot water use (litres/day)	44.7497	43.1225	41.4952	39.8679	38.2407	36.6134	36.6134	38.2407	39.8679	41.4952	43.1225	44.7497 (42c)
												70.1138 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	76.4943	74.3955	72.1044	69.2530	66.7091	64.0655	63.5165	65.8030	68.1481	70.8629	73.7395	76.3869 (44)
Distribution loss (46)m = 0.15 x (45)m	121.1482	105.9383	110.8217	94.8039	89.8033	78.7760	76.8177	81.4779	84.0334	96.1603	105.0554	119.6035 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	102.9760	90.0475	94.1985	80.5833	76.3328	66.9596	65.2951	69.2562	71.4284	81.7363	89.2971	101.6630 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.9760	90.0475	94.1985	80.5833	76.3328	66.9596	65.2951	69.2562	71.4284	81.7363	89.2971	101.6630 (64)
12Total per year (kWh/year)												990 (64)
Electric shower(s)	58.8871	52.4689	57.2940	54.6750	55.7010	53.1333	54.9044	55.7010	54.6750	57.2940	56.2167	58.8871 (64a)
												669.8376 (64a)
Heat gains from water heating, kWh/month	40.4658	35.6291	37.8731	33.8146	33.0084	30.0232	30.0499	31.2393	31.5259	34.7576	36.3785	40.1375 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.9467	182.6196	164.9467	170.4449	164.9467	170.4449	164.9467	164.9467	170.4449	164.9467	170.4449	164.9467 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	325.4400	328.8170	320.3070	302.1901	279.3207	257.8268	243.4675	240.0905	248.6005	266.7174	289.5868	311.0807 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437 (71)
Water heating gains (Table 5)	54.3895	53.0195	50.9047	46.9647	44.3662	41.6989	40.3896	41.9883	43.7859	46.7172	50.5256	53.9483 (72)
Total internal gains	611.8926	631.5725	603.2748	586.7161	555.7501	537.0871	515.9203	514.1419	529.9478	545.4977	577.6737	597.0921 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North					10.7100	10.6334		0.6300	0.7000	0.7700	34.8043 (74)	
East					5.1700	19.6403		0.6300	0.7000	0.7700	31.0320 (76)	
South					12.6900	46.7521		0.6300	0.7000	0.7700	181.3152 (78)	
West					2.5200	19.6403		0.6300	0.7000	0.7700	15.1258 (80)	
West					0.4300	25.9287		0.6300	0.7000	1.0000	4.4252 (82)	
Solar gains	266.7025	462.6085	655.0662	848.7391	984.5247	992.3074	950.4882	846.9040	721.7762	517.2393	320.9621	227.2624 (83)
Total gains	878.5951	1094.1810	1258.3410	1435.4552	1540.2748	1529.3944	1466.4084	1361.0459	1251.7240	1062.7371	898.6358	824.3545 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.4373	19.4760	19.5142	19.6952	19.7294	19.8904	19.8904	19.9205	19.8281	19.7294	19.6603	19.5885
alpha	2.2958	2.2984	2.3009	2.3130	2.3153	2.3260	2.3260	2.3280	2.3219	2.3153	2.3107	2.3059
util living area	0.9574	0.9309	0.8935	0.8236	0.7226	0.5879	0.4646	0.5075	0.6900	0.8596	0.9367	0.9628 (86)
MIT	17.8014	18.2281	18.8143	19.5596	20.1994	20.6589	20.8595	20.8227	20.4701	19.6136	18.5757	17.7279 (87)
Th 2	19.9463	19.9482	19.9500	19.9587	19.9603	19.9678	19.9678	19.9692	19.9649	19.9603	19.9570	19.9536 (88)
util rest of house	0.9517	0.9219	0.8792	0.7990	0.6814	0.5219	0.3739	0.4171	0.6310	0.8346	0.9269	0.9578 (89)
MIT 2	17.0203	17.4410	18.0163	18.7407	19.3397	19.7474	19.9003	19.8790	19.5973	18.8086	17.7951	16.9522 (90)
Living area fraction	17.1254	17.5469	18.1237	18.8509	19.4554	19.8700	20.0294	20.0060	19.7148	18.9169	17.9002	17.0566 (92)
Temperature adjustment	17.1254	17.5469	18.1237	18.8509	19.4554	19.8700	20.0294	20.0060	19.7148	18.9169	17.9002	17.0566 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	817.0562	978.3879	1066.4272	1101.9442	1014.6430	787.7514	556.8241	572.4722	769.5515	853.5493	809.1364	773.0483 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)

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Heat loss rate W	2313.7475	2277.0040	2088.6865	1771.6716	1378.3805	929.0749	604.5737	634.7568	992.9591	1478.1822	1926.2896	2301.4734 (97)
Space heating kWh	1113.5383	872.6700	760.5609	482.2037	270.6206	0.0000	0.0000	0.0000	0.0000	464.7269	804.3503	1137.1483 (98a)
Space heating requirement - total per year (kWh/year)												5905.8190
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1113.5383	872.6700	760.5609	482.2037	270.6206	0.0000	0.0000	0.0000	0.0000	464.7269	804.3503	1137.1483 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5905.8190
Space heating per m2										(98c) / (4) =		38.2105 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1657.1626	1304.5748	1337.8093	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7103	0.7746	0.7430	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1177.0400	1010.4783	993.9603	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1710.1828	1639.9877	1520.9028	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	383.8628	468.3550	392.0453	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	95.9657	117.0887	98.0113	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												311.0658 (107)
Energy for space heating												38.2105 (99)
Energy for space cooling												2.0126 (108)
Total												40.2231 (109)
Fabric Energy Efficiency (DFEE)												40.2 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	88.6500 (1b)	x 2.4000 (2b)	= 212.7600 (1b) - (3b)
First floor	65.9100 (1c)	x 2.4500 (2c)	= 161.4795 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	154.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	374.2395 (5)

2. Ventilation rate

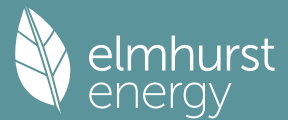
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1069 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3569 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3034 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3868	0.3792	0.3716	0.3337	0.3261	0.2882	0.2882	0.2806	0.3034	0.3261	0.3413	0.3564 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5748	0.5719	0.5690	0.5557	0.5532	0.5415	0.5415	0.5394	0.5460	0.5532	0.5582	0.5635 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			4.2000	1.0000	4.2000		(26)
TER Opening Type (Uw = 1.20)			31.0900	1.1450	35.5992		(27)

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Rooflight W			0.4300	1.4151	0.6085	(27a)
Ground Floor			88.6500	0.1300	11.5245	(28a)
Brick	148.5000	27.1900	121.3100	0.1800	21.8358	(29a)
Dormer	12.9200	8.1000	4.8200	0.1800	0.8676	(29a)
Ashlar	24.5300		24.5300	0.1800	4.4154	(29a)
Joists GF	22.7400		22.7400	0.1100	2.5014	(30)
Joists FF	41.6700		41.6700	0.1100	4.5837	(30)
Rafters	31.5000	0.4300	31.0700	0.1100	3.4177	(30)
Total net area of external elements Aum(A, m2)			370.5100			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		89.5538	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

81.6743 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	28.0800	0.0900	2.5272
E10 Eaves (insulation at ceiling level)	43.8400	0.0600	2.6304
E17 Corner (inverted - internal area greater than external area)	15.6000	-0.0900	-1.4040
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	44.4000	0.0600	2.6640
E13 Gable (insulation at rafter level)	4.4000	0.0800	0.3520
E12 Gable (insulation at ceiling level)	4.8500	0.0600	0.2910
R7 Flat ceiling (inverted)	6.0000	0.0400	0.2400
R9 Roof to wall (flat ceiling)	6.0000	0.0400	0.2400
E2 Other lintels (including other steel lintels)	24.2900	0.0500	1.2145
E3 Sill	22.2900	0.0500	1.1145
E4 Jamb	50.1000	0.0500	2.5050
E5 Ground floor (normal)	45.0000	0.1600	7.2000
E6 Intermediate floor within a dwelling	47.1100	0.0000	0.0000
R1 Head of roof window	0.5500	0.0800	0.0440
R2 Sill of roof window	0.5500	0.0600	0.0330
R3 Jamb of roof window	1.5600	0.0800	0.1248

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

21.1300 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 110.6838 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	70.9868	70.6281	70.2765	68.6251	68.3161	66.8778	66.8778	66.6114	67.4318	68.3161	68.9412	69.5946
Average = Sum(39)m / 12 =	181.6706	181.3119	180.9603	179.3089	179.0000	177.5616	177.5616	177.2953	178.1156	179.0000	179.6250	180.2785

179.3074 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1754	1.1731	1.1708	1.1601	1.1581	1.1488	1.1488	1.1471	1.1524	1.1581	1.1622	1.1664
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

1.1601 (40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9411 (42)
Hot water usage for mixer showers													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
31.7445	31.2731	30.6092	29.3851	28.4685	27.4521	26.9031	27.5624	28.2802	29.3677	30.6170	31.6372		(42b)
Hot water usage for other uses													
44.7497	43.1225	41.4952	39.8679	38.2407	36.6134	36.6134	38.2407	39.8679	41.4952	43.1225	44.7497		(42c)
Average daily hot water use (litres/day)													70.1138 (43)
Daily hot water use													
76.4943	74.3955	72.1044	69.2530	66.7091	64.0655	63.5165	65.8030	68.1481	70.8629	73.7395	76.3869		(44)
Energy conte	121.1482	105.9383	110.8217	94.8039	89.8033	78.7760	76.8177	81.4779	84.0334	96.1603	105.0554	119.6035	(45)
Energy content (annual)										Total = Sum(45)m =		1164.4397	
Distribution loss (46)m = 0.15 x (45)m													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
102.9760	90.0475	94.1985	80.5833	76.3328	66.9596	65.2951	69.2562	71.4284	81.7363	89.2971	101.6630		(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	102.9760	90.0475	94.1985	80.5833	76.3328	66.9596	65.2951	69.2562	71.4284	81.7363	89.2971	101.6630	(64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				989.7738	(64)
Electric shower(s)	58.8871	52.4689	57.2940	54.6750	55.7010	53.1333	54.9044	55.7010	54.6750	57.2940	56.2167	58.8871	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												669.8376	(64a)
Heat gains from water heating, kWh/month													
40.4658	35.6291	37.8731	33.8146	33.0084	30.0232	30.0499	31.2393	31.5259	34.7576	36.3785	40.1375		(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	147.0547	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
164.9467	182.6196	164.9467	170.4449	164.9467	170.4449	164.9467	164.9467	170.4449	164.9467	170.4449	164.9467		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
325.4400	328.8170	320.3070	302.1901	279.3207	257.8268	243.4675	240.0905	248.6005	266.7174	289.5868	311.0807		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055	37.7055		(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	(71)
Water heating gains (Table 5)													
54.3895	53.0195	50.9047	46.9647	44.3662	41.6989	40.3896	41.9883	43.7859	46.7172	50.5256	53.9483		(72)
Total internal gains													

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611.8926 631.5725 603.2748 586.7161 555.7501 537.0871 515.9203 514.1419 529.9478 545.4977 577.6737 597.0921 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					10.7100	10.6334	0.6300	0.7000			0.7700	34.8043 (74)
East					5.1700	19.6403	0.6300	0.7000			0.7700	31.0320 (76)
South					12.6900	46.7521	0.6300	0.7000			0.7700	181.3152 (78)
West					2.5200	19.6403	0.6300	0.7000			0.7700	15.1258 (80)
West					0.4300	25.9287	0.6300	0.7000			1.0000	4.4252 (82)
Solar gains	266.7025	462.6085	655.0662	848.7391	984.5247	992.3074	950.4882	846.9040	721.7762	517.2393	320.9621	227.2624 (83)
Total gains	878.5951	1094.1810	1258.3410	1435.4552	1540.2748	1529.3944	1466.4084	1361.0459	1251.7240	1062.7371	898.6358	824.3545 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.3017	19.3399	19.3774	19.5559	19.5897	19.7484	19.7484	19.7780	19.6869	19.5897	19.5215	19.4507
alpha	2.2868	2.2893	2.2918	2.3037	2.3060	2.3166	2.3166	2.3185	2.3125	2.3060	2.3014	2.2967
util living area	0.9575	0.9311	0.8940	0.8245	0.7241	0.5899	0.4667	0.5096	0.6917	0.8603	0.9369	0.9628 (86)
MIT	17.7805	18.2073	18.7951	19.5435	20.1880	20.6525	20.8563	20.8189	20.4619	19.5997	18.5577	17.7070 (87)
Th 2	19.9397	19.9416	19.9434	19.9520	19.9536	19.9612	19.9612	19.9626	19.9583	19.9536	19.9504	19.9470 (88)
util rest of house	0.9518	0.9221	0.8797	0.7999	0.6829	0.5235	0.3753	0.4186	0.6325	0.8353	0.9271	0.9578 (89)
MIT 2	16.9957	17.4164	17.9934	18.7210	19.3245	19.7368	19.8922	19.8706	19.5853	18.7909	17.7734	16.9276 (90)
Living area fraction	17.1013	17.5229	18.1013	18.8317	19.4407	19.8601	20.0220	19.9982	19.7033	18.8998	17.8789	17.0324 (92)
MIT	17.1013	17.5229	18.1013	18.8317	19.4407	19.8601	20.0220	19.9982	19.7033	18.8998	17.8789	17.0324 (93)
Temperature adjustment												0.0000
adjusted MIT	17.1013	17.5229	18.1013	18.8317	19.4407	19.8601	20.0220	19.9982	19.7033	18.8998	17.8789	17.0324 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9300	0.8943	0.8478	0.7683	0.6598	0.5165	0.3810	0.4220	0.6160	0.8037	0.9005	0.9378 (94)
Useful gains	817.0673	978.5424	1066.8457	1102.9263	1016.3320	789.9085	558.7559	574.3071	771.0183	854.0820	809.2360	773.0403 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2325.6293	2288.6758	2099.3667	1780.8378	1385.5881	933.9835	607.6106	637.9493	998.0316	1485.6579	1936.1614	2313.4134 (97)
Space heating kWh	1122.3702	880.4096	768.1956	488.0962	274.7266	0.0000	0.0000	0.0000	0.0000	469.8925	811.3863	1146.0376 (98a)
Space heating requirement - total per year (kWh/year)												5961.1145
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1122.3702	880.4096	768.1956	488.0962	274.7266	0.0000	0.0000	0.0000	0.0000	469.8925	811.3863	1146.0376 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5961.1145
Space heating per m2												(98c) / (4) = 38.5683 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1669.0792	1313.9560	1347.4440	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7069	0.7715	0.7397	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1179.9265	1013.6586	996.7369	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1710.1828	1639.9877	1520.9028	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	381.7846	465.9889	389.9795	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	95.4461	116.4972	97.4949	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												309.4382 (107)
Energy for space heating												38.5683 (99)
Energy for space cooling												2.0021 (108)
Total												40.5703 (109)
Fabric Energy Efficiency (TFEE)												40.6 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

Area Storey height Volume

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Ground floor	(m2)		(m)		(m3)
First floor	88.6500 (1b)	x	2.4000 (2b)	=	212.7600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.9100 (1c)	x	2.4500 (2c)	=	161.4795 (1c) - (3c)
Dwelling volume					(4)
			(3a) + (3b) + (3c) + (3d) + (3e) ... (3n)	=	374.2395 (5)

2. Ventilation rate

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	6 * 10 =	60.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	Air changes per hour	
Pressure test	60.0000 / (5) =	0.1603 (8)
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	
Infiltration rate	5.0000	(17)
Number of sides sheltered	0.4103	(18)
	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3488 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Effective ac	0.4447	0.4360	0.4273	0.3837	0.3749	0.3313	0.3313	0.3226	0.3488	0.3749	0.3924	0.4098
	0.5989	0.5950	0.5913	0.5736	0.5703	0.5549	0.5549	0.5520	0.5608	0.5703	0.5770	0.5840

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			31.0900	1.1450	35.5992		(27)
Solid Doors			4.2000	1.0000	4.2000		(26)
Rooflight W			0.4300	1.1450	0.4924		(27a)
Ground Floor			88.6500	0.1100	9.7515	75.0000	6648.7500 (28a)
Brick	148.5000	27.1900	121.3100	0.1800	21.8358	9.0000	1091.7900 (29a)
Dormer	12.9200	8.1000	4.8200	0.1800	0.8676	9.0000	43.3800 (29a)
Ashlar	24.5300		24.5300	0.1800	4.4154	9.0000	220.7700 (29a)
Joists GF	22.7400		22.7400	0.1100	2.5014	9.0000	204.6600 (30)
Joists FF	41.6700		41.6700	0.1100	4.5837	9.0000	375.0300 (30)
Rafters	31.5000	0.4300	31.0700	0.1300	4.0391	9.0000	279.6300 (30)
Total net area of external elements Aum(A, m2)			370.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		88.2861		(33)
GF			120.0000			9.0000	1080.0000 (32c)
FF			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			65.9100			18.0000	1186.3800 (32d)
Internal Ceiling 1			65.9100			9.0000	593.1900 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12623.5800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		81.6743 (35)
List of Thermal Bridges		
K1 Element	Length	Psi-value
E16 Corner (normal)	28.0800	0.0900
E10 Eaves (insulation at ceiling level)	43.8400	0.0600
E17 Corner (inverted - internal area greater than external area)	15.6000	-0.0900
R8 Roof to wall (rafter)	22.5600	0.0600
R6 Flat ceiling	44.4000	0.0600
E13 Gable (insulation at rafter level)	4.4000	0.0800
E12 Gable (insulation at ceiling level)	4.8500	0.0600
R7 Flat ceiling (inverted)	6.0000	0.0400
R9 Roof to wall (flat ceiling)	6.0000	0.0400
E2 Other lintels (including other steel lintels)	24.2900	0.0500
E3 Sill	22.2900	0.0500
E4 Jamb	50.1000	0.0500
E5 Ground floor (normal)	45.0000	0.1600
E6 Intermediate floor within a dwelling	47.1100	0.0000
R1 Head of roof window	0.5500	0.0800
R2 Sill of roof window	0.5500	0.0600
R3 Jamb of roof window	1.5600	0.0800
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		21.1300 (36)
Point Thermal bridges		(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) =	109.4161 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	73.9604	73.4863	73.0215	70.8385	70.4300	68.5287	68.5287	68.1766	69.2610	70.4300	71.2563	72.1201
Average = Sum(39)m / 12 =	183.3765	182.9024	182.4376	180.2546	179.8461	177.9448	177.9448	177.5927	178.6771	179.8461	180.6724	181.5362
												180.2526
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1864	1.1834	1.1804	1.1662	1.1636	1.1513	1.1513	1.1490	1.1560	1.1636	1.1689	1.1745
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9411 (42)

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Hot water usage for mixer showers	91.9154	90.5341	88.5212	84.6700	81.8279	78.6585	76.8569	78.8545	81.0443	84.4473	88.3813	91.5632 (42a)
Hot water usage for baths	31.7445	31.2731	30.6092	29.3851	28.4685	27.4521	26.9031	27.5624	28.2802	29.3677	30.6170	31.6372 (42b)
Hot water usage for other uses	44.7497	43.1225	41.4952	39.8679	38.2407	36.6134	36.6134	38.2407	39.8679	41.4952	43.1225	44.7497 (42c)
Average daily hot water use (litres/day)												154.8567 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	168.4096	164.9296	160.6256	153.9230	148.5371	142.7240	140.3735	144.6576	149.1924	155.3103	162.1208	167.9502 (44)
Distribution loss (46)m = 0.15 x (45)m	266.7197	234.8576	246.8756	210.7129	199.9595	175.4958	169.7695	179.1163	183.9691	210.7546	230.9708	262.9694 (45)
Water storage loss:	40.0080	35.2286	37.0313	31.6069	29.9939	26.3244	25.4654	26.8674	27.5954	31.6132	34.6456	39.4454 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	323.6948	286.3189	303.8506	265.8501	256.9345	230.6329	226.7446	236.0914	239.1063	267.7296	286.1079	319.9444 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	323.6948	286.3189	303.8506	265.8501	256.9345	230.6329	226.7446	236.0914	239.1063	267.7296	286.1079	319.9444 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	134.2643	119.2592	127.6662	114.1718	112.0666	102.4621	102.0284	105.1362	105.2795	115.6559	120.9075	133.0174 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)												

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.0626	35.5833	28.9383	21.9081	16.3766	13.8258	14.9393	19.4186	26.0636	33.0938	38.6253	41.1761 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	485.7313	490.7717	478.0701	451.0300	416.8966	384.8161	363.3844	358.3440	371.0456	398.0857	432.2190	464.2995 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437 (71)
Water heating gains (Table 5)	180.4628	177.4691	171.5943	158.5719	150.6271	142.3084	137.1350	141.3121	146.2215	155.4515	167.9271	178.7868 (72)
Total internal gains	823.6663	821.2335	796.0122	748.9195	701.3098	655.3599	629.8681	633.4843	657.7402	704.0405	756.1810	801.6719 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				10.7100	10.6334	0.6300	0.7000	0.7700	34.8043 (74)			
East				5.1700	19.6403	0.6300	0.7000	0.7700	31.0320 (76)			
South				12.6900	46.7521	0.6300	0.7000	0.7700	181.3152 (78)			
West				2.5200	19.6403	0.6300	0.7000	0.7700	15.1258 (80)			
West				0.4300	25.9287	0.6300	0.7000	1.0000	4.4252 (82)			
Solar gains	266.7025	462.6085	655.0662	848.7391	984.5247	992.3074	950.4882	846.9040	721.7762	517.2393	320.9621	227.2624 (83)
Total gains	1090.3688	1283.8421	1451.0784	1597.6586	1685.8346	1647.6672	1580.3563	1480.3883	1379.5164	1221.2799	1077.1430	1028.9344 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.1221	19.1717	19.2205	19.4533	19.4975	19.7058	19.7058	19.7449	19.6251	19.4975	19.4083	19.3160
alpha	2.2748	2.2781	2.2814	2.2969	2.2998	2.3137	2.3137	2.3163	2.3083	2.2998	2.2939	2.2877
util living area	0.9364	0.9089	0.8667	0.7961	0.6942	0.5625	0.4409	0.4793	0.6577	0.8275	0.9127	0.9432 (86)
MIT	18.0153	18.3976	18.9663	19.6602	20.2591	20.6858	20.8722	20.8408	20.5183	19.7319	18.7505	17.9459 (87)
Th 2	19.9309	19.9333	19.9357	19.9471	19.9492	19.9592	19.9592	19.9610	19.9553	19.9492	19.9449	19.9404 (88)
util rest of house	0.9282	0.8975	0.8497	0.7691	0.6513	0.4966	0.3524	0.3909	0.5970	0.7988	0.8999	0.9359 (89)
MIT 2	16.4533	16.9338	17.6455	18.5055	19.2196	19.7015	19.8815	19.8588	19.5326	18.6133	17.3927	16.3706 (90)
Living area fraction	16.6635	17.1308	17.8233	18.6609	19.3595	19.8340	20.0149	19.9909	19.6653	18.7638	17.5755	16.5826 (91)
MIT	16.6635	17.1308	17.8233	18.6609	19.3595	19.8340	20.0149	19.9909	19.6653	18.7638	17.5755	16.5826 (92)
Temperature adjustment												0.0000
adjusted MIT	16.6635	17.1308	17.8233	18.6609	19.3595	19.8340	20.0149	19.9909	19.6653	18.7638	17.5755	16.5826 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8920	0.8565	0.8063	0.7295	0.6241	0.4879	0.3574	0.3936	0.5779	0.7582	0.8599	0.9017	(94)
Useful gains	972.6004	1099.6098	1169.9705	1165.5339	1052.0846	803.9468	564.8846	582.7449	797.2464	925.9510	926.1834	927.8277	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2267.1698	2237.0481	2065.7940	1759.4458	1377.5251	931.3616	607.6557	637.7211	994.3834	1468.2290	1892.6246	2247.8896	(97)
Space heating kWh	963.1596	764.3586	666.4927	427.6165	242.1278	0.0000	0.0000	0.0000	0.0000	403.4549	695.8377	982.1260	(98a)
Space heating requirement - total per year (kWh/year)												5145.1737	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	963.1596	764.3586	666.4927	427.6165	242.1278	0.0000	0.0000	0.0000	0.0000	403.4549	695.8377	982.1260	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5145.1737	
Space heating per m2										(98c) / (4) =		33.2892	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	963.1596	764.3586	666.4927	427.6165	242.1278	0.0000	0.0000	0.0000	0.0000	403.4549	695.8377	982.1260	(98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating fuel (main heating system)	385.4180	305.8658	266.7038	171.1151	96.8899	0.0000	0.0000	0.0000	0.0000	161.4465	278.4464	393.0076	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	323.6948	286.3189	303.8506	265.8501	256.9345	230.6329	226.7446	236.0914	239.1063	267.7296	286.1079	319.9444	(64)	
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
Fuel for water heating, kWh/month	184.8628	163.5174	173.5298	151.8276	146.7359	131.7150	129.4943	134.8323	136.5541	152.9010	163.3969	182.7210	(219)	
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)	
Lighting	35.0666	28.1317	25.3295	18.5575	14.3343	11.7113	13.0763	16.9970	22.0774	28.9668	32.7179	36.0412	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1												2058.8931	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												175.1000		
Water heating fuel used												1852.0880	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
Total electricity for the above, kWh/year												0.0000	(231)	
Electricity for lighting (calculated in Appendix L)												283.0075	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation												0.0000	(233)	
Wind generation												0.0000	(234)	
Hydro-electric generation (Appendix N)												0.0000	(235a)	
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)	
Appendix Q - special features														
Energy saved or generated												-0.0000	(236)	
Energy used												0.0000	(237)	
Total delivered energy for all uses												4193.9885	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2058.8931	16.4900	339.5115	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1852.0880	16.4900	305.4093	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	283.0075	16.4900	46.6679	(250)
Additional standing charges			0.0000	(251)
Total energy cost			691.5887	(255)

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11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):

Energy cost factor (ECF)

SAP value

SAP rating (Section 12)

SAP band

$$\begin{aligned} & [(255) \times (256)] / [(4) + 45.0] = 0.3600 \quad (256) \\ & 1.2476 \quad (257) \\ & 79.7763 \\ & 80 \quad (258) \\ & C \end{aligned}$$

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	2058.8931	0.1544	317.8886 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	1852.0880	0.1410	261.1174 (264)
Space and water heating			579.0061 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	283.0075	0.1443	40.8467 (268)
Total CO ₂ , kg/year			619.8528 (272)
CO ₂ emissions per m ²			4.0100 (273)
EI value			95.8378
EI rating			96 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	88.6500 (1b)	x 2.4000 (2b)	= 212.7600 (1b) - (3b)
First floor	65.9100 (1c)	x 2.4500 (2c)	= 161.4795 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	154.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.2395 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 60.0000 / (5) = 0.1603 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4103 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3488 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3139	0.2877	0.2790	0.2790	0.2877	0.2529	0.2703	0.2441	0.2441	0.2616	0.2441	0.2790 (22b)
Effective ac	0.5493	0.5414	0.5389	0.5389	0.5414	0.5320	0.5365	0.5298	0.5298	0.5342	0.5298	0.5389 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			31.0900	1.1450	35.5992		(27)
Solid Doors			4.2000	1.0000	4.2000		(26)
Rooflight W			0.4300	1.1450	0.4924		(27a)
Ground Floor			88.6500	0.1100	9.7515	75.0000	6648.7500 (28a)
Brick	148.5000	27.1900	121.3100	0.1800	21.8358	9.0000	1091.7900 (29a)
Dormer	12.9200	8.1000	4.8200	0.1800	0.8676	9.0000	43.3800 (29a)
Ashlar	24.5300		24.5300	0.1800	4.4154	9.0000	220.7700 (29a)
Joists GF	22.7400		22.7400	0.1100	2.5014	9.0000	204.6600 (30)
Joists FF	41.6700		41.6700	0.1100	4.5837	9.0000	375.0300 (30)
Rafters	31.5000	0.4300	31.0700	0.1300	4.0391	9.0000	279.6300 (30)
Total net area of external elements A _{um} (A, m ²)			370.5100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.2861		(33)
GF			120.0000			9.0000	1080.0000 (32c)
FF			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			65.9100			18.0000	1186.3800 (32d)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28) ... (30) + (32) + (32a) ... (32e) = 12623.5800 (34)

Thermal mass parameter (TMP = C_m / TFA) in kJ/m2K 81.6743 (35)

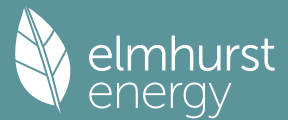
R3 Jamb or roof window	1.5600	0.0800	0.1248	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				21.1300 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =		109.4161 (37)

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.9411 (42)
Hot water usage for mixer showers	91.9154	90.5341	88.5212	84.6700	81.8279	78.6585	76.8569	78.8545	81.0443	84.4473	88.3813	91.5632 (42a)
Hot water usage for baths	31.7445	31.2731	30.6092	29.3851	28.4685	27.4521	26.9031	27.5624	28.2802	29.3677	30.6170	31.6372 (42b)
Hot water usage for other uses	44.7497	43.1225	41.4952	39.8679	38.2407	36.6134	36.6134	38.2407	39.8679	41.4952	43.1225	44.7497 (42c)
Average daily hot water use (litres/day)												154.8567 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	168.4096	164.9296	160.6256	153.9230	148.5371	142.7240	140.3735	144.6576	149.1924	155.3103	162.1208	167.9502 (44)
Energy content (annual)	266.7197	234.8576	246.8756	210.7129	199.9595	175.4958	169.7695	179.1163	183.9691	210.7546	230.9708	262.9694 (45)
Distribution loss (46)m = 0.15 x (45)m	40.0080	35.2286	37.0313	31.6069	29.9939	26.3244	25.4654	26.8674	27.5954	31.6132	34.6456	39.4454 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	323.6948	286.3189	303.8506	265.8501	256.9345	230.6329	226.7446	236.0914	239.1063	267.7296	286.1079	319.9444 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	323.6948	286.3189	303.8506	265.8501	256.9345	230.6329	226.7446	236.0914	239.1063	267.7296	286.1079	319.9444 (64)
												Total per year (kWh/year) = Sum(64)m = 3243.0060 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	134.2											

5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.0626	35.5833	28.9383	21.9081	16.3766	13.8258	14.9393	19.4186	26.0636	33.0938	38.6253	41.1761	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	485.7313	490.7717	478.0701	451.0300	416.8966	384.8161	363.3844	358.3440	371.0456	398.0857	432.2190	464.2995	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	(71)
Water heating gains (Table 5)	180.4628	177.4691	171.5943	158.5719	150.6271	142.3084	137.1350	141.3121	146.2215	155.4515	167.9271	178.7868	(72)
Total internal gains	823.6663	821.2335	796.0122	748.9195	701.3098	655.3599	629.8681	633.4843	657.7402	704.0405	756.1810	801.6719	(73)

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6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		FF Access factor Table 6d		Gains W	
North	10.7100		13.0723		0.6300		0.7000		0.7700		42.7871 (74)	
East	5.1700		24.4329		0.6300		0.7000		0.7700		38.6044 (76)	
South	12.6900		54.9219		0.6300		0.7000		0.7700		212.9998 (78)	
West	2.5200		24.4329		0.6300		0.7000		0.7700		18.8168 (80)	
West	0.4300		32.4879		0.6300		0.7000		1.0000		5.5446 (82)	
Solar gains	318.7527	485.5544	683.2700	919.9781	1044.4735	1142.5886	1071.7331	960.4040	806.5464	579.0988	384.8960	264.8515 (83)
Total gains	1142.4190	1306.7880	1479.2822	1668.8976	1745.7833	1797.9485	1701.6012	1593.8883	1464.2866	1283.1394	1141.0769	1066.5234 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.7831	19.8921	19.9266	19.9266	19.8921	20.0244	19.9602	20.0550	20.0550	19.9928	20.0550	19.9266
alpha	2.3189	2.3261	2.3284	2.3284	2.3261	2.3350	2.3307	2.3370	2.3370	2.3329	2.3370	2.3284
util living area	0.9220	0.8973	0.8457	0.7581	0.6311	0.4629	0.3475	0.3576	0.5839	0.7753	0.8865	0.9309 (86)
MIT	18.4059	18.6787	19.2725	19.9227	20.4884	20.8309	20.9387	20.9373	20.6839	20.0770	19.1679	18.3376 (87)
Th 2	19.9628	19.9679	19.9695	19.9695	19.9679	19.9740	19.9710	19.9754	19.9754	19.9725	19.9754	19.9695 (88)
util rest of house	0.9119	0.8846	0.8262	0.7269	0.5807	0.3906	0.2565	0.2620	0.5148	0.7377	0.8696	0.9219 (89)
MIT 2	16.9625	17.3048	18.0441	18.8340	19.4909	19.8521	19.9418	19.9463	19.7194	19.0406	17.9309	16.8812 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.1567	17.4897	18.2094	18.9806	19.6251	19.9838	20.0760	20.0797	19.8492	19.1801	18.0974	17.0772 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.1567	17.4897	18.2094	18.9806	19.6251	19.9838	20.0760	20.0797	19.8492	19.1801	18.0974	17.0772 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8738	0.8437	0.7844	0.6919	0.5623	0.3913	0.2662	0.2722	0.5055	0.7030	0.8286	0.8856 (94)
Useful gains	998.2235	1102.4926	1160.3363	1154.7852	981.5944	703.6121	452.9037	433.8658	740.1694	902.0597	945.4842	944.4866 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	2119.3268	2113.5269	1919.7659	1633.1268	1203.1219	767.6634	470.1127	451.0447	865.3421	1294.4049	1730.5227	2090.0596 (97)
Space heating kWh	834.1009	679.4150	565.0156	344.4059	164.8164	0.0000	0.0000	0.0000	0.0000	291.9048	565.2277	852.3063 (98a)
Space heating requirement - total per year (kWh/year)												4297.1926
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	834.1009	679.4150	565.0156	344.4059	164.8164	0.0000	0.0000	0.0000	0.0000	291.9048	565.2277	852.3063 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4297.1926
Space heating per m2												(98c) / (4) = 27.8027 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	834.1009	679.4150	565.0156	344.4059	164.8164	0.0000	0.0000	0.0000	0.0000	291.9048	565.2277	852.3063 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	333.7739	271.8748	226.0967	137.8175	65.9530	0.0000	0.0000	0.0000	0.0000	116.8086	226.1815	341.0589 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	323.6948	286.3189	303.8506	265.8501	256.9345	230.6329	226.7446	236.0914	239.1063	267.7296	286.1079	319.9444 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	184.8628	163.5174	173.5298	151.8276	146.7359	131.7150	129.4943	134.8323	136.5541	152.9010	163.3969	182.7210 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	35.0666	28.1317	25.3295	18.5575	14.3343	11.7113	13.0763	16.9970	22.0774	28.9668	32.7179	36.0412 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1719.5649	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1852.0880	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												283.0075	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3854.6603	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1719.5649	26.0600	448.1186	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1852.0880	26.0600	482.6541	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	283.0075	26.0600	73.7517	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1004.5245	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1719.5649	0.1550	266.5436	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1852.0880	0.1410	261.1174	(264)
Space and water heating			527.6610	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	283.0075	0.1443	40.8467	(268)
Total CO2, kg/year			568.5077	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1719.5649	1.5739	2706.3842	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1852.0880	1.5213	2817.6136	(278)
Space and water heating			5523.9978	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	283.0075	1.5338	434.0863	(282)
Total Primary energy kWh/year			5958.0841	(286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.6	-£ 103	-49 kg (8.7%)
U Solar photovoltaic panels	+ 4.6	-£ 268	-138 kg (26.6%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£103	0.32 kg/m ²	B 81 A 96
Solar photovoltaic panels	£268	0.89 kg/m ²	B 86 A 97
Total Savings	£371	1.21 kg/m ²	

Potential energy efficiency rating: B 86
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):
Current Potential Saving

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Electricity	£1005	£902	£103
Space heating	£448	£469	-£21
Water heating	£483	£359	£124
Lighting	£74	£74	£0
Generated (PV)	-£0	-£268	£268
Total cost of fuels	£1005	£634	£371
Total cost of uses	£1005	£634	£371
Delivered energy	25 kWh/m²	16 kWh/m²	9 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	2 kg/m²	1 kg/m²
Primary energy	39 kWh/m²	25 kWh/m²	14 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	88.6500 (1b)	x 2.4000 (2b)	= 212.7600 (1b) - (3b)
First floor	65.9100 (1c)	x 2.4500 (2c)	= 161.4795 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	154.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.2395 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	6 * 10 =	60.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1603 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4103	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3488 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4447	0.4360	0.4273	0.3837	0.3749	0.3313	0.3313	0.3226	0.3488	0.3749	0.3924	0.4098 (22b)
Effective ac	0.5989	0.5950	0.5913	0.5736	0.5703	0.5549	0.5549	0.5520	0.5608	0.5703	0.5770	0.5840 (25)

3. Heat losses and heat loss parameter

Element	Gross m²	Openings m²	NetArea m²	U-value W/m²K	A x U W/K	K-value kJ/m²K	A x K kJ/K
Windows (Uw = 1.20)			31.0900	1.1450	35.5992		(27)
Solid Doors			4.2000	1.0000	4.2000		(26)
Rooflight W			0.4300	1.1450	0.4924		(27a)
Ground Floor			88.6500	0.1100	9.7515	75.0000	6648.7500 (28a)
Brick	148.5000	27.1900	121.3100	0.1800	21.8358	9.0000	1091.7900 (29a)
Dormer	12.9200	8.1000	4.8200	0.1800	0.8676	9.0000	43.3800 (29a)
Ashlar	24.5300		24.5300	0.1800	4.4154	9.0000	220.7700 (29a)
Joists GF	22.7400		22.7400	0.1100	2.5014	9.0000	204.6600 (30)
Joists FF	41.6700		41.6700	0.1100	4.5837	9.0000	375.0300 (30)
Rafters	31.5000	0.4300	31.0700	0.1300	4.0391	9.0000	279.6300 (30)
Total net area of external elements Aum(A, m²)			370.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	88.2861			(33)
GF			120.0000			9.0000	1080.0000 (32c)
FF			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			65.9100			18.0000	1186.3800 (32d)
Internal Ceiling 1			65.9100			9.0000	593.1900 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	28.0800	0.0900	2.5272
E10 Eaves (insulation at ceiling level)	43.8400	0.0600	2.6304
E17 Corner (inverted - internal area greater than external area)	15.6000	-0.0900	-1.4040
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	44.4000	0.0600	2.6640
E13 Gable (insulation at rafter level)	4.4000	0.0800	0.3520
E12 Gable (insulation at ceiling level)	4.8500	0.0600	0.2910

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R7 Flat ceiling (inverted)	6.0000	0.0400	0.2400										
R9 Roof to wall (flat ceiling)	6.0000	0.0400	0.2400										
E2 Other lintels (including other steel lintels)	24.2900	0.0500	1.2145										
E3 Sill	22.2900	0.0500	1.1145										
E4 Jamb	50.1000	0.0500	2.5050										
E5 Ground floor (normal)	45.0000	0.1600	7.2000										
E6 Intermediate floor within a dwelling	47.1100	0.0000	0.0000										
R1 Head of roof window	0.5500	0.0800	0.0440										
R2 Sill of roof window	0.5500	0.0600	0.0330										
R3 Jamb of roof window	1.5600	0.0800	0.1248										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												21.1300	(36)
Point Thermal bridges												0.0000	
Total fabric heat loss												(33) + (36) + (36a) =	109.4161 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	73.9604	73.4863	73.0215	70.8385	70.4300	68.5287	68.5287	68.1766	69.2610	70.4300	71.2563	72.1201	(38)
Average = Sum(39)m / 12 =	183.3765	182.9024	182.4376	180.2546	179.8461	177.9448	177.9448	177.5927	178.6771	179.8461	180.6724	181.5362	(39)
												180.2526	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1864	1.1834	1.1804	1.1662	1.1636	1.1513	1.1513	1.1490	1.1560	1.1636	1.1689	1.1745	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												1.1662	
												31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.9411 (42)
Hot water usage for mixer showers													
	91.9154	90.5341	88.5212	84.6700	81.8279	78.6585	76.8569	78.8545	81.0443	84.4473	88.3813	91.5632	(42a)
Hot water usage for baths													
	31.7445	31.2731	30.6092	29.3851	28.4685	27.4521	26.9031	27.5624	28.2802	29.3677	30.6170	31.6372	(42b)
Hot water usage for other uses													
	44.7497	43.1225	41.4952	39.8679	38.2407	36.6134	36.6134	38.2407	39.8679	41.4952	43.1225	44.7497	(42c)
Average daily hot water use (litres/day)													154.8567 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	168.4096	164.9296	160.6256	153.9230	148.5371	142.7240	140.3735	144.6576	149.1924	155.3103	162.1208	167.9502	(44)
Energy conte	266.7197	234.8576	246.8756	210.7129	199.9595	175.4958	169.7695	179.1163	183.9691	210.7546	230.9708	262.9694	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													2572.1707
	40.0080	35.2286	37.0313	31.6069	29.9939	26.3244	25.4654	26.8674	27.5954	31.6132	34.6456	39.4454	(46)
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	323.6948	286.3189	302.4549	259.0965	244.1402	218.0262	213.7176	223.9949	233.7034	266.3339	286.1079	319.9444	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.8000 (H2)
Collector linear heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0000 (H4)
Collector loop efficiency													0.9000 (H5)
Incidence angle modifier													1.0000 (H6)
Overshading factor													0.8000 (H8)
Overall heat loss coefficient of system													6.5000 (H10)
Heat loss coefficient of collector loop													3.9667 (H11)
Dedicated solar storage volume													75.0000 (H12)
Effective solar volume													75.0000 (H14)
Reference volume													225.0000 (H15)
Storage tank correction coefficient													1.3161 (H16)
Heat delivered to hot water													645.7484 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													645.7484
Solar input	-0.0000	-16.1743	-59.5310	-82.8588	-109.6756	-101.3392	-100.7188	-87.2711	-59.3313	-28.8482	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	323.6948	270.1446	242.9239	176.2377	134.4646	116.6870	112.9988	136.7238	174.3721	237.4857	286.1079	319.9444	(64)
												2531.7853	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month													
	134.2643	119.2592	126.5496	108.7689	101.8311	92.3767	91.6069	95.4591	100.9572	114.5393	120.9075	133.0174	(65)

5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	40.0626	35.5833	28.9383	21.9081	16.3766	13.8258	14.9393	19.4186	26.0636	33.0938	38.6253	41.1761	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	485.7313	490.7717	478.0701	451.0300	416.8966	384.8161	363.3844	358.3440	371.0456	398.0857	432.2190	464.2995	(68)
Pumps, fans	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	(71)
Total internal gains	180.4628	177.4691	170.0935	151.0679	136.8698	128.3010	123.1275	128.3052	140.2183	153.9507	167.9271	178.7868	(72)

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823.6663 821.2335 794.5114 741.4155 687.5525 641.3524 615.8606 620.4773 651.7370 702.5397 756.1810 801.6719 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				10.7100	10.6334	0.6300	0.7000	0.7700	34.8043 (74)			
East				5.1700	19.6403	0.6300	0.7000	0.7700	31.0320 (76)			
South				12.6900	46.7521	0.6300	0.7000	0.7700	181.3152 (78)			
West				2.5200	19.6403	0.6300	0.7000	0.7700	15.1258 (80)			
West				0.4300	25.9287	0.6300	0.7000	1.0000	4.4252 (82)			

Solar gains	266.7025	462.6085	655.0662	848.7391	984.5247	992.3074	950.4882	846.9040	721.7762	517.2393	320.9621	227.2624 (83)
Total gains	1090.3688	1283.8421	1449.5776	1590.1546	1672.0772	1633.6598	1566.3488	1467.3813	1373.5132	1219.7791	1077.1430	1028.9344 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.1221	19.1717	19.2205	19.4533	19.4975	19.7058	19.7058	19.7449	19.6251	19.4975	19.4083	19.3160
alpha	2.2748	2.2781	2.2814	2.2969	2.2998	2.3137	2.3137	2.3163	2.3083	2.2998	2.2939	2.2877
util living area	0.9364	0.9089	0.8669	0.7974	0.6971	0.5657	0.4440	0.4825	0.6592	0.8279	0.9127	0.9432 (86)
MIT	18.0153	18.3976	18.9649	19.6546	20.2521	20.6819	20.8703	20.8385	20.5157	19.7306	18.7505	17.9459 (87)
Th 2	19.9309	19.9333	19.9357	19.9471	19.9492	19.9592	19.9592	19.9610	19.9553	19.9492	19.9449	19.9404 (88)
util rest of house	0.9282	0.8975	0.8500	0.7705	0.6543	0.4997	0.3551	0.3938	0.5986	0.7991	0.8999	0.9359 (89)
MIT 2	16.4533	16.9338	17.6438	18.4989	19.2120	19.6980	19.8802	19.8571	19.5301	18.6118	17.3927	16.3706 (90)
Living area fraction	16.6635	17.1308	17.8216	18.6544	19.3520	19.8304	20.0135	19.9892	19.6627	18.7624	17.5755	16.5826 (92)
MIT	16.6635	17.1308	17.8216	18.6544	19.3520	19.8304	20.0135	19.9892	19.6627	18.7624	17.5755	16.5826 (93)
Temperature adjustment												0.0000
adjusted MIT	16.6635	17.1308	17.8216	18.6544	19.3520	19.8304	20.0135	19.9892	19.6627	18.7624	17.5755	16.5826 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8920	0.8565	0.8065	0.7309	0.6267	0.4908	0.3601	0.3964	0.5794	0.7585	0.8599	0.9017 (94)
Useful gains	972.6004	1099.6098	1169.1134	1162.1936	1047.9657	801.7886	563.9866	581.6481	795.7865	925.2171	926.1834	927.8277 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2267.1698	2237.0481	2065.4836	1758.2822	1376.1843	930.7277	607.4118	637.4178	993.9262	1467.9705	1892.6246	2247.8896 (97)
Space heating kWh	963.1596	764.3586	666.8994	429.1838	244.1946	0.0000	0.0000	0.0000	0.0000	403.8085	695.8377	982.1260 (98a)
Space heating requirement - total per year (kWh/year)												5149.5682
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	963.1596	764.3586	666.8994	429.1838	244.1946	0.0000	0.0000	0.0000	0.0000	403.8085	695.8377	982.1260 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5149.5682
Space heating per m2										(98c) / (4) =		33.3176 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	963.1596	764.3586	666.8994	429.1838	244.1946	0.0000	0.0000	0.0000	0.0000	403.8085	695.8377	982.1260 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	385.4180	305.8658	266.8665	171.7422	97.7169	0.0000	0.0000	0.0000	0.0000	161.5880	278.4464	393.0076 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	323.6948	270.1446	242.9239	176.2377	134.4646	116.6870	112.9988	136.7238	174.3721	237.4857	286.1079	319.9444 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	184.8628	154.2802	138.7344	100.6497	76.7930	66.6402	64.5339	78.0832	99.5843	135.6286	163.3969	182.7210 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	35.0666	28.1317	25.3295	18.5575	14.3343	11.7113	13.0763	16.9970	22.0774	28.9668	32.7179	36.0412 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-40.0620	-60.9545	-93.3523	-109.7114	-119.1018	-104.3615	-102.8023	-96.0353	-83.7374	-70.9825	-45.3418	-34.1484 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)

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Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2060.6515	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1445.9082	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												283.0075	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-960.5913	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2908.9759	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2060.6515	16.4900	339.8014	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1445.9082	16.4900	238.4303	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	283.0075	16.4900	46.6679	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-960.5913	16.4900	-158.4015	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-158.4015	(252)
Total energy cost			479.6901	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8653	(257)
SAP value		85.9727	
SAP rating (Section 12)		86	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2060.6515	0.1544	318.1316	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1445.9082	0.1449	209.5300	(264)
Space and water heating			527.6617	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	283.0075	0.1443	40.8467	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-960.5913	0.1342	-128.9487	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-128.9487	(269)
Total CO2, kg/year			450.6567	(272)
CO2 emissions per m2			2.9200	(273)
EI value			96.9739	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	88.6500 (1b)	x 2.4000 (2b)	= 212.7600 (1b)	- (3b)
First floor	65.9100 (1c)	x 2.4500 (2c)	= 161.4795 (1c)	- (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	154.5600			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 374.2395	(5)

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2. Ventilation rate

			m3 per hour
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	6 * 10 =	60.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

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Average daily hot water use (litres/day)	44.7497	43.1225	41.4952	39.8679	38.2407	36.6134	36.6134	38.2407	39.8679	41.4952	43.1225	44.7497 (42c)
												154.8567 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	168.4096	164.9296	160.6256	153.9230	148.5371	142.7240	140.3735	144.6576	149.1924	155.3103	162.1208	167.9502 (44)
Energy content (annual)	266.7197	234.8576	246.8756	210.7129	199.9595	175.4958	169.7695	179.1163	183.9691	210.7546	230.9708	262.9694 (45)
Distribution loss (46)m = 0.15 x (45)m												2572.1707
Water storage loss:	40.0080	35.2286	37.0313	31.6069	29.9939	26.3244	25.4654	26.8674	27.5954	31.6132	34.6456	39.4454 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	323.6948	286.3189	302.4549	259.0965	244.1402	218.0262	213.7176	223.9949	233.7034	266.3339	286.1079	319.9444 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												767.0715 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												767.0715
Solar input	-1.7455	-20.9166	-66.5548	-94.6214	-119.6036	-120.5177	-117.0732	-104.5383	-72.9895	-40.9677	-7.5430	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	321.9492	265.4023	235.9001	164.4751	124.5366	97.5085	96.6444	119.4566	160.7139	225.3661	278.5649	319.9444 (64)
												2410.4622 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	134.2643	119.2592	126.5496	108.7689	101.8311	92.3767	91.6069	95.4591	100.9572	114.5393	120.9075	133.0174 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656	176.4656 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.0626	35.5833	28.9383	21.9081	16.3766	13.8258	14.9393	19.4186	26.0636	33.0938	38.6253	41.1761 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	485.7313	490.7717	478.0701	451.0300	416.8966	384.8161	363.3844	358.3440	371.0456	398.0857	432.2190	464.2995 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877	55.5877 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437	-117.6437 (71)
Water heating gains (Table 5)	180.4628	177.4691	170.0935	151.0679	136.8698	128.3010	123.1275	128.3052	140.2183	153.9507	167.9271	178.7868 (72)
Total internal gains	823.6663	821.2335	794.5114	741.4155	687.5525	641.3524	615.8606	620.4773	651.7370	702.5397	756.1810	801.6719 (73)

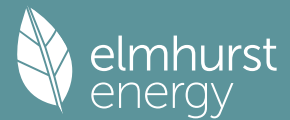
6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					10.7100	13.0723		0.6300	0.7000	0.7700		42.7871 (74)
East					5.1700	24.4329		0.6300	0.7000	0.7700		38.6044 (76)
South					12.6900	54.9219		0.6300	0.7000	0.7700		212.9998 (78)
West					2.5200	24.4329		0.6300	0.7000	0.7700		18.8168 (80)
West					0.4300	32.4879		0.6300	0.7000	1.0000		5.5446 (82)
Solar gains	318.7527	485.5544	683.2700	919.9781	1044.4735	1142.5886	1071.7331	960.4040	806.5464	579.0988	384.8960	264.8515 (83)
Total gains	1142.4190	1306.7880	1477.7814	1661.3936	1732.0260	1783.9410	1687.5938	1580.8813	1458.2834	1281.6386	1141.0769	1066.5234 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.7831	19.8921	19.9266	19.9266	19.8921	20.0244	19.9602	20.0550	20.0550	19.9928	20.0550	19.9266
alpha	2.3189	2.3261	2.3284	2.3284	2.3261	2.3350	2.3307	2.3370	2.3370	2.3329	2.3370	2.3284
util living area	0.9220	0.8973	0.8460	0.7596	0.6340	0.4657	0.3500	0.3601	0.5854	0.7757	0.8865	0.9309 (86)
MIT	18.4059	18.6787	19.2712	19.9178	20.4830	20.8287	20.9378	20.9363	20.6820	20.0760	19.1679	18.3376 (87)
Th 2	19.9628	19.9679	19.9695	19.9695	19.9679	19.9740	19.9710	19.9754	19.9754	19.9725	19.9754	19.9695 (88)
util rest of house												

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MIT 2	0.9119	0.8846	0.8264	0.7284	0.5837	0.3932	0.2584	0.2640	0.5163	0.7381	0.8696	0.9219 (89)
Living area fraction	16.9625	17.3048	18.0425	18.8284	19.4855	19.8503	19.9414	19.9458	19.7177	19.0395	17.9309	16.8812 (90)
MIT	17.1567	17.4897	18.2078	18.9750	19.6197	19.9820	20.0755	20.0791	fLA = Living area / (4) =			0.1346 (91)
Temperature adjustment									19.8475	19.1790	18.0974	17.0772 (92)
adjusted MIT	17.1567	17.4897	18.2078	18.9750	19.6197	19.9820	20.0755	20.0791	19.8475	19.1790	18.0974	17.0772 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8738	0.8437	0.7847	0.6933	0.5649	0.3938	0.2682	0.2742	0.5069	0.7034	0.8286	0.8856	(94)
Useful gains	998.2235	1102.4926	1159.5414	1151.8847	978.4979	702.4669	452.5317	433.4988	739.1665	901.4575	945.4842	944.4866	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	2119.3268	2113.5269	1919.4865	1632.1538	1202.1695	767.3497	470.0159	450.9491	865.0477	1294.2023	1730.5227	2090.0596	(97)
Space heating kWh	834.1009	679.4150	565.3992	345.7938	166.4116	0.0000	0.0000	0.0000	0.0000	292.2021	565.2277	852.3063	(98a)
Space heating requirement - total per year (kWh/year)												4300.8566	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	834.1009	679.4150	565.3992	345.7938	166.4116	0.0000	0.0000	0.0000	0.0000	292.2021	565.2277	852.3063	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4300.8566	
Space heating per m2												(98c) / (4) =	27.8265 (99)

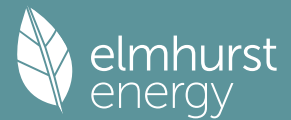
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	834.1009	679.4150	565.3992	345.7938	166.4116	0.0000	0.0000	0.0000	0.0000	292.2021	565.2277	852.3063	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	333.7739	271.8748	226.2502	138.3729	66.5913	0.0000	0.0000	0.0000	0.0000	116.9276	226.1815	341.0589	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	321.9492	265.4023	235.9001	164.4751	124.5366	97.5085	96.6444	119.4566	160.7139	225.3661	278.5649	319.9444	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	183.8659	151.5719	134.7230	93.9321	71.1231	55.6873	55.1938	68.2219	91.7841	128.7071	159.0890	182.7210	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	35.0666	28.1317	25.3295	18.5575	14.3343	11.7113	13.0763	16.9970	22.0774	28.9668	32.7179	36.0412	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-47.3956	-64.0845	-96.5518	-114.8108	-120.8815	-111.9529	-109.2286	-103.1740	-90.5196	-77.2848	-53.3008	-39.6053	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1721.0310	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1376.6203	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:												80.0000	(230g)
pump for solar water heating												80.0000	(231)
Total electricity for the above, kWh/year												283.0075	(232)
Electricity for lighting (calculated in Appendix L)													
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1028.7902	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2431.8686	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year

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Space heating - main system 1	1721.0310	26.0600	448.5007 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1376.6203	26.0600	358.7473 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	283.0075	26.0600	73.7517 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1028.7902	26.0600	-268.1027
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-268.1027 (252)
Total energy cost			633.7450 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1721.0310	0.1550	266.7469 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1376.6203	0.1457	200.6124 (264)
Space and water heating			467.3594 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	283.0075	0.1443	40.8467 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1028.7902	0.1344	-138.2982
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-138.2982 (269)
Total CO2, kg/year			381.0049 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1721.0310	1.5738	2708.6027 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1376.6203	1.5391	2118.7112 (278)
Space and water heating			4827.3139 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	283.0075	1.5338	434.0863 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1028.7902	1.4968	-1539.9090
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1539.9090 (283)
Total Primary energy kWh/year			3842.5152 (286)

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Property Reference	FURNERS LANE 5				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 5, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	78 C	DER	4.68	TER	9.35	
Environmental	96 A	% DER < TER				49.95
CO ₂ Emissions (t/year)	0.47	DFEE	39.67	TFEE	41.23	
Compliance Check	See BREL	% DFEE < TFEE				3.79
% DPER < TPER	0.08	DPER	49.21	TPER	49.25	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

2. Ventilation rate

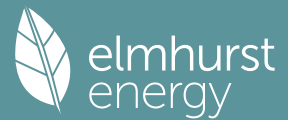
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.2298 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4798 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4078 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5200	0.5098	0.4996	0.4486	0.4384	0.3875	0.3875	0.3773	0.4078	0.4384	0.4588	0.4792 (22b)
Effective ac	0.6352	0.6300	0.6248	0.6006	0.5961	0.5751	0.5751	0.5712	0.5832	0.5961	0.6053	0.6148 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight S			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000 (28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800 (29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200 (29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300 (29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700 (30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700 (30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500 (30)
Total net area of external elements Aum(A, m ²)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3071		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			45.0000			9.0000	405.0000 (32c)
Internal Floor 1			31.0300			18.0000	558.5400 (32d)
Internal Ceiling 1			30.1300			9.0000	271.1700 (32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			9935.1300 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.2724 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.0000	0.0900	2.1600
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1000	4.1430
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			14.1428 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	81.4499 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.7248	54.2725	53.8292	51.7467	51.3571	49.5433	49.5433	49.2075	50.2420	51.3571	52.1453	52.9693	(38)
Heat transfer coeff	136.1747	135.7224	135.2790	133.1966	132.8070	130.9932	130.9932	130.6573	131.6918	132.8070	133.5952	134.4192	(39)
Average = Sum(39)m / 12 =												133.1947	
HLP	1.2236	1.2195	1.2156	1.1968	1.1933	1.1770	1.1770	1.1740	1.1833	1.1933	1.2004	1.2078	(40)
HLP (average)												1.1968	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

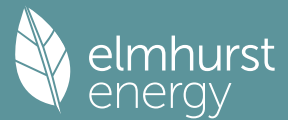
Assumed occupancy													2.8224 (42)
Hot water usage for mixer showers	89.4267	88.0828	86.1245	82.3775	79.6124	76.5287	74.7760	76.7195	78.8500	82.1609	85.9883	89.0841	(42a)
Hot water usage for baths	30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839	(42b)
Hot water usage for other uses	43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337	(42c)
Average daily hot water use (litres/day)												150.6629	(43)
Daily hot water use	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017	(44)
Energy conte	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476	(45)
Energy content (annual)										Total = Sum(45)m =		2502.5121	
Distribution loss (46)m = 0.15 x (45)m	38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771	(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3173.3474	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	131.8626	117.1444	125.4432	112.2744	110.2660	100.8818	100.4997	103.5233	103.6229	113.7581	118.8277	130.6494	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	137.9683	152.7507	137.9683	142.5673	137.9683	142.5673	137.9683	137.9683	142.5673	137.9683	142.5673	137.9683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.3965	276.2335	269.0844	253.8647	234.6525	216.5958	204.5329	201.6959	208.8450	224.0647	243.2768	261.3335	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	(71)
Water heating gains (Table 5)	177.2347	174.3220	168.6064	155.9367	148.2071	140.1137	135.0803	139.1443	143.9206	152.9007	165.0384	175.6040	(72)
Total internal gains	656.9348	671.6415	643.9944	620.7039	589.1632	564.6121	542.9167	544.1437	560.6682	583.2690	619.2178	643.2411	(73)

6. Solar gains

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[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W
North	7.4600	10.6334	0.6300	0.7000	0.7700	24.2428 (74)
East	3.7400	19.6403	0.6300	0.7000	0.7700	22.4487 (76)
South	9.6800	46.7521	0.6300	0.7000	0.7700	138.3082 (78)
West	2.8300	19.6403	0.6300	0.7000	0.7700	16.9866 (80)
South	0.5400	47.0123	0.6300	0.7000	1.0000	10.0760 (82)

Solar gains	212.0622	367.9678	520.6101	672.5144	777.4058	782.1528	749.7820	670.1063	573.0787	411.3798	255.2494	180.6634 (83)
Total gains	868.9970	1039.6093	1164.6045	1293.2183	1366.5690	1346.7649	1292.6987	1214.2500	1133.7469	994.6489	874.4671	823.9045 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.2663	20.3338	20.4005	20.7194	20.7802	21.0679	21.0679	21.1221	20.9562	20.7802	20.6576	20.5310
alpha	2.3511	2.3556	2.3600	2.3813	2.3853	2.4045	2.4045	2.4081	2.3971	2.3853	2.3772	2.3687
util living area	0.9330	0.9007	0.8564	0.7772	0.6682	0.5286	0.4080	0.4444	0.6243	0.8094	0.9041	0.9397 (86)
MIT	18.2097	18.6154	19.1561	19.8320	20.3794	20.7548	20.9051	20.8808	20.6114	19.8893	18.9496	18.1541 (87)
Th 2	19.9012	19.9044	19.9076	19.9225	19.9253	19.9384	19.9384	19.9408	19.9334	19.9253	19.9197	19.9137 (88)
util rest of house	0.9240	0.8878	0.8375	0.7475	0.6225	0.4614	0.3213	0.3570	0.5604	0.7773	0.8896	0.9315 (89)
MIT 2	16.6676	17.1761	17.8503	18.6836	19.3274	19.7446	19.8839	19.8683	19.6036	18.7742	17.6133	16.6047 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.0761	17.5573	18.1962	18.9878	19.6060	20.0122	20.1544	20.1365	19.8705	19.0696	17.9673	17.0152 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.0761	17.5573	18.1962	18.9878	19.6060	20.0122	20.1544	20.1365	19.8705	19.0696	17.9673	17.0152 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8915	0.8515	0.8008	0.7176	0.6075	0.4664	0.3398	0.3740	0.5563	0.7466	0.8546	0.9008 (94)
Useful gains	774.7502	885.2550	932.6225	928.0209	830.1801	628.0882	439.2189	454.1400	630.6901	742.5882	747.3112	742.1743 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1739.7842	1717.8815	1582.2540	1343.6573	1049.9754	708.9588	465.6034	488.1995	759.9323	1124.8161	1451.8190	1722.6031 (97)
Space heating kWh	717.9853	559.5250	483.3259	299.2582	163.5277	0.0000	0.0000	0.0000	0.0000	284.3775	507.2456	729.4391 (98a)
Space heating requirement - total per year (kWh/year)												3744.6844
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	717.9853	559.5250	483.3259	299.2582	163.5277	0.0000	0.0000	0.0000	0.0000	284.3775	507.2456	729.4391 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3744.6844
Space heating per m2	(98c) / (4) =											33.6480 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	717.9853	559.5250	483.3259	299.2582	163.5277	0.0000	0.0000	0.0000	0.0000	284.3775	507.2456	729.4391 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	287.3090	223.8996	193.4077	119.7512	65.4373	0.0000	0.0000	0.0000	0.0000	113.7965	202.9794	291.8924 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	180.7375	159.8850	169.7116	148.5687	143.6433	129.0008	126.8686	132.0620	133.7087	149.6413	159.8245	178.6537 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

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Annual totals kWh/year		
Space heating fuel - main system 1	1498.4731	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	175.1000	
Water heating fuel used	1812.3058	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	236.7193	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3547.4982	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1498.4731	0.1546	231.7135 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1812.3058	0.1410	255.4851 (264)
Space and water heating			487.1986 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Total CO2, kg/year			521.3645 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6800 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1498.4731	1.5725	2356.3163 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1812.3058	1.5213	2757.0039 (278)
Space and water heating			5113.3201 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	236.7193	1.5338	363.0879 (282)
Total Primary energy kWh/year			5476.4081 (286)
Dwelling Primary energy Rate (DPER)			49.2100 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1532 (8)
Pressure Test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4032 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3427 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												

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Effective ac	0.4370	0.4284	0.4198	0.3770	0.3684	0.3256	0.3256	0.3170	0.3427	0.3684	0.3856	0.4027 (22b)
	0.5955	0.5918	0.5881	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.0200	1.0000	2.0200		(26)
TER Opening Type (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Rooflight S			0.5400	1.4151	0.7642		(27a)
Ground Floor			81.1600	0.1300	10.5508		(28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476		(29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284		(29a)
Ashlar	27.0700		27.0700	0.1800	4.8726		(29a)
Joists GF	51.0300		51.0300	0.1100	5.6133		(30)
Joists FF	20.0000		20.0000	0.1100	2.2000		(30)
Rafters	13.1700	0.5400	12.6300	0.1100	1.3893		(30)
D Flat	1.4500		1.4500	0.1100	0.1595		(30)
Total net area of external elements Aum(A, m2)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.7945		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.2724 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.0000	0.0900	2.1600
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1600	6.6288
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0800	0.0440
R2 Sill of roof window	0.5500	0.0600	0.0330
R3 Jamb of roof window	1.9600	0.0800	0.1568

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.6678 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 85.4623 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	51.3023	50.9829	50.6698	49.1992	48.9241	47.6432	47.6432	47.4060	48.1366	48.9241	49.4807	50.0626 (38)
Heat transfer coeff	136.7646	136.4452	136.1321	134.6615	134.3864	133.1055	133.1055	132.8683	133.5989	134.3864	134.9430	135.5249 (39)
Average = Sum(39)m / 12 =												134.6602

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2289	1.2260	1.2232	1.2100	1.2075	1.1960	1.1960	1.1939	1.2005	1.2075	1.2125	1.2178 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8224 (42)
Hot water usage for mixer showers												
71.5414	70.4662	68.8996	65.9020	63.6899	61.2230	59.8208	61.3756	63.0800	65.7287	68.7906	71.2673 (42a)	
Hot water usage for baths												
30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839 (42b)	
Hot water usage for other uses												
43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337 (42c)	
Average daily hot water use (litres/day)												134.1732 (43)

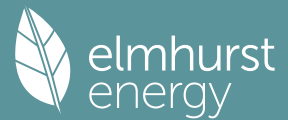
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	145.9634	142.8465	139.0508	133.2791	128.5921	123.5531	121.6168	125.3961	129.3820	134.6719	140.5325	145.5849 (44)
Energy conte	231.1704	203.4115	213.7159	182.4524	173.1096	151.9230	147.0849	155.2666	159.5409	182.7486	200.2144	227.9507 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
34.6756	30.5117	32.0574	27.3679	25.9664	22.7885	22.0627	23.2900	23.9311	27.4123	30.0322	34.1926 (46)	
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)	

If cylinder contains dedicated solar storage												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month												
286.0772	253.0048	268.6227	235.5880	228.0164	205.0586	201.9917	210.1734	212.6765	237.6554	253.3500	282.8575 (62)	
WWHRS	-32.7057	-28.9252	-30.2888	-25.0803	-23.3740	-20.0013	-18.7480	-19.9366	-20.6941	-24.3960	-27.6378	-32.1001 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	253.3714	224.0795	238.3339	210.5077	204.6425	185.0573	183.2437	190.2367	191.9824	213.2593	225.7122	250.7575 (64)
12Total per year (kWh/year)												2571.1842 (64)
Electric shower(s)												2571 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)

Heat gains from water heating, kWh/month												
120.7896	107.3089	114.9860	103.1739	101.4844	93.0229	92.8312	95.5516	95.5558	104.6893	109.0798	119.7191 (65)	

5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	137.9683	152.7507	137.9683	142.5673	137.9683	142.5673	137.9683	137.9683	142.5673	137.9683	142.5673	137.9683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.3965	276.2335	269.0844	253.8647	234.6525	216.5958	204.5329	201.6959	208.8450	224.0647	243.2768	261.3335	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	(71)
Water heating gains (Table 5)	162.3516	159.6859	154.5510	143.2971	136.4037	129.1984	124.7731	128.4295	132.7164	140.7115	151.4997	160.9127	(72)
Total internal gains	642.0517	657.0053	629.9390	608.0643	577.3599	553.6968	532.6096	533.4290	549.4640	571.0798	605.6791	628.5498	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					7.4600	10.6334		0.6300	0.7000	0.7700		24.2428 (74)	
East					3.7400	19.6403		0.6300	0.7000	0.7700		22.4487 (76)	
South					9.6800	46.7521		0.6300	0.7000	0.7700		138.3082 (78)	
West					2.8300	19.6403		0.6300	0.7000	0.7700		16.9866 (80)	
South					0.5400	47.0123		0.6300	0.7000	1.0000		10.0760 (82)	
Solar gains	212.0622	367.9678	520.6101	672.5144	777.4058	782.1528	749.7820	670.1063	573.0787	411.3798	255.2494	180.6634	(83)
Total gains	854.1139	1024.9731	1150.5491	1280.5787	1354.7657	1335.8497	1282.3915	1203.5353	1122.5427	982.4596	860.9284	809.2133	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	20.1789	20.2261	20.2727	20.4940	20.5360	20.7336	20.7336	20.7706	20.6570	20.5360	20.4513	20.3635		
alpha	2.3453	2.3484	2.3515	2.3663	2.3691	2.3822	2.3822	2.3847	2.3771	2.3691	2.3634	2.3576		
util living area	0.9352	0.9034	0.8598	0.7821	0.6743	0.5365	0.4154	0.4526	0.6320	0.8146	0.9074	0.9420	(86)	
MIT	18.1735	18.5791	19.1222	19.7969	20.3552	20.7396	20.8981	20.8719	20.5916	19.8544	18.9046	18.1060	(87)	
Th 2	19.8969	19.8992	19.9015	19.9120	19.9140	19.9232	19.9232	19.9249	19.9196	19.9140	19.9100	19.9058	(88)	
util rest of house	0.9265	0.8908	0.8412	0.7526	0.6284	0.4681	0.3265	0.3630	0.5675	0.7827	0.8931	0.9340	(89)	
MIT 2	16.6202	17.1283	17.8055	18.6355	19.2927	19.7176	19.8649	19.8472	19.5731	18.7261	17.5524	16.5401	(90)	
Living area fraction														
MIT	17.0317	17.5126	18.1543	18.9431	19.5741	19.9883	20.1386	20.1186	19.8429	19.0250	17.9106	16.9549	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.0317	17.5126	18.1543	18.9431	19.5741	19.9883	20.1386	20.1186	19.8429	19.0250	17.9106	16.9549	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.8944	0.8546	0.8042	0.7219	0.6125	0.4725	0.3452	0.3801	0.5625	0.7513	0.8581	0.9036	(94)	
Useful gains	763.9138	875.9365	925.2913	924.4114	829.8374	631.2369	442.6300	457.4353	631.3874	738.0808	738.7354	731.2119	(95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Heat loss rate W	1741.2409	1720.9258	1586.5229	1352.4199	1058.1733	717.2123	471.0019	494.0855	767.2447	1132.2056	1458.8138	1728.6062	(97)	
Space heating kWh	727.1314	567.8328	491.9563	308.1661	169.8819	0.0000	0.0000	0.0000	0.0000	293.2289	518.4565	742.0614	(98a)	
Space heating requirement - total per year (kWh/year)												3818.7152		
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)	
Solar heating contribution - total per year (kWh/year)												0.0000		
Space heating kWh	727.1314	567.8328	491.9563	308.1661	169.8819	0.0000	0.0000	0.0000	0.0000	293.2289	518.4565	742.0614	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												3818.7152		
Space heating per m2										(98c) / (4) =		34.3132	(99)	

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													92.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	727.1314	567.8328	491.9563	308.1661	169.8819	0.0000	0.0000	0.0000	0.0000	293.2289	518.4565	742.0614	(98)	
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)	
Space heating fuel (main heating system)	787.7913	615.2034	532.9971	333.8744	184.0541	0.0000	0.0000	0.0000	0.0000	317.6911	561.7080	803.9668	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	253.3714	224.0795	238.3339	210.5077	204.6425	185.0573	183.2437	190.2367	191.9824	213.2593	225.7122	250.7575	(64)	
Efficiency of water heater												79.8000	(216)	

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(217)m	86.2853	86.0538	85.6476	84.9132	83.6454	79.8000	79.8000	79.8000	79.8000	84.7743	85.8628	86.3405	(217)
Fuel for water heating, kWh/month	293.6438	260.3948	278.2728	247.9092	244.6549	231.9014	229.6287	238.3919	240.5795	251.5613	262.8753	290.4284	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	28.6671	22.9978	20.7070	15.1708	11.7184	9.5740	10.6899	13.8951	18.0484	23.6805	26.7470	29.4638	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-66.2250	-88.8236	-121.5277	-129.8283	-134.4741	-123.5238	-121.8757	-117.5957	-109.4642	-98.0916	-71.1184	-57.7932	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-52.6092	-108.4800	-211.7469	-312.6585	-408.4331	-408.6693	-403.9509	-344.3492	-255.4786	-153.3969	-69.6420	-41.7803	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4137.2862	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3070.2419	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												231.3599	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4011.5363	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3513.3517	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4137.2862	0.2100	868.8301 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3070.2419	0.2100	644.7508 (264)
Space and water heating			1513.5809 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	231.3599	0.1443	33.3924 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1240.3412	0.1357	-168.2922
PV Unit electricity exported	-2771.1952	0.1264	-350.2815
Total			-518.5738 (269)
Total CO2, kg/year			1040.3288 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.3500 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4137.2862	1.1300	4675.1334 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3070.2419	1.1300	3469.3733 (278)
Space and water heating			8144.5068 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	231.3599	1.5338	354.8675 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1240.3412	1.5015	-1862.3954
PV Unit electricity exported	-2771.1952	0.4640	-1285.8356
Total			-3148.2310 (283)
Total Primary energy kWh/year			5481.2441 (286)
Target Primary Energy Rate (TPER)			49.2500 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

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2. Ventilation rate

											m3 per hour					
Number of open chimneys													0 * 80 =	0.0000 (6a)		
Number of open flues													0 * 20 =	0.0000 (6b)		
Number of chimneys / flues attached to closed fire													0 * 10 =	0.0000 (6c)		
Number of flues attached to solid fuel boiler													0 * 20 =	0.0000 (6d)		
Number of flues attached to other heater													0 * 35 =	0.0000 (6e)		
Number of blocked chimneys													0 * 20 =	0.0000 (6f)		
Number of intermittent extract fans													4 * 10 =	40.0000 (7a)		
Number of passive vents													0 * 10 =	0.0000 (7b)		
Number of flueless gas fires													0 * 40 =	0.0000 (7c)		
													Air changes per hour			
Infiltration due to chimneys, flues and fans											= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000	/ (5) =	0.1532 (8)	
Pressure test															Yes	
Pressure Test Method															Blower Door	
Measured/design AP50															5.0000 (17)	
Infiltration rate															0.4032 (18)	
Number of sides sheltered															2 (19)	
Shelter factor													(20) = 1 - [0.075 x (19)] =		0.8500 (20)	
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) =		0.3427 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)			
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)			
	0.4370	0.4284	0.4198	0.3770	0.3684	0.3256	0.3256	0.3170	0.3427	0.3684	0.3856	0.4027	(22b)			
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)															0.0000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =															0.0000 (23c)	
Effective ac	0.5955	0.5918	0.5881	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811	(25)			

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			23.7100	1.1450	27.1489			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight S			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000	(28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800	(29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200	(29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300	(29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700	(30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000	(30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700	(30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500	(30)
Total net area of external elements Aum(A, m2)			297.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3071			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			45.0000			9.0000	405.0000	(32c)
Internal Floor 1			31.0300			18.0000	558.5400	(32d)
Internal Ceiling 1			30.1300			9.0000	271.1700	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9935.1300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.2724	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E16 Corner (normal)				24.0000	0.0900		2.1600	
E10 Eaves (insulation at ceiling level)				41.4300	0.0600		2.4858	
E17 Corner (inverted - internal area greater than external area)				14.4000	-0.0900		-1.2960	
R8 Roof to wall (rafter)				22.5600	0.0600		1.3536	
R6 Flat ceiling				22.5300	0.0600		1.3518	
E13 Gable (insulation at rafter level)				2.6000	0.0800		0.2080	
E2 Other lintels (including other steel lintels)				16.7200	0.0500		0.8360	
E3 Sill				15.7600	0.0500		0.7880	
E4 Jamb				38.3600	0.0500		1.9180	
E5 Ground floor (normal)				41.4300	0.1000		4.1430	
E6 Intermediate floor within a dwelling				26.9200	0.0000		0.0000	
R1 Head of roof window				0.5500	0.0600		0.0330	
R2 Sill of roof window				0.5500	0.0800		0.0440	
R3 Jamb of roof window				1.9600	0.0600		0.1176	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1428	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		81.4499	(37)

8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9215	0.8831	0.8336	0.7495	0.6371	0.4919	0.3605	0.3988	0.5897	0.7848	0.8890	0.9299 (94)
Useful gains	683.4329	807.0536	869.0138	884.3660	801.7917	613.4924	431.5004	445.0678	608.7887	693.9631	671.6931	648.8717 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1750.8708	1722.5379	1579.8100	1337.7016	1040.4044	701.9895	460.5525	483.1127	752.2985	1119.7787	1457.5061	1739.1559 (97)
Space heating kWh	794.1738	615.2055	528.8323	326.4017	177.5278	0.0000	0.0000	0.0000	0.0000	316.8068	565.7854	811.1714 (98a)
Space heating requirement - total per year (kWh/year)												4135.9047
Solar heating kWh												

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Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	794.1738	615.2055	528.8323	326.4017	177.5278	0.0000	0.0000	0.0000	0.0000	316.8068	565.7854	811.1714 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4135.9047
Space heating per m2										(98c) / (4) =		37.1633 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1213.4752	955.2890	979.3050	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7555	0.8156	0.7881	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	916.7446	779.1258	771.8184	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1394.5219	1338.6527	1247.4441	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	343.9996	416.2880	353.8655	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	fc = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	85.9999	104.0720	88.4664	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling requirement												0.0000 (107)
Energy for space heating												278.5383 (107)
Energy for space cooling												37.1633 (99)
Total												2.5028 (108)
Fabric Energy Efficiency (DFEE)												39.6661 (109)
												39.7 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.0700 (5)

2. Ventilation rate

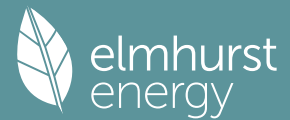
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1532 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4032 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3427 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4370	0.4284	0.4198	0.3770	0.3684	0.3256	0.3256	0.3170	0.3427	0.3684	0.3856	0.4027 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5955	0.5918	0.5881	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.0200	1.0000	2.0200		(26)
TER Opening Type (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Rooflight S			0.5400	1.4151	0.7642		(27a)
Ground Floor			81.1600	0.1300	10.5508		(28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476		(29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284		(29a)
Ashlar	27.0700		27.0700	0.1800	4.8726		(29a)
Joists GF	51.0300		51.0300	0.1100	5.6133		(30)

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Joists FF	20.0000		20.0000	0.1100	2.2000	(30)
Rafters	13.1700	0.5400	12.6300	0.1100	1.3893	(30)
D Flat	1.4500		1.4500	0.1100	0.1595	(30)
Total net area of external elements Aum(A, m2)			297.8100			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.7945	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 89.2724 (35)

List of Thermal Bridges						
K1 Element	Length	Psi-value	Total			
E16 Corner (normal)	24.0000	0.0900	2.1600			
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858			
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960			
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536			
R6 Flat ceiling	22.5300	0.0600	1.3518			
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080			
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360			
E3 Sill	15.7600	0.0500	0.7880			
E4 Jamb	38.3600	0.0500	1.9180			
E5 Ground floor (normal)	41.4300	0.1600	6.6288			
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000			
R1 Head of roof window	0.5500	0.0800	0.0440			
R2 Sill of roof window	0.5500	0.0600	0.0330			
R3 Jamb of roof window	1.9600	0.0800	0.1568			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.6678 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 85.4623 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	51.3023	50.9829	50.6698	49.1992	48.9241	47.6432	47.6432	47.4060	48.1366	48.9241	49.4807	50.0626	(38)
Heat transfer coeff	136.7646	136.4452	136.1321	134.6615	134.3864	133.1055	133.1055	132.8683	133.5989	134.3864	134.9430	135.5249	(39)
Average = Sum(39)m / 12 =												134.6602	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.2289	1.2260	1.2232	1.2100	1.2075	1.1960	1.1960	1.1939	1.2005	1.2075	1.2125	1.2178	(40)
HLP (average)												1.2100	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8224 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths 30.8883 30.4296 29.7836 28.5925 27.7006 26.7117 26.1775 26.8190 27.5174 28.5756 29.7913 30.7839 (42b)

Hot water usage for other uses 43.5337 41.9507 40.3676 38.7846 37.2015 35.6185 35.6185 37.2015 38.7846 40.3676 41.9507 43.5337 (42c)

Average daily hot water use (litres/day) 68.2145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.4220	72.3803	70.1512	67.3771	64.9022	62.3302	61.7960	64.0205	66.3020	68.9433	71.7419	74.3176	(44)
Energy conte	117.8663	103.0685	107.8198	92.2359	87.3708	76.6422	74.7369	79.2708	81.7570	93.5553	102.2095	116.3634	(45)
Energy content (annual)										Total = Sum(45)m =		1132.8965	

Distribution loss (46)m = 0.15 x (45)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (46)

Water storage loss: 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (46)

Total storage loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)

If cylinder contains dedicated solar storage 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)

Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 100.1864 87.6083 91.6469 78.4005 74.2652 65.1459 63.5264 67.3801 69.4934 79.5220 86.8781 98.9089 (62)

WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)

PV diverter 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h 100.1864 87.6083 91.6469 78.4005 74.2652 65.1459 63.5264 67.3801 69.4934 79.5220 86.8781 98.9089 (64)

Total per year (kWh/year) 962.9620 (64)

Electric shower(s) 57.2927 51.0483 55.7428 53.1946 54.1928 51.6947 53.4178 54.1928 53.1946 55.7428 54.6946 57.2927 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 651.7012 (64a)

Heat gains from water heating, kWh/month 39.3698 34.6641 36.8474 32.8988 32.1145 29.2101 29.2360 30.3932 30.6720 33.8162 35.3932 39.0504 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 137.9683 152.7507 137.9683 142.5673 137.9683 142.5673 137.9683 137.9683 142.5673 137.9683 142.5673 137.9683 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 273.3965 276.2335 269.0844 253.8647 234.6525 216.5958 204.5329 201.6959 208.8450 224.0647 243.2768 261.3335 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 (69)

Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5) -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 (71)

Water heating gains (Table 5) 52.9164 51.5835 49.5261 45.6927 43.1646 40.5696 39.2958 40.8511 42.6000 45.4519 49.1572 52.4871 (72)

Total internal gains 529.6165 545.9030 521.9140 507.4600 481.1208 465.0680 447.1322 445.8506 459.3476 472.8202 500.3366 517.1242 (73)

6. Solar gains

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[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.4600	10.6334	0.6300	0.7000	0.7700	24.2428 (74)
East	3.7400	19.6403	0.6300	0.7000	0.7700	22.4487 (76)
South	9.6800	46.7521	0.6300	0.7000	0.7700	138.3082 (78)
West	2.8300	19.6403	0.6300	0.7000	0.7700	16.9866 (80)
South	0.5400	47.0123	0.6300	0.7000	1.0000	10.0760 (82)

Solar gains	212.0622	367.9678	520.6101	672.5144	777.4058	782.1528	749.7820	670.1063	573.0787	411.3798	255.2494	180.6634 (83)
Total gains	741.6787	913.8707	1042.5242	1179.9743	1258.5266	1247.2208	1196.9142	1115.9569	1032.4263	884.2000	755.5859	697.7877 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.1789	20.2261	20.2727	20.4940	20.5360	20.7336	20.7336	20.7706	20.6570	20.5360	20.4513	20.3635
alpha	2.3453	2.3484	2.3515	2.3663	2.3691	2.3822	2.3822	2.3847	2.3771	2.3691	2.3634	2.3576
util living area	0.9506	0.9214	0.8808	0.8060	0.7007	0.5625	0.4393	0.4799	0.6631	0.8421	0.9269	0.9565 (86)
MIT	17.9950	18.4191	18.9868	19.7002	20.2944	20.7106	20.8848	20.8542	20.5438	19.7475	18.7499	17.9248 (87)
Th 2	19.8969	19.8992	19.9015	19.9120	19.9140	19.9232	19.9232	19.9249	19.9196	19.9140	19.9100	19.9058 (88)
util rest of house	0.9436	0.9107	0.8642	0.7783	0.6559	0.4932	0.3470	0.3872	0.5993	0.8132	0.9151	0.9503 (89)
MIT 2	17.1693	17.5858	18.1405	18.8303	19.3800	19.7434	19.8713	19.8551	19.6144	18.8925	17.9245	17.1058 (90)
Living area fraction	17.3880	17.8065	18.3647	19.0608	19.6222	19.9996	20.1397	20.1198	fLA = Living area / (4) =			0.2649 (91)
MIT	17.3880	17.8065	18.3647	19.0608	19.6222	19.9996	20.1397	20.1198	19.8606	19.1189	18.1431	17.3227 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3880	17.8065	18.3647	19.0608	19.6222	19.9996	20.1397	20.1198	19.8606	19.1189	18.1431	17.3227 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9217	0.8840	0.8354	0.7530	0.6425	0.4985	0.3666	0.4051	0.5954	0.7876	0.8898	0.9300 (94)
Useful gains	683.6162	807.8824	870.9398	888.5253	808.5452	621.7687	438.7768	452.0826	614.7380	696.3839	672.2881	648.9631 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1789.9751	1761.0317	1615.1695	1368.2637	1064.6360	718.7149	471.1578	494.2412	769.6058	1144.8306	1490.1921	1778.4554 (97)
Space heating kWh	823.1310	640.5163	553.7069	345.4117	190.5315	0.0000	0.0000	0.0000	0.0000	333.6443	588.8908	840.3422 (98a)
Space heating requirement - total per year (kWh/year)												4316.1748
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	823.1310	640.5163	553.7069	345.4117	190.5315	0.0000	0.0000	0.0000	0.0000	333.6443	588.8908	840.3422 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4316.1748
Space heating per m2										(98c) / (4) =		38.7831 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1251.1920	984.9810	1009.7994	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7415	0.8030	0.7748	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	927.7498	790.9335	782.3631	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1394.5219	1338.6527	1247.4441	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	336.0759	407.5031	346.0203	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	84.0190	101.8758	86.5051	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												272.3998 (107)
Energy for space heating												38.7831 (99)
Energy for space cooling												2.4477 (108)
Total												41.2308 (109)
Fabric Energy Efficiency (TFEE)												41.2 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x	2.4000 (2b) =
First floor	30.1300 (1c)	x	2.2000 (2c) =
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.0700 (5)

Full SAP Calculation Printout



2. Ventilation rate

										m3 per hour	
Number of open chimneys										0 * 80 =	0.0000 (6a)
Number of open flues										0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire										0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler										0 * 20 =	0.0000 (6d)
Number of flues attached to other heater										0 * 35 =	0.0000 (6e)
Number of blocked chimneys										0 * 20 =	0.0000 (6f)
Number of intermittent extract fans										6 * 10 =	60.0000 (7a)
Number of passive vents										0 * 10 =	0.0000 (7b)
Number of flueless gas fires										0 * 40 =	0.0000 (7c)
										Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =									60.0000 / (5) =	0.2298 (8)
Pressure test										Yes	
Pressure Test Method										Blower Door	
Measured/design AP50										5.0000 (17)	
Infiltration rate										0.4798 (18)	
Number of sides sheltered										2 (19)	
Shelter factor										(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =	0.4078 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Effective ac	0.5200	0.5098	0.4996	0.4486	0.4384	0.3875	0.3875	0.3773	0.4078	0.4384	0.4588	0.4792	(22b)
	0.6352	0.6300	0.6248	0.6006	0.5961	0.5751	0.5751	0.5712	0.5832	0.5961	0.6053	0.6148	(25)

3. Heat losses and heat loss parameter

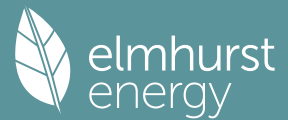
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			23.7100	1.1450	27.1489			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight S			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000	(28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800	(29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200	(29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300	(29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700	(30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000	(30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700	(30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500	(30)
Total net area of external elements Aum(A, m2)			297.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3071			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			45.0000			9.0000	405.0000	(32c)
Internal Floor 1			31.0300			18.0000	558.5400	(32d)
Internal Ceiling 1			30.1300			9.0000	271.1700	(32e)
Heat capacity Cm = Sum(A x k)								(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E16 Corner (normal)				24.0000	0.0900	2.1600		
E10 Eaves (insulation at ceiling level)				41.4300	0.0600	2.4858		
E17 Corner (inverted - internal area greater than external area)				14.4000	-0.0900	-1.2960		
R8 Roof to wall (rafter)				22.5600	0.0600	1.3536		
R6 Flat ceiling				22.5300	0.0600	1.3518		
E13 Gable (insulation at rafter level)				2.6000	0.0800	0.2080		
E2 Other lintels (including other steel lintels)				16.7200	0.0500	0.8360		
E3 Sill				15.7600	0.0500	0.7880		
E4 Jamb				38.3600	0.0500	1.9180		
E5 Ground floor (normal)				41.4300	0.1000	4.1430		
E6 Intermediate floor within a dwelling				26.9200	0.0000	0.0000		
R1 Head of roof window				0.5500	0.0600	0.0330		
R2 Sill of roof window				0.5500	0.0800	0.0440		
R3 Jamb of roof window				1.9600	0.0600	0.1176		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1428	(36)
Point Thermal bridges							(36a) =	0.0000
Total fabric heat loss							(33) + (36) + (36a) =	81.4499 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	54.7248	54.2725	53.8292	51.7467	51.3571	49.5433	49.5433	49.2075	50.2420	51.3571	52.1453	52.9693 (38)
Average = Sum(39)m / 12 =	136.1747	135.7224	135.2790	133.1966	132.8070	130.9932	130.9932	130.6573	131.6918	132.8070	133.5952	134.4192 (39)
												133.1947
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2236	1.2195	1.2156	1.1968	1.1933	1.1770	1.1770	1.1740	1.1833	1.1933	1.2004	1.2078 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

												2.8224 (42)
Hot water usage for mixer showers	89.4267	88.0828	86.1245	82.3775	79.6124	76.5287	74.7760	76.7195	78.8500	82.1609	85.9883	89.0841 (42a)
Hot water usage for baths	30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839 (42b)
Hot water usage for other uses	43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337 (42c)
Average daily hot water use (litres/day)												150.6629 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Energy conte	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017 (44)
Energy content (annual)	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2502.5121
Water storage loss:	38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
WWHRS	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	131.8626	117.1444	125.4432	112.2744	110.2660	100.8818	100.4997	103.5233	103.6229	113.7581	118.8277	130.6494 (65)
Total per year (kWh/year) = Sum(64)m =												
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.5101	29.7633	24.2052	18.3249	13.6981	11.5645	12.4958	16.2425	21.8007	27.6810	32.3078	34.4414 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.0545	412.2888	401.6184	378.9025	350.2277	323.2774	305.2729	301.0386	311.7090	334.4249	363.0998	390.0500 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941 (71)
Water heating gains (Table 5)	177.2347	174.3220	168.6064	155.9367	148.2071	140.1137	135.0803	139.1443	143.9206	152.9007	165.0384	175.6040 (72)
Total internal gains	733.0027	730.5777	708.6335	667.3675	626.3363	586.1590	564.0525	567.6289	588.6338	629.2101	674.6495	714.2989 (73)

6. Solar gains

[Jan]												

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.2663	20.3338	20.4005	20.7194	20.7802	21.0679	21.0679	21.1221	20.9562	20.7802	20.6576	20.5310
alpha	2.3511	2.3556	2.3600	2.3813	2.3853	2.4045	2.4045	2.4081	2.3971	2.3853	2.3772	2.3687
util living area	0.9217	0.8907	0.8436	0.7661	0.6583	0.5226	0.4025	0.4376	0.6151	0.7964	0.8932	0.9295 (86)
MIT	18.3247	18.6958	19.2318	19.8733	20.4005	20.7610	20.9079	20.8848	20.6245	19.9351	19.0265	18.2646 (87)
Th 2	19.9012	19.9044	19.9076	19.9225	19.9253	19.9384	19.9384	19.9408	19.9334	19.9253	19.9197	19.9137 (88)
util rest of house	0.9115	0.8769	0.8236	0.7357	0.6123	0.4557	0.3167	0.3511	0.5511	0.7631	0.8774	0.9202 (89)
MIT 2	16.8107	17.2748	17.9411	18.7308	19.3494	19.7498	19.8856	19.8709	19.6157	18.8261	17.7070	16.7426 (90)
Living area fraction	17.2118	17.6512	18.2830	19.0334	19.6278	20.0177	20.1564	20.1395	19.8829	19.1199	18.0566	17.1458 (91)
MIT	17.2118	17.6512	18.2830	19.0334	19.6278	20.0177	20.1564	20.1395	19.8829	19.1199	18.0566	17.1458 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2118	17.6512	18.2830	19.0334	19.6278	20.0177	20.1564	20.1395	19.8829	19.1199	18.0566	17.1458 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	829.0269	922.7539	967.6392	947.0711	839.9255	630.7819	440.2622	455.6724	636.4220	763.2786	782.7569	794.2687 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1758.2582	1730.6288	1593.9937	1349.7379	1052.8683	709.6815	465.8663	488.5904	761.5631	1131.4964	1463.7427	1740.1641 (97)
Space heating kWh	691.3481	542.8920	466.0078	289.9201	158.4294	0.0000	0.0000	0.0000	0.0000	273.9540	490.3098	703.7462 (98a)

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Space heating requirement - total per year (kWh/year)	3616.6074										
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000										
Space heating kWh	691.3481	542.8920	466.0078	289.9201	158.4294	0.0000	0.0000	0.0000	273.9540	490.3098	703.7462 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3616.6074										
Space heating per m2	(98c) / (4) = 32.4971 (99)										

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	691.3481	542.8920	466.0078	289.9201	158.4294	0.0000	0.0000	0.0000	0.0000	273.9540	490.3098	703.7462 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	276.6499	217.2437	186.4777	116.0145	63.3971	0.0000	0.0000	0.0000	0.0000	109.6255	196.2024	281.6111 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	180.7375	159.8850	169.7116	148.5687	143.6433	129.0008	126.8686	132.0620	133.7087	149.6413	159.8245	178.6537 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1447.2218 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1812.3058 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												236.7193 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3496.2469 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1447.2218	16.4900	238.6469 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1812.3058	16.4900	298.8492 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	236.7193	16.4900	39.0350 (250)
Additional standing charges			0.0000 (251)
Total energy cost			576.5311 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)	
Energy cost factor (ECF)	1.3280 (257)	
SAP value	78.4733	
SAP rating (Section 12)	78 (258)	
SAP band	C	

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12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1447.2218	0.1546	223.7807 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1812.3058	0.1410	255.4851 (264)
Space and water heating			479.2659 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Total CO2, kg/year			513.4318 (272)
CO2 emissions per m2			4.6100 (273)
EI value			95.5979
EI rating			96 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 60.0000 / (5) = 0.2298 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4798 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4078 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3671	0.3365	0.3263	0.3263	0.3365	0.2957	0.3161	0.2855	0.2855	0.3059	0.2855	0.3263 (22b)
Effective ac	0.5674	0.5566	0.5532	0.5532	0.5566	0.5437	0.5500	0.5408	0.5408	0.5468	0.5408	0.5532 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight S			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000 (28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800 (29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200 (29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300 (29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700 (30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700 (30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500 (30)
Total net area of external elements Aum(A, m2)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	67.3071			(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			45.0000			9.0000	405.0000 (32c)
Internal Floor 1			31.0300			18.0000	558.5400 (32d)
Internal Ceiling 1			30.1300			9.0000	271.1700 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				9935.1300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.2724 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				24.0000	0.0900	2.1600	
E10 Eaves (insulation at ceiling level)				41.4300	0.0600	2.4858	
E17 Corner (inverted - internal area greater than external area)				14.4000	-0.0900	-1.2960	

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R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1000	4.1430
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			14.1428 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	81.4499 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.8805	47.9535	47.6624	47.6624	47.9535	46.8429	47.3803	46.5876	46.5876	47.1071	46.5876	47.6624 (38)
Average = Sum(39)m / 12 =	130.3304	129.4034	129.1123	129.1123	129.4034	128.2927	128.8302	128.0375	128.0375	128.5570	128.0375	129.1123 (39)
												128.8555
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1711	1.1628	1.1601	1.1601	1.1628	1.1528	1.1576	1.1505	1.1505	1.1552	1.1505	1.1601 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.1578
												31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8224 (42)
Hot water usage for mixer showers	89.4267	88.0828	86.1245	82.3775	79.6124	76.5287	74.7760	76.7195	78.8500	82.1609	85.9883	89.0841 (42a)
Hot water usage for baths	30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839 (42b)
Hot water usage for other uses	43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337 (42c)
Average daily hot water use (litres/day)												150.6629 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017 (44)
Energy conte	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476 (45)
Energy content (annual)										Total = Sum(45)m =		2502.5121
Distribution loss (46)m = 0.15 x (45)m	38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
								Total per year (kWh/year) = Sum(64)m =				3173.3474 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	131.8626	117.1444	125.4432	112.2744	110.2660	100.8818	100.4997	103.5233	103.6229	113.7581	118.8277	130.6494 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	33.5101	29.7633	24.2052	18.3249	13.6981	11.5645	12.4958	16.2425	21.8007	27.6810	32.3078	34.4414 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	408.0545	412.2888	401.6184	378.9025	350.2277	323.2774	305.2729	301.0386	311.7090	334.4249	363.0998	390.0500 (68)
Pumps, fans	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941 (71)
Total internal gains	177.2347	174.3220	168.6064	155.9367	148.2071	140.1137	135.0803	139.1443	143.9206	152.9007	165.0384	175.6040 (72)
	733.0027	730.5777	708.6335	667.3675	626.3363	586.1590	564.0525	567.6289	588.6338	629.2101	674.6495	714.2989 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	7.4600	13.0723	0.6300	0.7000	0.7700	29.8032 (74)
East	3.7400	24.4329	0.6300	0.7000	0.7700	27.9266 (76)
South	9.6800	54.9219	0.6300	0.7000	0.7700	162.4774 (78)

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West	2.8300	24.4329	0.6300	0.7000	0.7700	21.1316 (80)
South	0.5400	56.7286	0.6300	0.7000	1.0000	12.1584 (82)

Solar gains	253.4971	386.2046	542.7622	728.2836	823.8526	899.6481	844.5132	759.1344	639.9467	460.4906	306.1347	210.5957 (83)
Total gains	986.4998	1116.7823	1251.3957	1395.6511	1450.1889	1485.8071	1408.5658	1326.7633	1228.5805	1089.7008	980.7842	924.8946 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.1751	21.3268	21.3749	21.3749	21.3268	21.5114	21.4217	21.5543	21.5543	21.4672	21.5543	21.3749
alpha	2.4117	2.4218	2.4250	2.4250	2.4218	2.4341	2.4281	2.4370	2.4370	2.4311	2.4370	2.4250
util living area	0.9039	0.8759	0.8180	0.7236	0.5914	0.4244	0.3140	0.3215	0.5384	0.7370	0.8613	0.9140 (86)
MIT	18.7308	18.9968	19.5457	20.1236	20.6033	20.8782	20.9581	20.9577	20.7659	20.2578	19.4449	18.6688 (87)
Th 2	19.9432	19.9499	19.9520	19.9520	19.9499	19.9580	19.9541	19.9598	19.9598	19.9560	19.9598	19.9520 (88)
util rest of house	0.8914	0.8605	0.7952	0.6891	0.5389	0.3538	0.2283	0.2319	0.4684	0.6948	0.8409	0.9026 (89)
MIT 2	17.3441	17.6762	18.3534	19.0456	19.5905	19.8739	19.9354	19.9415	19.7779	19.2250	18.2485	17.2730 (90)
Living area fraction									fLA = Living area / (4) =			0.2649 (91)
MIT	17.7114	18.0260	18.6692	19.3312	19.8588	20.1399	20.2063	20.2107	20.0396	19.4986	18.5654	17.6427 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7114	18.0260	18.6692	19.3312	19.8588	20.1399	20.2063	20.2107	20.0396	19.4986	18.5654	17.6427 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8566	0.8249	0.7621	0.6662	0.5341	0.3666	0.2496	0.2542	0.4741	0.6737	0.8068	0.8690 (94)
Useful gains	845.0635	921.2151	953.7000	929.7246	774.4910	544.6880	351.5552	337.2145	582.4796	734.1706	791.2772	803.7500 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	1630.6176	1620.9125	1467.9084	1243.5001	913.4348	582.4422	361.5407	347.0740	658.0605	989.7052	1327.1645	1606.5072 (97)
Space heating kWh	584.4523	470.1966	382.5710	225.9184	103.3742	0.0000	0.0000	0.0000	0.0000	190.1177	385.8388	597.2514 (98a)
Space heating requirement - total per year (kWh/year)												2939.7205
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	584.4523	470.1966	382.5710	225.9184	103.3742	0.0000	0.0000	0.0000	0.0000	190.1177	385.8388	597.2514 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2939.7205
Space heating per m2										(98c) / (4) =		26.4150 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	584.4523	470.1966	382.5710	225.9184	103.3742	0.0000	0.0000	0.0000	0.0000	190.1177	385.8388	597.2514 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	233.8745	188.1539	153.0897	90.4035	41.3662	0.0000	0.0000	0.0000	0.0000	76.0775	154.3973	238.9961 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	180.7375	159.8850	169.7116	148.5687	143.6433	129.0008	126.8686	132.0620	133.7087	149.6413	159.8245	178.6537 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1176.3587 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1812.3058 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	236.7193 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3225.3838 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1176.3587	26.0600	306.5591 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1812.3058	26.0600	472.2869 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	236.7193	26.0600	61.6890 (250)
Additional standing charges			0.0000 (251)
Total energy cost			840.5350 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1176.3587	0.1553	182.6538 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1812.3058	0.1410	255.4851 (264)
Space and water heating			438.1390 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Total CO2, kg/year			472.3049 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1176.3587	1.5749	1852.5910 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1812.3058	1.5213	2757.0039 (278)
Space and water heating			4609.5949 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	236.7193	1.5338	363.0879 (282)
Total Primary energy kWh/year			4972.6828 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:	C 78
Current environmental impact rating:	A 96

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.0	-£ 102	-49 kg (10.4%)
U Solar photovoltaic panels	+ 5.6	-£ 254	-131 kg (31.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£102	0.44 kg/m²	C 80 A 96
Solar photovoltaic panels	£254	1.18 kg/m²	B 86 A 97
Total Savings	£357	1.62 kg/m²	

Potential energy efficiency rating:	B 86
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£841	£738	£102
Space heating	£307	£328	-£21
Water heating	£472	£349	£123
Lighting	£62	£62	£0
Generated (PV)	-£10	-£254	£254
Total cost of fuels	£841	£484	£356
Total cost of uses	£841	£485	£356
Delivered energy	29 kWh/m²	17 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	3 kg/m²	2 kg/m²

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Primary energy 45 kWh/m² 26 kWh/m² 18 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.2298 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4798 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4078 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5200	0.5098	0.4996	0.4486	0.4384	0.3875	0.3875	0.3773	0.4078	0.4384	0.4588	0.4792 (22b)
Effective ac	0.6352	0.6300	0.6248	0.6006	0.5961	0.5751	0.5751	0.5712	0.5832	0.5961	0.6053	0.6148 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight S			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000 (28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800 (29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200 (29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300 (29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700 (30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700 (30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500 (30)
Total net area of external elements Aum(A, m2)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3071		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			45.0000			9.0000	405.0000 (32c)
Internal Floor 1			31.0300			18.0000	558.5400 (32d)
Internal Ceiling 1			30.1300			9.0000	271.1700 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9935.1300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 89.2724 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.0000	0.0900	2.1600
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1000	4.1430
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.1428 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 81.4499 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	54.7248	54.2725	53.8292	51.7467	51.3571	49.5433	49.5433	49.2075	50.2420	51.3571	52.1453	52.9693 (38)
Average = Sum(39)m / 12 =	136.1747	135.7224	135.2790	133.1966	132.8070	130.9932	130.9932	130.6573	131.6918	132.8070	133.5952	134.4192 (39)
												133.1947

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2236	1.2195	1.2156	1.1968	1.1933	1.1770	1.1770	1.1740	1.1833	1.1933	1.2004	1.2078 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8224 (42)
Hot water usage for mixer showers	89.4267	88.0828	86.1245	82.3775	79.6124	76.5287	74.7760	76.7195	78.8500	82.1609	85.9883	89.0841 (42a)
Hot water usage for baths	30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839 (42b)
Hot water usage for other uses	43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337 (42c)
Average daily hot water use (litres/day)												150.6629 (43)
Daily hot water use	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017 (44)
Energy conte	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476 (45)
Energy content (annual)										Total = Sum(45)m =		2502.5121
Distribution loss (46)m = 0.15 x (45)m	38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	316.4714	279.9586	295.7692	253.3901	238.7251	213.2736	209.1201	219.1441	228.7211	260.6262	279.8527	312.8226 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												643.0091 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												643.0091
Solar input	-0.0000	-16.1781	-59.3926	-82.5498	-109.1021	-100.7843	-100.1538	-86.8676	-59.1534	-28.8275	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	316.4714	263.7805	236.3766	170.8403	129.6230	112.4893	108.9663	132.2765	169.5678	231.7987	279.8527	312.8226 (64)
										Total per year (kWh/year) = Sum(64)m =		2464.8659 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month	131.8626	117.1444	124.3266	106.8715	100.0306	90.7965	90.0782	93.8462	99.3006	112.6415	118.8277	130.6494 (65)

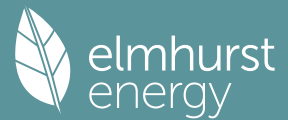
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.5101	29.7633	24.2052	18.3249	13.6981	11.5645	12.4958	16.2425	21.8007	27.6810	32.3078	34.4414 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.0545	412.2888	401.6184	378.9025	350.2277	323.2774	305.2729	301.0386	311.7090	334.4249	363.0998	390.0500 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941 (71)
Water heating gains (Table 5)	177.2347	174.3220	167.1056	148.4327	134.4497	126.1062	121.0728	126.1373	137.9174	151.3999	165.0384	175.6040 (72)
Total internal gains	733.0027	730.5777	707.1327	659.8635	612.5789	572.1515	550.0450	554.6220	582.6306	627.7093	674.6495	714.2989 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.4600	10.6334	0.6300	0.7000	0.7700	24.2428 (74)
East	3.7400	19.6403	0.6300	0.7000	0.7700	22.4487 (76)

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South	9.6800	46.7521	0.6300	0.7000	0.7700	138.3082 (78)
West	2.8300	19.6403	0.6300	0.7000	0.7700	16.9866 (80)
South	0.5400	47.0123	0.6300	0.7000	1.0000	10.0760 (82)

Solar gains	212.0622	367.9678	520.6101	672.5144	777.4058	782.1528	749.7820	670.1063	573.0787	411.3798	255.2494	180.6634 (83)
Total gains	945.0649	1098.5455	1227.7429	1332.3779	1389.9848	1354.3044	1299.8270	1224.7283	1155.7093	1039.0892	929.8988	894.9624 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.2663	20.3338	20.4005	20.7194	20.7802	21.0679	21.0679	21.1221	20.9562	20.7802	20.6576	20.5310
alpha	2.3511	2.3556	2.3600	2.3813	2.3853	2.4045	2.4045	2.4081	2.3971	2.3853	2.3772	2.3687
util living area	0.9217	0.8907	0.8439	0.7679	0.6620	0.5265	0.4062	0.4414	0.6171	0.7969	0.8932	0.9295 (86)
MIT	18.3247	18.6958	19.2301	19.8668	20.3928	20.7570	20.9061	20.8826	20.6217	19.9336	19.0265	18.2646 (87)
Th 2	19.9012	19.9044	19.9076	19.9225	19.9253	19.9384	19.9384	19.9408	19.9334	19.9253	19.9197	19.9137 (88)
util rest of house	0.9115	0.8769	0.8239	0.7376	0.6161	0.4594	0.3198	0.3544	0.5531	0.7636	0.8774	0.9202 (89)
MIT 2	16.8107	17.2748	17.9390	18.7233	19.3413	19.7464	19.8845	19.8695	19.6131	18.8245	17.7070	16.7426 (90)
Living area fraction	17.2118	17.6512	18.2810	19.0262	19.6199	20.0141	20.1551	20.1378	19.8803	19.1183	18.0566	0.2649 (91)
MIT	17.2118	17.6512	18.2810	19.0262	19.6199	20.0141	20.1551	20.1378	19.8803	19.1183	18.0566	17.1458 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2118	17.6512	18.2810	19.0262	19.6199	20.0141	20.1551	20.1378	19.8803	19.1183	18.0566	17.1458 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8772	0.8400	0.7875	0.7086	0.6017	0.4645	0.3382	0.3714	0.5496	0.7339	0.8418	0.8875 (94)
Useful gains	829.0269	922.7539	966.8434	944.0579	836.3653	629.0410	439.5756	454.8325	635.2119	762.6175	782.7569	794.2687 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1758.2582	1730.6288	1593.7275	1348.7786	1051.8135	709.2147	465.6933	488.3763	761.2195	1131.2836	1463.7427	1740.1641 (97)
Space heating kWh	691.3481	542.8920	466.4018	291.3989	160.2934	0.0000	0.0000	0.0000	0.0000	274.2876	490.3098	703.7462 (98a)
Space heating requirement - total per year (kWh/year)												3620.6778
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	691.3481	542.8920	466.4018	291.3989	160.2934	0.0000	0.0000	0.0000	0.0000	274.2876	490.3098	703.7462 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3620.6778
Space heating per m2										(98c) / (4) =		32.5337 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	691.3481	542.8920	466.4018	291.3989	160.2934	0.0000	0.0000	0.0000	0.0000	274.2876	490.3098	703.7462 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	276.6499	217.2437	186.6354	116.6062	64.1430	0.0000	0.0000	0.0000	0.0000	109.7589	196.2024	281.6111 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	316.4714	263.7805	236.3766	170.8403	129.6230	112.4893	108.9663	132.2765	169.5678	231.7987	279.8527	312.8226 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	180.7375	150.6457	134.9952	97.5673	74.0280	64.2429	62.2309	75.5434	96.8405	132.3807	159.8245	178.6537 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.1299	-58.9587	-89.2711	-103.5323	-111.3112	-98.4666	-96.9938	-91.2117	-80.2976	-68.2189	-44.0999	-33.4098 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1448.8506 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1407.6904 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	80.0000 (231)
Electricity for lighting (calculated in Appendix L)	236.7193 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-914.9014 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2258.3590 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1448.8506	16.4900	238.9155 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1407.6904	16.4900	232.1282 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	236.7193	16.4900	39.0350 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-914.9014	16.4900	-150.8672
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-150.8672 (252)
Total energy cost			372.4034 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	0.8578 (257)
SAP value	86.0951
SAP rating (Section 12)	86 (258)
SAP band	B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1448.8506	0.1546	224.0061 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1407.6904	0.1450	204.0916 (264)
Space and water heating			428.0977 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-914.9014	0.1344	-122.9452
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-122.9452 (269)
Total CO2, kg/year			350.4154 (272)
CO2 emissions per m2			3.1500 (273)
EI value			96.9956
EI rating			97 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

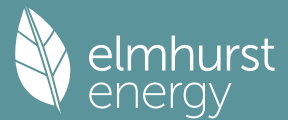
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)

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Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6f)
6 * 10 = 60.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
60.0000 / (5) = 0.2298 (8)
Yes
Blower Door
5.0000 (17)
0.4798 (18)
2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.4078 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate													
Effective ac	0.3671	0.3365	0.3263	0.3263	0.3365	0.2957	0.3161	0.2855	0.2855	0.3059	0.2855	0.3263	(22b)
	0.5674	0.5566	0.5532	0.5532	0.5566	0.5437	0.5500	0.5408	0.5408	0.5468	0.5408	0.5532	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			23.7100	1.1450	27.1489			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight S			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000	(28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800	(29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200	(29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300	(29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700	(30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000	(30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700	(30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500	(30)
Total net area of external elements Aum(A, m2)			297.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3071			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			45.0000			9.0000	405.0000	(32c)
Internal Floor 1			31.0300			18.0000	558.5400	(32d)
Internal Ceiling 1			30.1300			9.0000	271.1700	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 9935.1300 (34)
89.2724 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.0000	0.0900	2.1600
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1000	4.1430
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 81.4499 (37)

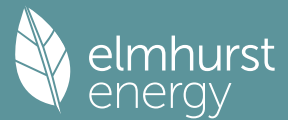
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m
Heat transfer coeff
Average = Sum(39)m / 12 =

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1711	1.1628	1.1601	1.1601	1.1628	1.1528	1.1576	1.1505	1.1505	1.1552	1.1505	1.1601	(40)
HLP (average)												1.1578	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8224 (42)
Hot water usage for mixer showers													
Hot water usage for baths													
Hot water usage for other uses													
Average daily hot water use (litres/day)													150.6629 (43)
Daily hot water use													
Energy conte													
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)

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Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
WWHRS	316.4714	279.9586	295.7692	253.3901	238.7251	213.2736	209.1201	219.1441	228.7211	260.6262	279.8527	312.8226 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Aperture area of solar collector	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Zero-loss collector efficiency												3.0000 (H1)
Collector linear heat loss coefficient												0.8000 (H2)
Collector 2nd order heat loss coefficient												1.8000 (H3)
Collector loop efficiency												0.0000 (H4)
Incidence angle modifier												0.9000 (H5)
Overshading factor												1.0000 (H6)
Overall heat loss coefficient of system												0.8000 (H8)
Heat loss coefficient of collector loop												6.5000 (H10)
Dedicated solar storage volume												3.9667 (H11)
Effective solar volume												75.0000 (H12)
Reference volume												75.0000 (H14)
Storage tank correction coefficient												225.0000 (H15)
Heat delivered to hot water												1.3161 (H16)
Heat delivered to space heating												763.4754 (H24)
Solar input												0.0000 (H29)
Solar input	-1.7811	-20.9077	-66.3852	-94.2285	-118.9341	-119.7484	-116.3206	-103.9739	-72.7236	-40.8984	-7.5739	763.4754
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
	314.6904	259.0509	229.3840	159.1616	119.7910	93.5253	92.7994	115.1702	155.9976	219.7278	272.2788	312.8226 (64)
Electric shower(s)												2344.3996 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month												0.0000 (64a)
	131.8626	117.1444	124.3266	106.8715	100.0306	90.7965	90.0782	93.8462	99.3006	112.6415	118.8277	130.6494 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.5101	29.7633	24.2052	18.3249	13.6981	11.5645	12.4958	16.2425	21.8007	27.6810	32.3078	34.4414	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.0545	412.2888	401.6184	378.9025	350.2277	323.2774	305.2729	301.0386	311.7090	334.4249	363.0998	390.0500	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	(71)
Water heating gains (Table 5)	177.2347	174.3220	167.1056	148.4327	134.4497	126.1062	121.0728	126.1373	137.9174	151.3999	165.0384	175.6040	(72)
Total internal gains	733.0027	730.5777	707.1327	659.8635	612.5789	572.1515	550.0450	554.6220	582.6306	627.7093	674.6495	714.2989	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					7.4600	13.0723	0.6300	0.7000	0.7700		29.8032 (74)	
East					3.7400	24.4329	0.6300	0.7000	0.7700		27.9266 (76)	
South					9.6800	54.9219	0.6300	0.7000	0.7700		162.4774 (78)	
West					2.8300	24.4329	0.6300	0.7000	0.7700		21.1316 (80)	
South					0.5400	56.7286	0.6300	0.7000	1.0000		12.1584 (82)	
Solar gains	253.4971	386.2046	542.7622	728.2836	823.8526	899.6481	844.5132	759.1344	639.9467	460.4906	306.1347	210.5957 (83)
Total gains	986.4998	1116.7823	1249.8949	1388.1471	1436.4315	1471.7996	1394.5583	1313.7563	1222.5773	1088.2000	980.7842	924.8946 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	21.1751	21.3268	21.3749	21.3749	21.3268	21.5114	21.4217	21.5543	21.5543	21.4672	21.5543	21.3749	21.0000 (85)
tau	2.4117	2.4218	2.4250	2.4250	2.4218	2.4341	2.4281	2.4370	2.4370	2.4311	2.4370	2.4250	
util living area	0.9039	0.8759	0.8183	0.7254	0.5950	0.4277	0.3169	0.3243	0.5403	0.7374	0.8613	0.9140	(86)
MIT	18.7308	18.9968	19.5441	20.1180	20.5977	20.8761	20.9573	20.9569	20.7641	20.2566	19.4449	18.6688	(87)
Th 2	19.9432	19.9499	19.9520	19.9520	19.9499	19.9580	19.9541	19.9598	19.9598	19.9560	19.9598	19.9520	(88)
util rest of house	0.8914	0.8605	0.7956	0.6910	0.5426	0.3567	0.2305	0.2341	0.4702	0.6953	0.8409	0.9026	(89)
MIT 2	17.3441	17.6762	18.3515	19.0394	19.5850	19.8724	19.9350	19.9412	19.7763	19.2237	18.2485	17.2730	(90)
Living area fraction	17.7114	18.0260	18.6674	19.3252	19.8533	20.1382	20.2058	20.2102	20.0380	19.4973	18.5654	17.6427	(91)
MIT	17.7114	18.0260	18.6674	19.3252	19.8533	20.1382	20.2058	20.2102	20.0380	19.4973	18.5654	17.6427	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7114	18.0260	18.6674	19.3252	19.8533	20.1382	20.2058	20.2102	20.0380	19.4973	18.5654	17.6427	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8566	0.8249	0.7624	0.6679	0.5374	0.3695	0.2519	0.2565	0.4758	0.6742	0.8068	0.8690	(94)
	845.0635	921.2151	952.9756	927.1755	771.9242	543.8137	351.2807	336.9473	581.6902	733.6476	791.2772	803.7500	(95)

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Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	1630.6176	1620.9125	1467.6760	1242.7252	912.7189	582.2220	361.4734	347.0085	657.8505	989.5463	1327.1645	1606.5072 (97)
Space heating kWh	584.4523	470.1966	382.9371	227.1958	104.7513	0.0000	0.0000	0.0000	0.0000	190.3886	385.8388	597.2514 (98a)
Space heating requirement - total per year (kWh/year)												2943.0119
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	584.4523	470.1966	382.9371	227.1958	104.7513	0.0000	0.0000	0.0000	0.0000	190.3886	385.8388	597.2514 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2943.0119
Space heating per m2												(98c) / (4) = 26.4445 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	584.4523	470.1966	382.9371	227.1958	104.7513	0.0000	0.0000	0.0000	0.0000	190.3886	385.8388	597.2514 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	233.8745	188.1539	153.2361	90.9147	41.9173	0.0000	0.0000	0.0000	0.0000	76.1859	154.3973	238.9961 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	314.6904	259.0509	229.3840	159.1616	119.7910	93.5253	92.7994	115.1702	155.9976	219.7278	272.2788	312.8226 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	179.7204	147.9445	131.0017	90.8975	68.4129	53.4125	52.9980	65.7740	89.0906	125.4870	155.4990	178.6537 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-46.1379	-61.8341	-92.0514	-107.8707	-112.7326	-104.8607	-102.4154	-97.4168	-86.4432	-74.0299	-51.6327	-38.6440 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1177.6758 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1338.8918 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												236.7193 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-976.0697 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												1857.2173 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1177.6758	26.0600	306.9023 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1338.8918	26.0600	348.9152 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	236.7193	26.0600	61.6890 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-976.0697	26.0600	-254.3638
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-254.3638 (252)
Total energy cost			483.9908 (255)

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12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1177.6758	0.1553	182.8368 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1338.8918	0.1458	195.2328 (264)
Space and water heating			378.0696 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-976.0697	0.1346	-131.3758
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-131.3758 (269)
Total CO2, kg/year			291.9568 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1177.6758	1.5748	1854.5852 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1338.8918	1.5394	2061.0875 (278)
Space and water heating			3915.6727 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	236.7193	1.5338	363.0879 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-976.0697	1.4974	-1461.6130
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1461.6130 (283)
Total Primary energy kWh/year			2938.1716 (286)

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Property Reference	FURNERS LANE 6				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 6, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	3.90	TER	8.53	
Environmental	96 A	% DER < TER				54.28
CO ₂ Emissions (t/year)	0.61	DFEE	40.95	TFEE	41.03	
Compliance Check	See BREL	% DFEE < TFEE				0.21
% DPER < TPER	9.20	DPER	40.67	TPER	44.79	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880 (1b) - (3b)
First floor	83.2900 (1c)	x 2.7000 (2c)	= 224.8830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.1710 (5)

2. Ventilation rate

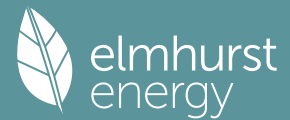
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1576 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4076 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3465 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4417	0.4331	0.4244	0.3811	0.3724	0.3291	0.3291	0.3205	0.3465	0.3724	0.3898	0.4071 (22b)
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			45.1200	1.1450	51.6641		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Rooflight S			0.7600	1.1450	0.8702		(27a)
Ground Floor			91.3700	0.1100	10.0507	75.0000	6852.7500 (28a)
Brick	209.4400	47.0700	162.3700	0.1800	29.2266	9.0000	1461.3300 (29a)
Ashlar	5.9400		5.9400	0.1800	1.0692	9.0000	53.4600 (29a)
Joists FF	77.7400		77.7400	0.1100	8.5514	9.0000	699.6600 (30)
Rafters	6.4400	0.7600	5.6800	0.1300	0.7384	9.0000	51.1200 (30)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400 (30)
GF Flat	1.0600		1.0600	0.1300	0.1378	9.0000	9.5400 (30)
Total net area of external elements Aum(A, m ²)			398.5500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	104.9801		(33)
GF			120.0000			9.0000	1080.0000 (32c)
FF			140.0000			9.0000	1260.0000 (32c)
Internal Floor 1			82.3900			18.0000	1483.0200 (32d)
Internal Ceiling 1			83.2900			9.0000	749.6100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13759.5300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							78.7789 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	13.1600	0.0600	0.7896
E12 Gable (insulation at ceiling level)	29.4300	0.0600	1.7658
E10 Eaves (insulation at ceiling level)	45.3000	0.0900	4.0770
E16 Corner (normal)	24.9000	-0.0900	-2.2410
E17 Corner (inverted - internal area greater than external area)	4.9500	0.0600	0.2970
R6 Flat ceiling	4.9500	0.0800	0.3960
R8 Roof to wall (rafter)	28.9300	0.0500	1.4465
E2 Other lintels (including other steel lintels)	28.0000	0.0500	1.4000
E3 Sill	60.5400	0.0500	3.0270
E4 Jamb	44.9200	0.1500	6.7380
E5 Ground floor (normal)	42.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	0.7800	0.0600	0.0468
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	1.9600	0.0600	0.1176
R3 Jamb of roof window	2.9200	0.0400	0.1168
E14 Flat roof			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			18.0395 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	123.0196 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	87.5888	87.0335	86.4892	83.9326	83.4542	81.2275	81.2275	80.8151	82.0852	83.4542	84.4219	85.4336	(38)
Heat transfer coeff	210.6084	210.0531	209.5087	206.9521	206.4738	204.2470	204.2470	203.8347	205.1048	206.4738	207.4415	208.4531	(39)
Average = Sum(39)m / 12 =												206.9498	
HLP	1.2058	1.2026	1.1995	1.1849	1.1821	1.1694	1.1694	1.1670	1.1743	1.1821	1.1877	1.1935	(40)
HLP (average)												1.1849	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

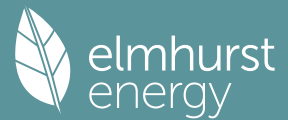
Assumed occupancy													2.9688 (42)
Hot water usage for mixer showers													
92.4956	91.1055	89.0800	85.2045	82.3444	79.1550	77.3421	79.3523	81.5558	84.9804	88.9391	92.1412	(42a)	
Hot water usage for baths													
31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361	(42b)	
Hot water usage for other uses													
45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332	(42c)	
Average daily hot water use (litres/day)												155.8343	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	169.4729	165.9709	161.6397	154.8948	149.4748	143.6250	141.2597	145.5709	150.1343	156.2908	163.1443	169.0105	(44)
Energy content (annual)	268.4037	236.3403	248.4342	212.0432	201.2219	176.6037	170.8413	180.2471	185.1306	212.0852	232.4290	264.6296	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2588.4099	
40.2605	35.4510	37.2651	31.8065	30.1833	26.4906	25.6262	27.0371	27.7696	31.8128	34.8644	39.6944	(46)	
Water storage loss:													
Store volume												300.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7368	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.2281	(55)
Total storage loss													
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)	
If cylinder contains dedicated solar storage													
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3310.5470	(64)
Electric shower(s)												3311	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
138.3100	122.9006	131.6701	117.9874	115.9720	106.2037	105.8705	108.9979	109.0389	119.5841	124.7656	137.0551	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.6549	193.3679	174.6549	180.4767	174.6549	180.4767	174.6549	174.6549	180.4767	174.6549	180.4767	174.6549	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.2728	349.8660	340.8112	321.5346	297.2013	274.3314	259.0530	255.4597	264.5145	283.7912	308.1245	330.9943	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	(71)
Water heating gains (Table 5)	185.9005	182.8878	176.9760	163.8713	155.8764	147.5052	142.2991	146.5026	151.4429	160.7313	173.2856	184.2138	(72)
Total internal gains	777.3598	796.6534	762.9737	736.4142	698.2642	669.8449	643.5385	644.1488	663.9658	689.7090	732.4184	760.3947	(73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North	8.2200				10.6334	0.6300	0.7000	0.7700	26.7126 (74)			
East	13.3500				19.6403	0.6300	0.7000	0.7700	80.1310 (76)			
South	6.3000				46.7521	0.6300	0.7000	0.7700	90.0146 (78)			
West	17.2500				19.6403	0.6300	0.7000	0.7700	103.5400 (80)			
South	0.7600				45.6416	0.6300	0.7000	1.0000	13.7675 (82)			
Solar gains	314.1657	582.6038	903.1594	1263.9933	1524.3540	1554.7573	1482.1787	1285.7933	1029.9855	674.4231	385.4278	262.6896 (83)
Total gains	1091.5255	1379.2572	1666.1330	2000.4075	2222.6181	2224.6022	2125.7173	1929.9421	1693.9513	1364.1321	1117.8462	1023.0843 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.1479	18.1958	18.2431	18.4685	18.5113	18.7131	18.7131	18.7509	18.6348	18.5113	18.4249	18.3355
alpha	2.2099	2.2131	2.2162	2.2312	2.2341	2.2475	2.2475	2.2501	2.2423	2.2341	2.2283	2.2224
util living area	0.9468	0.9138	0.8605	0.7638	0.6390	0.4984	0.3852	0.4314	0.6275	0.8280	0.9222	0.9532 (86)
MIT	17.7479	18.2188	18.8944	19.7114	20.3392	20.7364	20.8940	20.8603	20.5330	19.6549	18.5572	17.6755 (87)
Th 2	19.9153	19.9179	19.9204	19.9321	19.9343	19.9446	19.9446	19.9465	19.9406	19.9343	19.9299	19.9252 (88)
util rest of house	0.9399	0.9030	0.8431	0.7348	0.5945	0.4347	0.3039	0.3478	0.5661	0.7994	0.9106	0.9470 (89)
MIT 2	16.1191	16.7109	17.5538	18.5559	19.2924	19.7324	19.8814	19.8582	19.5344	18.5166	17.1519	16.0316 (90)
Living area fraction	16.3355	16.9113	17.7319	18.7095	19.4315	19.8658	20.0160	19.9914	fLA = Living area / (4) =	18.6679	17.3387	0.1329 (91)
MIT	16.3355	16.9113	17.7319	18.7095	19.4315	19.8658	20.0160	19.9914	19.6671	18.6679	17.3387	16.2500 (92)
Temperature adjustment	16.3355	16.9113	17.7319	18.7095	19.4315	19.8658	20.0160	19.9914	19.6671	18.6679	17.3387	0.0000
adjusted MIT	16.3355	16.9113	17.7319	18.7095	19.4315	19.8658	20.0160	19.9914	19.6671	18.6679	17.3387	16.2500 (93)
8. Space heating requirement												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9052	0.8609	0.7974	0.6956	0.5712	0.4296	0.3097	0.3515	0.5483	0.7565	0.8703	0.9148 (94)
Useful gains	988.0324	1187.3986	1328.6313	1391.4631	1269.5671	955.7458	658.3236	678.4562	928.8695	1031.9507	972.9157	935.8766 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2534.7824	2523.0045	2353.1851	2030.0868	1596.3502	1075.5269	697.7035	732.0538	1141.8310	1665.8045	2123.9240	2511.8703 (97)
Space heating kWh	1150.7820	897.5272	762.2680	459.8090	243.1266	0.0000	0.0000	0.0000	0.0000	471.5873	828.7260	1172.5393 (98a)
Space heating requirement - total per year (kWh/year)												5986.3654
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1150.7820	897.5272	762.2680	459.8090	243.1266	0.0000	0.0000	0.0000	0.0000	471.5873	828.7260	1172.5393 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5986.3654
Space heating per m2										(98c) / (4) =		34.2744 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1150.7820	897.5272	762.2680	459.8090	243.1266	0.0000	0.0000	0.0000	0.0000	471.5873	828.7260	1172.5393 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	460.4970	359.1545	305.0292	183.9972	97.2896	0.0000	0.0000	0.0000	0.0000	188.7104	331.6230	469.2034 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	188.3129	166.6117	176.9083	154.9954	149.9452	134.7558	132.5948	137.9665	139.6256	156.1493	166.6378	186.1575 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	37.1305	29.7874	26.8203	19.6497	15.1780	12.4005	13.8459	17.9974	23.3768	30.6717	34.6436	38.1624 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

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Annual totals kWh/year		
Space heating fuel - main system 1	2395.5044	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	175.1000	
Water heating fuel used	1890.6608	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	299.6642	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4585.8293	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2395.5044	0.1547	370.5689	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1890.6608	0.1410	266.4945	(264)
Space and water heating			637.0634	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	299.6642	0.1443	43.2508	(268)
Total CO2, kg/year			680.3142	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2395.5044	1.5727	3767.4119	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1890.6608	1.5212	2876.0661	(278)
Space and water heating			6643.4780	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	299.6642	1.5338	459.6350	(282)
Total Primary energy kWh/year			7103.1130	(286)
Dwelling Primary energy Rate (DPER)			40.6700	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880	(1b) - (3b)
First floor	83.2900 (1c)	x 2.7000 (2c)	= 224.8830	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.1710	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0901 (8)
Pressure Test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3401	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2890 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Adj infilt rate												

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Effective ac	0.3685	0.3613	0.3541	0.3180	0.3107	0.2746	0.2746	0.2674	0.2890	0.3107	0.3252	0.3396 (22b)
	0.5679	0.5653	0.5627	0.5505	0.5483	0.5377	0.5377	0.5357	0.5418	0.5483	0.5529	0.5577 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			41.0400	1.1450	46.9924		(27)
Rooflight S			0.6900	1.5038	1.0376		(27a)
Ground Floor			91.3700	0.1300	11.8781		(28a)
Brick	209.4400	42.9900	166.4500	0.1800	29.9610		(29a)
Ashlar	5.9400		5.9400	0.1800	1.0692		(29a)
Joists FF	77.7400		77.7400	0.1100	8.5514		(30)
Rafters	6.4400	0.6900	5.7500	0.1100	0.6325		(30)
GF Joists	6.5600		6.5600	0.1100	0.7216		(30)
GF Flat	1.0600		1.0600	0.1100	0.1166		(30)
Total net area of external elements Aum(A, m2)			398.5500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 102.9104		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

78.7789 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	13.1600	0.0600	0.7896
E10 Eaves (insulation at ceiling level)	29.4300	0.0600	1.7658
E16 Corner (normal)	45.3000	0.0900	4.0770
E17 Corner (inverted - internal area greater than external area)	24.9000	-0.0900	-2.2410
R6 Flat ceiling	4.9500	0.0600	0.2970
R8 Roof to wall (rafter)	4.9500	0.0600	0.2970
E2 Other lintels (including other steel lintels)	28.9300	0.0500	1.4465
E3 Sill	28.0000	0.0500	1.4000
E4 Jamb	60.5400	0.0500	3.0270
E5 Ground floor (normal)	44.9200	0.1600	7.1872
E6 Intermediate floor within a dwelling	42.5800	0.0000	0.0000
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.9600	0.0800	0.1568
E14 Flat roof	2.9200	0.0800	0.2336

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

18.5457 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 121.4561 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
83.2421	82.8556	82.4767	80.6972	80.3642	78.8143	78.8143	78.5273	79.4113	80.3642	81.0378	81.7419	(38)
Heat transfer coeff	204.6981	204.3116	203.9328	202.1532	201.8203	200.2704	200.2704	199.9834	200.8674	201.8203	202.4938	203.1980 (39)
Average = Sum(39)m / 12 =												202.1516

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.1720	1.1698	1.1676	1.1574	1.1555	1.1466	1.1466	1.1450	1.1500	1.1555	1.1594	1.1634	(40)
HLP (average)												1.1574
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9688 (42)
Hot water usage for mixer showers												
73.9965	72.8844	71.2640	68.1636	65.8756	63.3240	61.8737	63.4818	65.2447	67.9843	71.1513	73.7129	(42a)
Hot water usage for baths												
31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361	(42b)
Hot water usage for other uses												
45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332	(42c)
Average daily hot water use (litres/day)												138.7788 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
150.9738	147.7498	143.8237	137.8539	133.0059	127.7940	125.7913	129.7004	133.8232	139.2947	145.3565	150.5823	(44)
Energy conte	239.1056	210.3937	221.0517	188.7151	179.0516	157.1377	152.1336	160.5962	165.0173	189.0217	207.0870	235.7755 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
35.8658	31.5591	33.1577	28.3073	26.8577	23.5706	22.8200	24.0894	24.7526	28.3532	31.0630	35.3663	(46)

Water storage loss:

Store volume

300.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):

2.1127 (48)

Temperature factor from Table 2b

0.5400 (49)

Enter (49) or (54) in (55)

1.1409 (55)

Total storage loss

35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)

If cylinder contains dedicated solar storage

35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)

Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

297.7344	263.3488	279.6805	245.4527	237.6804	213.8752	210.7624	219.2250	221.7549	247.6505	263.8245	294.4043	(62)

WWHRS	-33.8281	-29.9178	-31.3282	-25.9410	-24.1761	-20.6877	-19.3914	-20.6208	-21.4042	-25.2332	-28.5862	-33.2016 (63a)

PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)

FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

263.9063	233.4309	248.3522	219.5116	213.5043	193.1876	191.3711	198.6042	200.3507	222.4172	235.2383	261.2026	(64)

Total per year (kWh/year) = Sum(64)m = 2681.0771 (64)

12Total per year (kWh/year)

2681 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

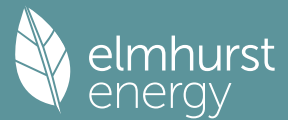
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

126.4057	112.3200	120.4027	108.1378	106.4377	97.6383	97.4875	100.3013	100.2583	109.7528	114.2465	125.2984	(65)

5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.6549	193.3679	174.6549	180.4767	174.6549	180.4767	174.6549	174.6549	180.4767	174.6549	180.4767	174.6549	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.2728	349.8660	340.8112	321.5346	297.2013	274.3314	259.0530	255.4597	264.5145	283.7912	308.1245	330.9943	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	(71)
Water heating gains (Table 5)	169.9001	167.1428	161.8316	150.1914	143.0614	135.6088	131.0316	134.8136	139.2477	147.5171	158.6757	168.4118	(72)
Total internal gains	761.3594	780.9084	747.8293	722.7343	685.4492	657.9485	632.2710	632.4598	651.7705	676.4948	717.8085	744.5927	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					7.4800	10.6334	0.6300	0.7000			0.7700			24.3078 (74)
East					12.1400	19.6403	0.6300	0.7000			0.7700			72.8682 (76)
South					5.7300	46.7521	0.6300	0.7000			0.7700			81.8705 (78)
West					15.6900	19.6403	0.6300	0.7000			0.7700			94.1764 (80)
South					0.6900	45.6416	0.6300	0.7000			1.0000			12.4994 (82)
Solar gains	285.7222	529.8579	821.3964	1149.5741	1386.3774	1414.0340	1348.0225	1169.4047	936.7440	613.3653	350.5326	238.9066	(83)	
Total gains	1047.0816	1310.7662	1569.2257	1872.3084	2071.8266	2071.9826	1980.2935	1801.8645	1588.5145	1289.8601	1068.3411	983.4993	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
tau	18.6718	18.7072	18.7419	18.9069	18.9381	19.0847	19.0847	19.1120	19.0279	18.9381	18.8751	18.8097		
alpha	2.2448	2.2471	2.2495	2.2605	2.2625	2.2723	2.2723	2.2741	2.2685	2.2625	2.2583	2.2540		
util living area	0.9502	0.9199	0.8706	0.7796	0.6586	0.5186	0.4028	0.4496	0.6455	0.8390	0.9273	0.9562	(86)	
MIT	17.7845	18.2330	18.8857	19.6838	20.3156	20.7224	20.8880	20.8528	20.5175	19.6422	18.5679	17.7072	(87)	
Th 2	19.9425	19.9443	19.9460	19.9542	19.9558	19.9629	19.9629	19.9643	19.9602	19.9558	19.9526	19.9494	(88)	
util rest of house	0.9438	0.9098	0.8544	0.7520	0.6152	0.4549	0.3202	0.3651	0.5853	0.8120	0.9165	0.9505	(89)	
MIT 2	16.1763	16.7411	17.5576	18.5394	19.2850	19.7368	19.8951	19.8698	19.5357	18.5155	17.1764	16.0816	(90)	
Living area fraction	16.3900	16.9393	17.7341	18.6915	19.4219	19.8678	20.0270	20.0004	19.6661	18.6653	17.3613	16.2976	(92)	
MIT	16.3900	16.9393	17.7341	18.6915	19.4219	19.8678	20.0270	20.0004	19.6661	18.6653	17.3613	16.2976	(92)	
Temperature adjustment												0.0000		
adjusted MIT	16.3900	16.9393	17.7341	18.6915	19.4219	19.8678	20.0270	20.0004	19.6661	18.6653	17.3613	16.2976	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9109	0.8696	0.8099	0.7123	0.5905	0.4486	0.3255	0.3683	0.5662	0.7695	0.8779	0.9198	(94)	
Useful gains	953.7518	1139.8080	1270.9628	1333.7126	1223.3249	929.4907	644.6624	663.5388	899.4058	992.4978	937.8577	904.6597	(95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Heat loss rate W	2474.8011	2459.7782	2291.0069	1979.3785	1558.4457	1054.9777	686.3278	720.0235	1118.0516	1627.7320	2077.8445	2458.2167	(97)	
Space heating kWh	1131.6606	887.0200	758.9128	464.8794	249.3299	0.0000	0.0000	0.0000	0.0000	472.6143	820.7905	1155.8464	(98a)	
Space heating requirement - total per year (kWh/year)												5941.0539		
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)	
Solar heating contribution - total per year (kWh/year)												0.0000		
Space heating kWh	1131.6606	887.0200	758.9128	464.8794	249.3299	0.0000	0.0000	0.0000	0.0000	472.6143	820.7905	1155.8464	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												5941.0539		
Space heating per m2												34.0150	(99)	

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													92.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	1131.6606	887.0200	758.9128	464.8794	249.3299	0.0000	0.0000	0.0000	0.0000	472.6143	820.7905	1155.8464	(98)	
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)	
Space heating fuel (main heating system)	1226.0679	961.0184	822.2240	503.6614	270.1299	0.0000	0.0000	0.0000	0.0000	512.0414	889.2638	1252.2712	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	263.9063	233.4309	248.3522	219.5116	213.5043	193.1876	191.3711	198.6042	200.3507	222.4172	235.2383	261.2026	(64)	
Efficiency of water heater												79.8000	(216)	

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(217)m	86.9457	86.7614	86.3975	85.6999	84.4086	79.8000	79.8000	79.8000	79.8000	85.7067	86.6237	86.9915	(217)
Fuel for water heating, kWh/month	303.5301	269.0493	287.4531	256.1399	252.9415	242.0897	239.8134	248.8775	251.0660	259.5096	271.5633	300.2621	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	36.2898	29.1131	26.2131	19.2048	14.8344	12.1198	13.5324	17.5899	22.8476	29.9772	33.8592	37.2984	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-76.8315	-104.1866	-144.0630	-155.5295	-162.3330	-149.4522	-147.3730	-141.5471	-130.7761	-115.7544	-82.8829	-66.8999	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-56.9521	-117.9380	-231.1379	-342.6225	-448.8725	-449.6913	-444.6030	-378.5109	-280.0768	-167.3716	-75.5853	-45.2001	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												6436.6781	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3182.2955	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												292.8797	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4516.1912	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5481.6622	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6436.6781	0.2100	1351.7024 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3182.2955	0.2100	668.2820 (264)
Space and water heating			2019.9845 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	292.8797	0.1443	42.2716 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1477.6292	0.1355	-200.1669
PV Unit electricity exported	-3038.5620	0.1263	-383.7021
Total			-583.8690 (269)
Total CO2, kg/year			1490.3163 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.5300 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	6436.6781	1.1300	7273.4463 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3182.2955	1.1300	3595.9939 (278)
Space and water heating			10869.4402 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	292.8797	1.5338	449.2287 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1477.6292	1.5007	-2217.4842
PV Unit electricity exported	-3038.5620	0.4635	-1408.5001
Total			-3625.9843 (283)
Total Primary energy kWh/year			7822.7854 (286)
Target Primary Energy Rate (TPER)			44.7900 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880 (1b) - (3b)
First floor	83.2900 (1c)	x 2.7000 (2c)	= 224.8830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.1710 (5)

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2. Ventilation rate

											m3 per hour		
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
													Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.0901 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000 (17)	
Infiltration rate												0.3401 (18)	
Number of sides sheltered												2 (19)	
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.2890 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
Adj infilt rate	0.3685	0.3613	0.3541	0.3180	0.3107	0.2746	0.2746	0.2674	0.2890	0.3107	0.3252	0.3396 (22b)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5679	0.5653	0.5627	0.5505	0.5483	0.5377	0.5377	0.5357	0.5418	0.5483	0.5529	0.5577 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			45.1200	1.1450	51.6641			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Rooflight S			0.7600	1.1450	0.8702			(27a)
Ground Floor			91.3700	0.1100	10.0507	75.0000	6852.7500	(28a)
Brick	209.4400	47.0700	162.3700	0.1800	29.2266	9.0000	1461.3300	(29a)
Ashlar	5.9400		5.9400	0.1800	1.0692	9.0000	53.4600	(29a)
Joists FF	77.7400		77.7400	0.1100	8.5514	9.0000	699.6600	(30)
Rafters	6.4400	0.7600	5.6800	0.1300	0.7384	9.0000	51.1200	(30)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
GF Flat	1.0600		1.0600	0.1300	0.1378	9.0000	9.5400	(30)
Total net area of external elements Aum(A, m2)			398.5500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	104.9801				(33)
GF			120.0000			9.0000	1080.0000	(32c)
FF			140.0000			9.0000	1260.0000	(32c)
Internal Floor 1			82.3900			18.0000	1483.0200	(32d)
Internal Ceiling 1			83.2900			9.0000	749.6100	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		13759.5300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							78.7789	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E12 Gable (insulation at ceiling level)				13.1600	0.0600		0.7896	
E10 Eaves (insulation at ceiling level)				29.4300	0.0600		1.7658	
E16 Corner (normal)				45.3000	0.0900		4.0770	
E17 Corner (inverted - internal area greater than external area)				24.9000	-0.0900		-2.2410	
R6 Flat ceiling				4.9500	0.0600		0.2970	
R8 Roof to wall (rafter)				4.9500	0.0800		0.3960	
E2 Other lintels (including other steel lintels)				28.9300	0.0500		1.4465	
E3 Sill				28.0000	0.0500		1.4000	
E4 Jamb				60.5400	0.0500		3.0270	
E5 Ground floor (normal)				44.9200	0.1500		6.7380	
E6 Intermediate floor within a dwelling				42.5800	0.0000		0.0000	
R1 Head of roof window				0.7800	0.0600		0.0468	
R2 Sill of roof window				0.7800	0.0800		0.0624	
R3 Jamb of roof window				1.9600	0.0600		0.1176	
E14 Flat roof				2.9200	0.0400		0.1168	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.0395	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		123.0196	(37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9688 (42)
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
	31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361 (42b)
Hot water usage for other uses												
	45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332 (42c)
Average daily hot water use (litres/day)												70.5565 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.9773	74.8654	72.5597	69.6903	67.1304	64.4701	63.9176	66.2186	68.5785	71.3104	74.2052	76.8693	(44)
Energy conte	121.9133	106.6073	111.5216	95.4026	90.3704	79.2735	77.3028	81.9924	84.5641	96.7676	105.7189	120.3588	(45)
Energy content (annual)	Total = Sum(45)m = 1171.7932												
Distribution loss	(46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
WWHRS	103.6263	90.6162	94.7933	81.0922	76.8148	67.3824	65.7074	69.6936	71.8795	82.2525	89.8611	102.3050	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.6263	90.6162	94.7933	81.0922	76.8148	67.3824	65.7074	69.6936	71.8795	82.2525	89.8611	102.3050	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 996 (64)												
Electric shower(s)	59.2588	52.8001	57.6557	55.0201	56.0525	53.4687	55.2510	56.0525	55.0201	57.6557	56.5715	59.2588	(64a)
Heat gains from water heating, kWh/month	40.7213	35.8541	38.1123	34.0281	33.2168	30.2128	30.2396	31.4365	31.7249	34.9770	36.6082	40.3910	(65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	674.0657 (64a)												

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.6549	193.3679	174.6549	180.4767	174.6549	180.4767	174.6549	174.6549	180.4767	174.6549	180.4767	174.6549	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.2728	349.8660	340.8112	321.5346	297.2013	274.3314	259.0530	255.4597	264.5145	283.7912	308.1245	330.9943	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	(71)
Water heating gains (Table 5)	54.7329	53.3543	51.2261	47.2612	44.6463	41.9622	40.6446	42.2534	44.0624	47.0121	50.8447	54.2889	(72)
Total internal gains	643.1922	664.1198	634.2239	616.8041	584.0341	564.3019	541.8841	539.8996	556.5852	572.9898	606.9775	627.4698	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North					8.2200	10.6334	0.6300	0.7000	0.7700	26.7126 (74)				
East					13.3500	19.6403	0.6300	0.7000	0.7700	80.1310 (76)				
South					6.3000	46.7521	0.6300	0.7000	0.7700	90.0146 (78)				
West					17.2500	19.6403	0.6300	0.7000	0.7700	103.5400 (80)				
South					0.7600	45.6416	0.6300	0.7000	1.0000	13.7675 (82)				
Solar gains	314.1657	582.6038	903.1594	1263.9933	1524.3540	1554.7573	1482.1787	1285.7933	1029.9855	674.4231	385.4278	262.6896	(83)	
Total gains	957.3579	1246.7236	1537.3832	1880.7974	2108.3881	2119.0593	2024.0628	1825.6930	1586.5707	1247.4129	992.4052	890.1594	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.5303	18.5651	18.5993	18.7618	18.7925	18.9368	18.9368	18.9638	18.8810	18.7925	18.7305	18.6661
alpha	2.2354	2.2377	2.2400	2.2508	2.2528	2.2625	2.2625	2.2643	2.2587	2.2528	2.2487	2.2444
util living area	0.9581	0.9270	0.8755	0.7796	0.6542	0.5126	0.3978	0.4473	0.6479	0.8478	0.9366	0.9639 (86)
MIT	17.6585	18.1431	18.8362	19.6720	20.3185	20.7257	20.8892	20.8524	20.5082	19.5926	18.4663	17.5747 (87)
Th 2	19.9353	19.9371	19.9388	19.9470	19.9485	19.9557	19.9557	19.9570	19.9529	19.9485	19.9454	19.9422 (88)
util rest of house	0.9525	0.9176	0.8596	0.7518	0.6105	0.4488	0.3154	0.3625	0.5875	0.8217	0.9269	0.9591 (89)
MIT 2	16.8771	17.3544	18.0315	18.8348	19.4289	19.7822	19.9037	19.8835	19.6159	18.7823	17.6849	16.7985 (90)
Living area fraction	16.9809	17.4592	18.1384	18.9460	19.5471	19.9076	20.0346	20.0122	19.7345	18.8900	17.7887	16.9017 (91)
MIT	16.9809	17.4592	18.1384	18.9460	19.5471	19.9076	20.0346	20.0122	19.7345	18.8900	17.7887	16.9017 (92)
Temperature adjustment	16.9809	17.4592	18.1384	18.9460	19.5471	19.9076	20.0346	20.0122	19.7345	18.8900	17.7887	16.9017 (93)
adjusted MIT	16.9809	17.4592	18.1384	18.9460	19.5471	19.9076	20.0346	20.0122	19.7345	18.8900	17.7887	16.9017 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9303	0.8882	0.8256	0.7211	0.5920	0.4457	0.3219	0.3673	0.5734	0.7888	0.8995	0.9388	(94)
Useful gains	890.5891	1107.3869	1269.2507	1356.1816	1248.2696	944.3593	651.6062	670.5834	909.6776	983.9361	892.6204	835.7039	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2615.5862	2585.6209	2391.6515	2046.5431	1595.9739	1071.2441	693.2282	728.0324	1140.5888	1686.0437	2181.1064	2600.8166	(97)
Space heating kWh	1283.3979	993.3732	835.0662	497.0603	258.6920	0.0000	0.0000	0.0000	0.0000	522.3681	927.7099	1313.2439	(98a)
Space heating requirement - total per year (kWh/year)	6630.9114												
Solar heating kWh													

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Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	1283.3979	993.3732	835.0662	497.0603	258.6920	0.0000	0.0000	0.0000	0.0000	522.3681	927.7099	1313.2439 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6630.9114
Space heating per m2										(98c) / (4) =		37.9647 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1897.2383	1493.5706	1531.7560	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7688	0.8232	0.7877	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1458.6417	1229.5574	1206.6256	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	2389.2531	2281.9417	2054.6560	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	670.0402	782.9740	630.9346	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	167.5100	195.7435	157.7336	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												520.9872 (107)
Energy for space heating												37.9647 (99)
Energy for space cooling												2.9829 (108)
Total												40.9475 (109)
Fabric Energy Efficiency (DFEE)												40.9 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

Ground floor	Area (m2)	Storey height (m)	Volume (m3)
First floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.2900 (1c)	x 2.7000 (2c)	= 224.8830 (1c) - (3c)
Dwelling volume	174.6600	(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.1710 (5)

2. Ventilation rate

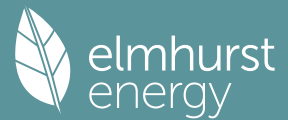
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0901 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3401	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2890 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.3685	0.3613	0.3541	0.3180	0.3107	0.2746	0.2746	0.2674	0.2890	0.3107	0.3252	0.3396 (22b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23b)
Effective ac	0.5679	0.5653	0.5627	0.5505	0.5483	0.5377	0.5377	0.5357	0.5418	0.5483	0.5529	0.5577 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			41.0400	1.1450	46.9924		(27)
Rooflight S			0.6900	1.5038	1.0376		(27a)
Ground Floor			91.3700	0.1300	11.8781		(28a)
Brick	209.4400	42.9900	166.4500	0.1800	29.9610		(29a)
Ashlar	5.9400		5.9400	0.1800	1.0692		(29a)
Joists FF	77.7400		77.7400	0.1100	8.5514		(30)
Rafters	6.4400	0.6900	5.7500	0.1100	0.6325		(30)

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GF Joists	6.5600	6.5600	0.1100	0.7216	(30)
GF Flat	1.0600	1.0600	0.1100	0.1166	(30)
Total net area of external elements Aum(A, m2)		398.5500			(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	102.9104		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 78.7789 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	13.1600	0.0600	0.7896
E10 Eaves (insulation at ceiling level)	29.4300	0.0600	1.7658
E16 Corner (normal)	45.3000	0.0900	4.0770
E17 Corner (inverted - internal area greater than external area)	24.9000	-0.0900	-2.2410
R6 Flat ceiling	4.9500	0.0600	0.2970
R8 Roof to wall (rafter)	4.9500	0.0600	0.2970
E2 Other lintels (including other steel lintels)	28.9300	0.0500	1.4465
E3 Sill	28.0000	0.0500	1.4000
E4 Jamb	60.5400	0.0500	3.0270
E5 Ground floor (normal)	44.9200	0.1600	7.1872
E6 Intermediate floor within a dwelling	42.5800	0.0000	0.0000
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.9600	0.0800	0.1568
E14 Flat roof	2.9200	0.0800	0.2336

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.5457 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 121.4561 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	83.2421	82.8556	82.4767	80.6972	80.3642	78.8143	78.8143	78.5273	79.4113	80.3642	81.0378	81.7419	(38)
Average = Sum(39)m / 12 =	204.6981	204.3116	203.9328	202.1532	201.8203	200.2704	200.2704	199.9834	200.8674	201.8203	202.4938	203.1980	(39)
												202.1516	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	1.1720	1.1698	1.1676	1.1574	1.1555	1.1466	1.1466	1.1450	1.1500	1.1555	1.1594	1.1634	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9688 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361	(42b)
Hot water usage for other uses	45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332	(42c)
Average daily hot water use (litres/day)												70.5565	(43)
Daily hot water use	76.9773	74.8654	72.5597	69.6903	67.1304	64.4701	63.9176	66.2186	68.5785	71.3104	74.2052	76.8693	(44)
Energy content (annual)	121.9133	106.6073	111.5216	95.4026	90.3704	79.2735	77.3028	81.9924	84.5641	96.7676	105.7189	120.3588	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	103.6263	90.6162	94.7933	81.0922	76.8148	67.3824	65.7074	69.6936	71.8795	82.2525	89.8611	102.3050	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.6263	90.6162	94.7933	81.0922	76.8148	67.3824	65.7074	69.6936	71.8795	82.2525	89.8611	102.3050	(64)
Total per year (kWh/year)												996.0243	(64)
Electric shower(s)	59.2588	52.8001	57.6557	55.0201	56.0525	53.4687	55.2510	56.0525	55.0201	57.6557	56.5715	59.2588	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												674.0657	(64a)
Heat gains from water heating, kWh/month	40.7213	35.8541	38.1123	34.0281	33.2168	30.2128	30.2396	31.4365	31.7249	34.9770	36.6082	40.3910	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	148.4387	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.6549	193.3679	174.6549	180.4767	174.6549	180.4767	174.6549	174.6549	180.4767	174.6549	180.4767	174.6549	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.2728	349.8660	340.8112	321.5346	297.2013	274.3314	259.0530	255.4597	264.5145	283.7912	308.1245	330.9943	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	37.8439	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	(71)
Water heating gains (Table 5)	54.7329	53.3543	51.2261	47.2612	44.6463	41.9622	40.6446	42.2534	44.0624	47.0121	50.8447	54.2889	(72)
Total internal gains	643.1922	664.1198	634.2239	616.8041	584.0341	564.3019	541.8841	539.8996	556.5852	572.9898	606.9775	627.4698	(73)

6. Solar gains

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[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	7.4800		10.6334		0.6300		0.7000		0.7700		24.3078 (74)	
East	12.1400		19.6403		0.6300		0.7000		0.7700		72.8682 (76)	
South	5.7300		46.7521		0.6300		0.7000		0.7700		81.8705 (78)	
West	15.6900		19.6403		0.6300		0.7000		0.7700		94.1764 (80)	
South	0.6900		45.6416		0.6300		0.7000		1.0000		12.4994 (82)	
Solar gains	285.7222	529.8579	821.3964	1149.5741	1386.3774	1414.0340	1348.0225	1169.4047	936.7440	613.3653	350.5326	238.9066 (83)
Total gains	928.9145	1193.9777	1455.6202	1766.3782	1970.4115	1978.3360	1889.9065	1709.3044	1493.3292	1186.3551	957.5101	866.3764 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	18.6718	18.7072	18.7419	18.9069	18.9381	19.0847	19.0847	19.1120	19.0279	18.9381	18.8751	18.8097
alpha	2.2448	2.2471	2.2495	2.2605	2.2625	2.2723	2.2723	2.2741	2.2685	2.2625	2.2583	2.2540
util living area	0.9603	0.9321	0.8855	0.7965	0.6765	0.5357	0.4184	0.4682	0.6678	0.8584	0.9404	0.9657 (86)
MIT	17.6480	18.1097	18.7829	19.6132	20.2735	20.7025	20.8787	20.8397	20.4797	19.5570	18.4476	17.5691 (87)
Th 2	19.9425	19.9443	19.9460	19.9542	19.9558	19.9629	19.9629	19.9643	19.9602	19.9558	19.9526	19.9494 (88)
util rest of house	0.9551	0.9234	0.8706	0.7700	0.6336	0.4713	0.3336	0.3817	0.6083	0.8336	0.9313	0.9611 (89)
MIT 2	16.8712	17.3266	17.9858	18.7872	19.3979	19.7730	19.9053	19.8834	19.6005	18.7548	17.6713	16.7974 (90)
Living area fraction	16.9744	17.4307	18.0917	18.8970	19.5143	19.8965	20.0346	20.0105	fLA = Living area / (4) =	18.8614	17.7745	0.1329 (91)
MIT	16.9744	17.4307	18.0917	18.8970	19.5143	19.8965	20.0346	20.0105	19.7173	18.8614	17.7745	16.9000 (92)
Temperature adjustment	16.9744	17.4307	18.0917	18.8970	19.5143	19.8965	20.0346	20.0105	19.7173	18.8614	17.7745	0.0000
adjusted MIT	16.9744	17.4307	18.0917	18.8970	19.5143	19.8965	20.0346	20.0105	19.7173	18.8614	17.7745	16.9000 (93)
8. Space heating requirement												
Utilisation	0.9336	0.8951	0.8372	0.7385	0.6134	0.4668	0.3398	0.3859	0.5926	0.8008	0.9047	0.9416 (94)
Useful gains	867.2628	1068.6831	1218.7018	1304.4525	1208.7057	923.5261	642.1679	659.5609	884.9072	950.0570	866.2771	815.7625 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2594.4259	2560.1591	2363.9318	2020.9217	1577.0796	1060.7349	687.8511	722.0352	1128.3303	1667.3240	2161.5144	2580.6093 (97)
Space heating kWh	1285.0093	1002.2719	852.0511	515.8578	274.0702	0.0000	0.0000	0.0000	0.0000	533.6466	932.5709	1313.0460 (98a)
Space heating requirement - total per year (kWh/year)												6708.5238
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1285.0093	1002.2719	852.0511	515.8578	274.0702	0.0000	0.0000	0.0000	0.0000	533.6466	932.5709	1313.0460 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6708.5238
Space heating per m2										(98c) / (4) =		38.4090 (99)
8c. Space cooling requirement												
Calculated for June, July and August. See Table 10b												
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1882.5415	1482.0008	1519.8735	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7502	0.8075	0.7708	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1412.2582	1196.6692	1171.5899	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2225.6782	2126.0047	1919.3889	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	585.6625	691.4256	556.3624	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	146.4156	172.8564	139.0906	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												458.3626 (107)
Energy for space heating												38.4090 (99)
Energy for space cooling												2.6243 (108)
Total												41.0334 (109)
Fabric Energy Efficiency (TFEE)												41.0 (109)
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)												
CALCULATION OF ENERGY RATING												
1. Overall dwelling characteristics												
Ground floor	Area (m2)		Storey height (m)		Volume (m3)							
First floor	91.3700 (1b)		x 2.4000 (2b)		= 219.2880 (1b) - (3b)							
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.2900 (1c)		x 2.7000 (2c)		= 224.8830 (1c) - (3c)							
Dwelling volume	174.6600		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 444.1710 (5)							

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2. Ventilation rate

										m3 per hour		
Number of open chimneys										0 * 80 =	0.0000 (6a)	
Number of open flues										0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire										1 * 10 =	10.0000 (6c)	
Number of flues attached to solid fuel boiler										0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater										0 * 35 =	0.0000 (6e)	
Number of blocked chimneys										0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans										6 * 10 =	60.0000 (7a)	
Number of passive vents										0 * 10 =	0.0000 (7b)	
Number of flueless gas fires										0 * 40 =	0.0000 (7c)	
										Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =								70.0000 / (5) =	0.1576 (8)		
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											5.0000 (17)	
Infiltration rate											0.4076 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3465 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4417	0.4331	0.4244	0.3811	0.3724	0.3291	0.3291	0.3205	0.3465	0.3724	0.3898	0.4071	(22b)
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			45.1200	1.1450	51.6641			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Rooflight S			0.7600	1.1450	0.8702			(27a)
Ground Floor			91.3700	0.1100	10.0507	75.0000	6852.7500	(28a)
Brick	209.4400	47.0700	162.3700	0.1800	29.2266	9.0000	1461.3300	(29a)
Ashlar	5.9400		5.9400	0.1800	1.0692	9.0000	53.4600	(29a)
Joists FF	77.7400		77.7400	0.1100	8.5514	9.0000	699.6600	(30)
Rafters	6.4400	0.7600	5.6800	0.1300	0.7384	9.0000	51.1200	(30)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
GF Flat	1.0600		1.0600	0.1300	0.1378	9.0000	9.5400	(30)
Total net area of external elements Aum(A, m2)			398.5500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	104.9801			(33)
GF			120.0000			9.0000	1080.0000	(32c)
FF			140.0000			9.0000	1260.0000	(32c)
Internal Floor 1			82.3900			18.0000	1483.0200	(32d)
Internal Ceiling 1			83.2900			9.0000	749.6100	(32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13759.5300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							78.7789	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E12 Gable (insulation at ceiling level)				13.1600	0.0600	0.7896		
E10 Eaves (insulation at ceiling level)				29.4300	0.0600	1.7658		
E16 Corner (normal)				45.3000	0.0900	4.0770		
E17 Corner (inverted - internal area greater than external area)				24.9000	-0.0900	-2.2410		
R6 Flat ceiling				4.9500	0.0600	0.2970		
R8 Roof to wall (rafter)				4.9500	0.0800	0.3960		
E2 Other lintels (including other steel lintels)				28.9300	0.0500	1.4465		
E3 Sill				28.0000	0.0500	1.4000		
E4 Jamb				60.5400	0.0500	3.0270		
E5 Ground floor (normal)				44.9200	0.1500	6.7380		
E6 Intermediate floor within a dwelling				42.5800	0.0000	0.0000		
R1 Head of roof window				0.7800	0.0600	0.0468		
R2 Sill of roof window				0.7800	0.0800	0.0624		
R3 Jamb of roof window				1.9600	0.0600	0.1176		
E14 Flat roof				2.9200	0.0400	0.1168		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.0395	(36)
Point Thermal bridges							(36a) =	0.0000
Total fabric heat loss							(33) + (36) + (36a) =	123.0196 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	87.5888	87.0335	86.4892	83.9326	83.4542	81.2275	81.2275	80.8151	82.0852	83.4542	84.4219	85.4336	(38)
Average = Sum(39)m / 12 =	210.6084	210.0531	209.5087	206.9521	206.4738	204.2470	204.2470	203.8347	205.1048	206.4738	207.4415	208.4531	(39)
													206.9498
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2058	1.2026	1.1995	1.1849	1.1821	1.1694	1.1694	1.1670	1.1743	1.1821	1.1877	1.1935	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9688 (42)
Hot water usage for mixer showers													
	92.4956	91.1055	89.0800	85.2045	82.3444	79.1550	77.3421	79.3523	81.5558	84.9804	88.9391	92.1412	(42a)
Hot water usage for baths													
	31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361	(42b)
Hot water usage for other uses													
	45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332	(42c)
Average daily hot water use (litres/day)													155.8343 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Energy conte	169.4729	165.9709	161.6397	154.8948	149.4748	143.6250	141.2597	145.5709	150.1343	156.2908	163.1443	169.0105 (44)
Energy content (annual)	268.4037	236.3403	248.4342	212.0432	201.2219	176.6037	170.8413	180.2471	185.1306	212.0852	232.4290	264.6296 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2588.4099
Water storage loss:	40.2605	35.4510	37.2651	31.8065	30.1833	26.4906	25.6262	27.0371	27.7696	31.8128	34.8644	39.6944 (46)
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7368 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss												
	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (56)
If cylinder contains dedicated solar storage												
	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	138.3100	122.9006	131.6701	117.9874	115.9720	106.2037	105.8705	108.9979	109.0389	119.5841	124.7656	137.0551 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	42.4206	37.6776	30.6415	23.1976	17.3404	14.6395	15.8185	20.5615	27.5976	35.0415	40.8987	43.5996 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	516.8251	522.1881	508.6735	479.9024	453.5840	409.4499	386.6462	381.2832	394.7978	423.5689	459.8873	494.0214 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510 (71)
Water heating gains (Table 5)												
	185.9005	182.8878	176.9760	163.8713	155.8764	147.5052	142.2991	146.5026	151.4429	160.7313	173.2856	184.2138 (72)
Total internal gains												
	863.3031	860.9104	834.4478	785.1282	734.9578	686.7515	659.9207	663.5042	688.9953	737.4987	792.2285	839.9917 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					8.2200	10.6334	0.6300	0.7000	0.7700		26.7126 (74)	
East					13.3500	19.6403	0.6300	0.7000	0.7700		80.1310 (76)	
South					6.3000	46.7521	0.6300	0.7000	0.7700		90.0146 (78)	
West					17.2500	19.6403	0.6300	0.7000	0.7700		103.5400 (80)	
South					0.7600	45.6416	0.6300	0.7000	1.0000		13.7675 (82)	
Solar gains	314.1657	582.6038	903.1594	1263.9933	1524.3540	1554.7573	1482.1787	1285.7933	1029.9855	674.4231	385.4278	262.6896 (83)
Total gains	1177.4688	1443.5142	1737.6072	2049.1214	2259.3117	2241.5088	2142.0995	1949.2976	1718.9808	1411.9218	1177.6562	1102.6814 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.1479	18.1958	18.2431	18.4685	18.5113	18.7131	18.7131	18.7509	18.6348	18.5113	18.4249	18.3355
alpha	2.2099	2.2131	2.2162	2.2312	2.2341	2.2475	2.2475	2.2501	2.2423	2.2341	2.2283	2.2224
util living area												
	0.9389	0.9069	0.8512	0.7564	0.6330	0.4956	0.3828	0.4280	0.6221	0.8192	0.9148	0.9462 (86)
MIT												
	17.8423	18.2826	18.9540	19.7405	20.3525	20.7394	20.8954	20.8626	20.5416	19.6908	18.6184	17.7652 (87)
Th 2												
	19.9153	19.9179	19.9204	19.9321	19.9343	19.9446	19.9446	19.9465	19.9406	19.9343	19.9299	19.9252 (88)
util rest of house												
	0.9311	0.8954	0.8330	0.7269	0.5884	0.4321	0.3018	0.3448	0.5607	0.7897	0.9024	0.9392 (89)
MIT 2												
	16.2373	16.7898	17.6257	18.5893	19.3062	19.7350	19.8823	19.8598	19.5426	18.5581	17.2275	16.1442 (90)
Living area fraction												
	16.4506	16.9882	17.8022	18.7423	19.4453	19.8685	20.0169	19.9931	19.6753	18.7086	17.4124	16.3596 (92)
MIT												
	16.4506	16.9882	17.8022	18.7423	19.4453	19.8685	20.0169	19.9931	19.6753	18.7086	17.4124	16.3596 (93)
Temperature adjustment												
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8941	0.8523	0.7874	0.6884	0.5658	0.4272	0.3077	0.3487	0.5435	0.7473	0.8609	0.9046 (94)
Useful gains	1052.7966	1230.2923	1368.1093	1410.7169	1278.3463	957.6221	659.0442	679.6739	934.2325	1055.1104	1013.8209	997.5057 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	2559.0156	2539.1639	2367.9068	2036.8823	1599.1929	1076.0738	697.8999	732.3922	1143.5291	1674.2235	2139.2093	2534.7128 (97)
Space heating kWh												
	1120.6270	879.5617	743.8493	450.8391	238.7099	0.0000	0.0000	0.0000	0.0000	460.6201	810.2797	1143.6821 (98a)

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Space heating requirement - total per year (kWh/year)	5848.1690										
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000										
Space heating kWh	1120.6270	879.5617	743.8493	450.8391	238.7099	0.0000	0.0000	0.0000	460.6201	810.2797	1143.6821 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5848.1690										
Space heating per m2	(98c) / (4) = 33.4832 (99)										

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1120.6270	879.5617	743.8493	450.8391	238.7099	0.0000	0.0000	0.0000	0.0000	460.6201	810.2797	1143.6821 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	448.4302	351.9655	297.6588	180.4078	95.5222	0.0000	0.0000	0.0000	0.0000	184.3218	324.2416	457.6559 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	188.3129	166.6117	176.9083	154.9954	149.9452	134.7558	132.5948	137.9665	139.6256	156.1493	166.6378	186.1575 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	37.1305	29.7874	26.8203	19.6497	15.1780	12.4005	13.8459	17.9974	23.3768	30.6717	34.6436	38.1624 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												2340.2037 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1890.6608 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												299.6642 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												4530.5286 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2340.2037	16.4900	385.8996 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1890.6608	16.4900	311.7700 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	299.6642	16.4900	49.4146 (250)
Additional standing charges			0.0000 (251)
Total energy cost			747.0842 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)	
Energy cost factor (ECF)	1.2244 (257)	
SAP value	80.1526	
SAP rating (Section 12)	80 (258)	
SAP band	C	

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12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2340.2037	0.1547	361.9838 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1890.6608	0.1410	266.4945 (264)
Space and water heating			628.4783 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	299.6642	0.1443	43.2508 (268)
Total CO2, kg/year			671.7291 (272)
CO2 emissions per m2			3.8500 (273)
EI value			95.9022
EI rating			96 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880 (1b) - (3b)
First floor	83.2900 (1c)	x 2.7000 (2c)	= 224.8830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600		(4)
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	444.1710 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1576 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4076 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3465 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3118	0.2858	0.2772	0.2772	0.2858	0.2512	0.2685	0.2425	0.2425	0.2598	0.2425	0.2772 (22b)
Effective ac	0.5486	0.5408	0.5384	0.5384	0.5408	0.5315	0.5360	0.5294	0.5294	0.5338	0.5294	0.5384 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			45.1200	1.1450	51.6641		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Rooflight S			0.7600	1.1450	0.8702		(27a)
Ground Floor			91.3700	0.1100	10.0507	75.0000	6852.7500 (28a)
Brick	209.4400	47.0700	162.3700	0.1800	29.2266	9.0000	1461.3300 (29a)
Ashlar	5.9400		5.9400	0.1800	1.0692	9.0000	53.4600 (29a)
Joists FF	77.7400		77.7400	0.1100	8.5514	9.0000	699.6600 (30)
Rafters	6.4400	0.7600	5.6800	0.1300	0.7384	9.0000	51.1200 (30)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400 (30)
GF Flat	1.0600		1.0600	0.1300	0.1378	9.0000	9.5400 (30)
Total net area of external elements Aum(A, m2)			398.5500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	104.9801		(33)
GF			120.0000			9.0000	1080.0000 (32c)
FF			140.0000			9.0000	1260.0000 (32c)
Internal Floor 1			82.3900			18.0000	1483.0200 (32d)
Internal Ceiling 1			83.2900			9.0000	749.6100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13759.5300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							78.7789 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				13.1600	0.0600	0.7896	
E10 Eaves (insulation at ceiling level)				29.4300	0.0600	1.7658	
E16 Corner (normal)				45.3000	0.0900	4.0770	
E17 Corner (inverted - internal area greater than external area)				24.9000	-0.0900	-2.2410	

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R6 Flat ceiling	4.9500	0.0600	0.2970
R8 Roof to wall (rafter)	4.9500	0.0800	0.3960
E2 Other lintels (including other steel lintels)	28.9300	0.0500	1.4465
E3 Sill	28.0000	0.0500	1.4000
E4 Jamb	60.5400	0.0500	3.0270
E5 Ground floor (normal)	44.9200	0.1500	6.7380
E6 Intermediate floor within a dwelling	42.5800	0.0000	0.0000
R1 Head of roof window	0.7800	0.0600	0.0468
R2 Sill of roof window	0.7800	0.0800	0.0624
R3 Jamb of roof window	1.9600	0.0600	0.1176
E14 Flat roof	2.9200	0.0400	0.1168
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			18.0395 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	123.0196 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	80.4138	79.2757	78.9183	78.9183	79.2757	77.9121	78.5719	77.5987	77.5987	78.2365	77.5987	78.9183 (38)
Average = Sum(39)m / 12 =	203.4333	202.2952	201.9378	201.9378	202.2952	200.9317	201.5915	200.6183	200.6183	201.2561	200.6183	201.9378 (39)
												201.6226
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1647	1.1582	1.1562	1.1562	1.1582	1.1504	1.1542	1.1486	1.1486	1.1523	1.1486	1.1562 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.1544
												31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9688 (42)
Hot water usage for mixer showers	92.4956	91.1055	89.0800	85.2045	82.3444	79.1550	77.3421	79.3523	81.5558	84.9804	88.9391	92.1412 (42a)
Hot water usage for baths	31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361 (42b)
Hot water usage for other uses	45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332 (42c)
Average daily hot water use (litres/day)												155.8343 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	169.4729	165.9709	161.6397	154.8948	149.4748	143.6250	141.2597	145.5709	150.1343	156.2908	163.1443	169.0105 (44)
Energy conte	268.4037	236.3403	248.4342	212.0432	201.2219	176.6037	170.8413	180.2471	185.1306	212.0852	232.4290	264.6296 (45)
Energy content (annual)										Total = Sum(45)m =		2588.4099
Distribution loss (46)m = 0.15 x (45)m	40.2605	35.4510	37.2651	31.8065	30.1833	26.4906	25.6262	27.0371	27.7696	31.8128	34.8644	39.6944 (46)
Water storage loss:												
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7368 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618 (64)
								Total per year (kWh/year) = Sum(64)m =				3310.5470 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
								Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =				0.0000 (64a)
Heat gains from water heating, kWh/month	138.3100	122.9006	131.6701	117.9874	115.9720	106.2037	105.8705	108.9979	109.0389	119.5841	124.7656	137.0551 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	42.4206	37.6776	30.6415	23.1976	17.3404	14.6395	15.8185	20.5615	27.5976	35.0415	40.8987	43.5996 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	516.8251	522.1881	508.6735	479.9024	443.5840	409.4499	386.6462	381.2832	394.7978	423.5689	459.8873	494.0214 (68)
Pumps, fans	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510 (71)
Total internal gains	185.9005	182.8878	176.9760	163.8713	155.8764	147.5052	142.2991	146.5026	151.4429	160.7313	173.2856	184.2138 (72)
	863.3031	860.9104	834.4478	785.1282	734.9578	686.7515	659.9207	663.5042	688.9953	737.4987	792.2285	839.9917 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.2200	13.0723	0.6300	0.7000	0.7700	32.8394 (74)
East	13.3500	24.4329	0.6300	0.7000	0.7700	99.6845 (76)
South	6.3000	54.9219	0.6300	0.7000	0.7700	105.7446 (78)

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West			17.2500		24.4329		0.6300		0.7000		0.7700		128.8058 (80)
South			0.7600		55.2632		0.6300		0.7000		1.0000		16.6698 (82)

Solar gains	383.7440	625.1607	960.5959	1388.3659	1629.6116	1799.7659	1681.8265	1473.9231	1171.0365	771.5437	472.4961	312.7642 (83)
Total gains	1247.0471	1486.0711	1795.0437	2173.4941	2364.5693	2486.5174	2341.7472	2137.4273	1860.0318	1509.0423	1264.7246	1152.7559 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.7879	18.8936	18.9271	18.9271	18.8936	19.0218	18.9596	19.0516	19.0516	18.9912	19.0516	18.9271
alpha	2.2525	2.2596	2.2618	2.2618	2.2596	2.2681	2.2640	2.2701	2.2701	2.2661	2.2701	2.2618
util living area	0.9240	0.8933	0.8254	0.7101	0.5643	0.3962	0.2945	0.3104	0.5412	0.7612	0.8872	0.9337 (86)
MIT	18.2563	18.5880	19.2845	20.0141	20.5672	20.8663	20.9518	20.9482	20.7094	20.0601	19.0638	18.1773 (87)
Th 2	19.9483	19.9536	19.9552	19.9552	19.9536	19.9599	19.9568	19.9613	19.9613	19.9584	19.9613	19.9552 (88)
util rest of house	0.9142	0.8802	0.8043	0.6765	0.5139	0.3302	0.2145	0.2246	0.4731	0.7225	0.8705	0.9250 (89)
MIT 2	16.7741	17.1891	18.0515	18.9269	19.5567	19.8654	19.9343	19.9377	19.7288	19.0124	17.7995	16.6790 (90)
Living area fraction									fLA = Living area / (4) =			0.1329 (91)
MIT	16.9711	17.3750	18.2153	19.0713	19.6910	19.9984	20.0695	20.0720	19.8591	19.1516	17.9675	16.8781 (92)
Temperature adjustment												0.0000
adjusted MIT	16.9711	17.3750	18.2153	19.0713	19.6910	19.9984	20.0695	20.0720	19.8591	19.1516	17.9675	16.8781 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8748	0.8371	0.7610	0.6442	0.5003	0.3327	0.2234	0.2341	0.4658	0.6869	0.8276	0.8879 (94)
Useful gains	1090.8867	1244.0144	1366.0624	1400.1487	1182.9302	827.3197	523.1759	500.2964	866.4899	1036.6339	1046.6656	1023.4971 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	2394.6265	2402.2590	2204.2188	1892.4274	1394.0203	883.7733	538.1461	515.9856	994.8825	1479.5533	1959.5400	2358.2527 (97)
Space heating kWh	969.9824	778.3404	623.5884	354.4407	157.0510	0.0000	0.0000	0.0000	0.0000	329.5320	657.2696	993.0581 (98a)
Space heating requirement - total per year (kWh/year)												4863.2627
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	969.9824	778.3404	623.5884	354.4407	157.0510	0.0000	0.0000	0.0000	0.0000	329.5320	657.2696	993.0581 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4863.2627
Space heating per m2										(98c) / (4) =		27.8442 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	969.9824	778.3404	623.5884	354.4407	157.0510	0.0000	0.0000	0.0000	0.0000	329.5320	657.2696	993.0581 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	388.1482	311.4608	249.5352	141.8330	62.8455	0.0000	0.0000	0.0000	0.0000	131.8656	263.0131	397.3822 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	329.7358	291.7371	309.7664	271.3970	262.5540	235.9575	232.1735	241.5793	244.4844	273.4174	291.7827	325.9618 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	188.3129	166.6117	176.9083	154.9954	149.9452	134.7558	132.5948	137.9665	139.6256	156.1493	166.6378	186.1575 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	37.1305	29.7874	26.8203	19.6497	15.1780	12.4005	13.8459	17.9974	23.3768	30.6717	34.6436	38.1624 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1946.0835 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1890.6608 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	299.6642 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4136.4085 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1946.0835	26.0600	507.1494 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1890.6608	26.0600	492.7062 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	299.6642	26.0600	78.0925 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1077.9481 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1946.0835	0.1553	302.2805 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1890.6608	0.1410	266.4945 (264)
Space and water heating			568.7750 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	299.6642	0.1443	43.2508 (268)
Total CO2, kg/year			612.0258 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1946.0835	1.5751	3065.1986 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1890.6608	1.5212	2876.0661 (278)
Space and water heating			5941.2647 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	299.6642	1.5338	459.6350 (282)
Total Primary energy kWh/year			6400.8997 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:	C 80
Current environmental impact rating:	A 96

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 103	-50 kg (8.1%)
U Solar photovoltaic panels	+ 4.3	-£ 273	-141 kg (25.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£103	0.28 kg/m²	B 82 A 96
Solar photovoltaic panels	£273	0.81 kg/m²	B 86 A 97
Total Savings	£376	1.09 kg/m²	

Potential energy efficiency rating:	B 86
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£1078	£975	£103
Space heating	£507	£528	-£21
Water heating	£493	£368	£124
Lighting	£78	£78	£0
Generated (PV)	-£0	-£273	£273
Total cost of fuels	£1078	£702	£376
Total cost of uses	£1078	£701	£376
Delivered energy	24 kWh/m²	15 kWh/m²	8 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	2 kg/m²	1 kg/m²

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Primary energy 37 kWh/m² 24 kWh/m² 12 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880 (1b) - (3b)
First floor	83.2900 (1c)	x 2.7000 (2c)	= 224.8830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.1710 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1576 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4076 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3465 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4417	0.4331	0.4244	0.3811	0.3724	0.3291	0.3291	0.3205	0.3465	0.3724	0.3898	0.4071 (22b)
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			45.1200	1.1450	51.6641		(27)
Solid Doors			1.9500	1.9500	1.9500		(26)
Rooflight S			0.7600	1.1450	0.8702		(27a)
Ground Floor			91.3700	0.1100	10.0507	75.0000	6852.7500 (28a)
Brick	209.4400	47.0700	162.3700	0.1800	29.2266	9.0000	1461.3300 (29a)
Ashlar	5.9400		5.9400	0.1800	1.0692	9.0000	53.4600 (29a)
Joists FF	77.7400		77.7400	0.1100	8.5514	9.0000	699.6600 (30)
Rafters	6.4400	0.7600	5.6800	0.1300	0.7384	9.0000	51.1200 (30)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400 (30)
GF Flat	1.0600		1.0600	0.1300	0.1378	9.0000	9.5400 (30)
Total net area of external elements Aum(A, m2)			398.5500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	104.9801		(33)
GF			120.0000			9.0000	1080.0000 (32c)
FF			140.0000			9.0000	1260.0000 (32c)
Internal Floor 1			82.3900			18.0000	1483.0200 (32d)
Internal Ceiling 1			83.2900			9.0000	749.6100 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 13759.5300 (34)
78.7789 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	13.1600	0.0600	0.7896
E10 Eaves (insulation at ceiling level)	29.4300	0.0600	1.7658
E16 Corner (normal)	45.3000	0.0900	4.0770
E17 Corner (inverted - internal area greater than external area)	24.9000	-0.0900	-2.2410
R6 Flat ceiling	4.9500	0.0600	0.2970
R8 Roof to wall (rafter)	4.9500	0.0800	0.3960
E2 Other lintels (including other steel lintels)	28.9300	0.0500	1.4465
E3 Sill	28.0000	0.0500	1.4000
E4 Jamb	60.5400	0.0500	3.0270
E5 Ground floor (normal)	44.9200	0.1500	6.7380
E6 Intermediate floor within a dwelling	42.5800	0.0000	0.0000
R1 Head of roof window	0.7800	0.0600	0.0468
R2 Sill of roof window	0.7800	0.0800	0.0624
R3 Jamb of roof window	1.9600	0.0600	0.1176
E14 Flat roof	2.9200	0.0400	0.1168

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
(36a) = 18.0395 (36)
Total fabric heat loss
(33) + (36) + (36a) = 123.0196 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	87.5888	87.0335	86.4892	83.9326	83.4542	81.2275	81.2275	80.8151	82.0852	83.4542	84.4219	85.4336	(38)
Heat transfer coeff	210.6084	210.0531	209.5087	206.9521	206.4738	204.2470	204.2470	203.8347	205.1048	206.4738	207.4415	208.4531	(39)
Average = Sum(39)m / 12 =												206.9498	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2058	1.2026	1.1995	1.1849	1.1821	1.1694	1.1694	1.1670	1.1743	1.1821	1.1877	1.1935	(40)
HLP (average)												1.1849	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9688	(42)
Hot water usage for mixer showers														
92.4956	91.1055	89.0800	85.2045	82.3444	79.1550	77.3421	79.3523	81.5558	84.9804	88.9391	92.1412	92.1412	(42a)	
Hot water usage for baths														
31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361	31.8361	(42b)	
Hot water usage for other uses														
45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332	45.0332	(42c)	
Average daily hot water use (litres/day)												155.8343	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	169.4729	165.9709	161.6397	154.8948	149.4748	143.6250	141.2597	145.5709	150.1343	156.2908	163.1443	169.0105	(44)	
Energy conte	268.4037	236.3403	248.4342	212.0432	201.2219	176.6037	170.8413	180.2471	185.1306	212.0852	232.4290	264.6296	(45)	
Energy content (annual)										Total = Sum(45)m =		2588.4099		
Distribution loss (46)m = 0.15 x (45)m														
40.2605	35.4510	37.2651	31.8065	30.1833	26.4906	25.6262	27.0371	27.7696	31.8128	34.8644	39.6944	39.6944	(46)	
Water storage loss:														
Store volume												300.0000	(47)	
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)	
Volume factor from Table 2a												0.7368	(52)	
Temperature factor from Table 2b												0.5400	(53)	
Enter (49) or (54) in (55)												1.2281	(55)	
Total storage loss														
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	(56)	
If cylinder contains dedicated solar storage														
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month														
329.7358	291.7371	308.3706	264.6434	249.7597	223.3507	219.1466	229.4829	239.0815	272.0216	291.7827	325.9618	325.9618	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Aperture area of solar collector												3.0000	(H1)	
Zero-loss collector efficiency												0.8000	(H2)	
Collector linear heat loss coefficient												1.8000	(H3)	
Collector 2nd order heat loss coefficient												0.0000	(H4)	
Collector loop efficiency												0.9000	(H5)	
Incidence angle modifier												1.0000	(H6)	
Overshading factor												0.8000	(H8)	
Overall heat loss coefficient of system												6.5000	(H10)	
Heat loss coefficient of collector loop												3.9667	(H11)	
Dedicated solar storage volume												75.0000	(H12)	
Effective solar volume												75.0000	(H14)	
Reference volume												225.0000	(H15)	
Storage tank correction coefficient												1.3161	(H16)	
Heat delivered to hot water												648.6020	(H24)	
Heat delivered to space heating												0.0000	(H29)	
Solar input												648.6020		
Solar input	-0.0000	-16.1712	-59.6488	-83.1473	-110.2470	-101.9358	-101.3589	-87.7091	-59.5157	-28.8682	-0.0000	-0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h	329.7358	275.5659	248.7219	181.4960	139.5127	121.4149	117.7877	141.7738	179.5658	243.1535	291.7827	325.9618	(64)	
										Total per year (kWh/year) = Sum(64)m =		2596.4726	(64)	
Electric shower(s)														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
												0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =														
Heat gains from water heating, kWh/month														
138.3100	122.9006	130.5535	112.5845	105.7366	96.1183	95.4489	99.3208	104.7166	118.4675	124.7656	137.0551	137.0551	(65)	

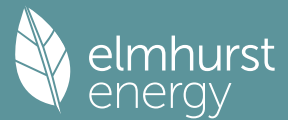
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
42.4206	37.6776	30.6415	23.1976	17.3404	14.6395	15.8185	20.5615	27.5976	35.0415	40.8987	43.5996	43.5996	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
516.8251	522.1881	508.6735	479.9024	443.5840	409.4499	386.6462	381.2832	394.7978	423.5689	459.8873	494.0214	494.0214	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	(71)
Water heating gains (Table 5)													
185.9005	182.8878	175.4752	156.3673	142.1190	133.4977	128.2916	133.4957	145.4397	159.2305	173.2856	184.2138	184.2138	(72)
Total internal gains	863.3031	860.9104	832.9470	777.6242	721.2004	672.7441	645.9132	650.4973	682.9921	735.9979	792.2285	839.9917	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.2200	10.6334	0.6300	0.7000	0.7700	26.7126 (74)
East	13.3500	19.6403	0.6300	0.7000	0.7700	80.1310 (76)

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South	6.3000	46.7521	0.6300	0.7000	0.7700	90.0146 (78)
West	17.2500	19.6403	0.6300	0.7000	0.7700	103.5400 (80)
South	0.7600	45.6416	0.6300	0.7000	1.0000	13.7675 (82)

Solar gains	314.1657	582.6038	903.1594	1263.9933	1524.3540	1554.7573	1482.1787	1285.7933	1029.9855	674.4231	385.4278	262.6896 (83)
Total gains	1177.4688	1443.5142	1736.1064	2041.6174	2245.5544	2227.5014	2128.0920	1936.2906	1712.9776	1410.4210	1177.6562	1102.6814 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.1479	18.1958	18.2431	18.4685	18.5113	18.7131	18.7131	18.7509	18.6348	18.5113	18.4249	18.3355
alpha	2.2099	2.2131	2.2162	2.2312	2.2341	2.2475	2.2475	2.2501	2.2423	2.2341	2.2283	2.2224
util living area	0.9389	0.9069	0.8514	0.7576	0.6352	0.4979	0.3849	0.4303	0.6234	0.8195	0.9148	0.9462 (86)
MIT	17.8423	18.2826	18.9528	19.7360	20.3475	20.7369	20.8942	20.8611	20.5396	19.6897	18.6184	17.7652 (87)
Th 2	19.9153	19.9179	19.9204	19.9321	19.9343	19.9446	19.9446	19.9465	19.9406	19.9343	19.9299	19.9252 (88)
util rest of house	0.9311	0.8954	0.8332	0.7281	0.5907	0.4343	0.3036	0.3468	0.5619	0.7900	0.9024	0.9392 (89)
MIT 2	16.2373	16.7898	17.6242	18.5842	19.3011	19.7328	19.8815	19.8588	19.5406	18.5569	17.2275	16.1442 (90)
Living area fraction	16.4506	16.9882	17.8007	18.7373	19.4401	19.8663	20.0161	19.9920	19.6734	18.7074	17.4124	0.1329 (91)
MIT	16.4506	16.9882	17.8007	18.7373	19.4401	19.8663	20.0161	19.9920	19.6734	18.7074	17.4124	16.3596 (92)
Temperature adjustment												0.0000
adjusted MIT	16.4506	16.9882	17.8007	18.7373	19.4401	19.8663	20.0161	19.9920	19.6734	18.7074	17.4124	16.3596 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8941	0.8523	0.7876	0.6895	0.5678	0.4292	0.3094	0.3506	0.5446	0.7476	0.8609	0.9046 (94)
Useful gains	1052.7966	1230.2923	1367.2928	1407.7831	1275.0802	956.0696	658.4289	678.8587	932.9577	1054.3936	1013.8209	997.5057 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2559.0156	2539.1639	2367.6027	2035.8487	1598.1366	1075.6213	697.7323	732.1657	1143.1260	1673.9635	2139.2093	2534.7128 (97)
Space heating kWh	1120.6270	879.5617	744.2306	452.2072	240.3540	0.0000	0.0000	0.0000	0.0000	460.9600	810.2797	1143.6821 (98a)
Space heating requirement - total per year (kWh/year)												5851.9023
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1120.6270	879.5617	744.2306	452.2072	240.3540	0.0000	0.0000	0.0000	0.0000	460.9600	810.2797	1143.6821 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5851.9023
Space heating per m2										(98c) / (4) =		33.5045 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1120.6270	879.5617	744.2306	452.2072	240.3540	0.0000	0.0000	0.0000	0.0000	460.9600	810.2797	1143.6821 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	448.4302	351.9655	297.8114	180.9553	96.1801	0.0000	0.0000	0.0000	0.0000	184.4578	324.2416	457.6559 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	329.7358	275.5659	248.7219	181.4960	139.5127	121.4149	117.7877	141.7738	179.5658	243.1535	291.7827	325.9618 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	188.3129	157.3763	142.0456	103.6528	79.6760	69.3403	67.2688	80.9673	102.5504	138.8655	166.6378	186.1575 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	37.1305	29.7874	26.8203	19.6497	15.1780	12.4005	13.8459	17.9974	23.3768	30.6717	34.6436	38.1624 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-40.4592	-61.7508	-94.7396	-111.3136	-120.8111	-106.6624	-105.0799	-97.9283	-85.0824	-72.0070	-45.8591	-34.4639 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												2341.6976 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1482.8513 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	80.0000 (231)
Electricity for lighting (calculated in Appendix L)	299.6642 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-976.1572 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3228.0560 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2341.6976	16.4900	386.1459 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1482.8513	16.4900	244.5222 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	299.6642	16.4900	49.4146 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-976.1572	16.4900	-160.9683
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-160.9683 (252)
Total energy cost			532.3064 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8724 (257)
SAP value		85.8585
SAP rating (Section 12)		86 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2341.6976	0.1547	362.1908 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1482.8513	0.1448	214.7066 (264)
Space and water heating			576.8974 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	299.6642	0.1443	43.2508 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-976.1572	0.1342	-130.9817
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-130.9817 (269)
Total CO2, kg/year			500.2635 (272)
CO2 emissions per m2			2.8600 (273)
EI value			96.9482
EI rating			97 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	91.3700 (1b)	x 2.4000 (2b)	= 219.2880 (1b) - (3b)
First floor	83.2900 (1c)	x 2.7000 (2c)	= 224.8830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	444.1710 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)

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Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6f)
6 * 10 = 60.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
70.0000 / (5) = 0.1576 (8)
Yes
Blower Door
5.0000 (17)
0.4076 (18)
2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3465 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate													
Effective ac	0.3118	0.2858	0.2772	0.2772	0.2858	0.2512	0.2685	0.2425	0.2425	0.2598	0.2425	0.2772	(22b)
	0.5486	0.5408	0.5384	0.5384	0.5408	0.5315	0.5360	0.5294	0.5294	0.5338	0.5294	0.5384	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			45.1200	1.1450	51.6641			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Rooflight S			0.7600	1.1450	0.8702			(27a)
Ground Floor			91.3700	0.1100	10.0507	75.0000	6852.7500	(28a)
Brick	209.4400	47.0700	162.3700	0.1800	29.2266	9.0000	1461.3300	(29a)
Ashlar	5.9400		5.9400	0.1800	1.0692	9.0000	53.4600	(29a)
Joists FF	77.7400		77.7400	0.1100	8.5514	9.0000	699.6600	(30)
Rafters	6.4400	0.7600	5.6800	0.1300	0.7384	9.0000	51.1200	(30)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
GF Flat	1.0600		1.0600	0.1300	0.1378	9.0000	9.5400	(30)
Total net area of external elements Aum(A, m2)			398.5500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	104.9801			(33)
GF			120.0000			9.0000	1080.0000	(32c)
FF			140.0000			9.0000	1260.0000	(32c)
Internal Floor 1			82.3900			18.0000	1483.0200	(32d)
Internal Ceiling 1			83.2900			9.0000	749.6100	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 13759.5300 (34)
List of Thermal Bridges 78.7789 (35)

Element	Length	Psi-value	Total	
K1 Element				
E12 Gable (insulation at ceiling level)	13.1600	0.0600	0.7896	
E10 Eaves (insulation at ceiling level)	29.4300	0.0600	1.7658	
E16 Corner (normal)	45.3000	0.0900	4.0770	
E17 Corner (inverted - internal area greater than external area)	24.9000	-0.0900	-2.2410	
R6 Flat ceiling	4.9500	0.0600	0.2970	
R8 Roof to wall (rafter)	4.9500	0.0800	0.3960	
E2 Other lintels (including other steel lintels)	28.9300	0.0500	1.4465	
E3 Sill	28.0000	0.0500	1.4000	
E4 Jamb	60.5400	0.0500	3.0270	
E5 Ground floor (normal)	44.9200	0.1500	6.7380	
E6 Intermediate floor within a dwelling	42.5800	0.0000	0.0000	
R1 Head of roof window	0.7800	0.0600	0.0468	
R2 Sill of roof window	0.7800	0.0800	0.0624	
R3 Jamb of roof window	1.9600	0.0600	0.1176	
E14 Flat roof	2.9200	0.0400	0.1168	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			18.0395	(36)
Point Thermal Bridges			0.0000	(36a) =
Total fabric heat loss			123.0196	(33) + (36) + (36a) =

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	80.4138	79.2757	78.9183	78.9183	79.2757	77.9121	78.5719	77.5987	77.5987	78.2365	77.5987	78.9183	(38)
Average = Sum(39)m / 12 =	203.4333	202.2952	201.9378	201.9378	202.2952	200.9317	201.5915	200.6183	200.6183	201.2561	200.6183	201.9378	(39)
												201.6226	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1647	1.1582	1.1562	1.1562	1.1582	1.1504	1.1542	1.1486	1.1486	1.1523	1.1486	1.1562	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9688 (42)
Hot water usage for mixer showers													
	92.4956	91.1055	89.0800	85.2045	82.3444	79.1550	77.3421	79.3523	81.5558	84.9804	88.9391	92.1412	(42a)
Hot water usage for baths													
	31.9441	31.4697	30.8016	29.5698	28.6474	27.6247	27.0722	27.7356	28.4580	29.5524	30.8095	31.8361	(42b)
Hot water usage for other uses													
	45.0332	43.3957	41.7581	40.1205	38.4829	36.8454	36.8454	38.4829	40.1205	41.7581	43.3957	45.0332	(42c)
Average daily hot water use (litres/day)													155.8343 (43)
Daily hot water use													
	169.4729	165.9709	161.6397	154.8948	149.4748	143.6250	141.2597	145.5709	150.1343	156.2908	163.1443	169.0105	(44)
Energy conte	268.4037	236.3403	248.4342	212.0432	201.2219	176.6037	170.8413	180.2471	185.1306	212.0852	232.4290	264.6296	(45)
Energy content (annual)													Total = Sum(45)m = 2588.4099
Distribution loss (46)m = 0.15 x (45)m													
	40.2605	35.4510	37.2651	31.8065	30.1833	26.4906	25.6262	27.0371	27.7696	31.8128	34.8644	39.6944	(46)
Water storage loss:													
Store volume													300.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7368 (52)
Temperature factor from Table 2b													0.5400 (53)

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Enter (49) or (54) in (55)													1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	329.7358	291.7371	308.3706	264.6434	249.7597	223.3507	219.1466	229.4829	239.0815	272.0216	291.7827	325.9618	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector													(H1)
Zero-loss collector efficiency													(H2)
Collector linear heat loss coefficient													(H3)
Collector 2nd order heat loss coefficient													(H4)
Collector loop efficiency													(H5)
Incidence angle modifier													(H6)
Overshading factor													(H8)
Overall heat loss coefficient of system													(H10)
Heat loss coefficient of collector loop													(H11)
Dedicated solar storage volume													(H12)
Effective solar volume													(H14)
Reference volume													(H15)
Storage tank correction coefficient													(H16)
Heat delivered to hot water													(H24)
Heat delivered to space heating													(H29)
Solar input													(64a)
Solar input	-1.7171	-20.9239	-66.6992	-94.9882	-120.2707	-121.3453	-117.9262	-105.1511	-73.2651	-41.0342	-7.5162	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	328.0188	270.8133	241.6715	169.6552	129.4890	102.0054	101.2204	124.3318	165.8164	230.9874	284.2665	325.9618	(64)
													(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													(64a)
Heat gains from water heating, kWh/month	138.3100	122.9006	130.5535	112.5845	105.7366	96.1183	95.4489	99.3208	104.7166	118.4675	124.7656	137.0551	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	178.1265	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.4206	37.6776	30.6415	23.1976	17.3404	14.6395	15.8185	20.5615	27.5976	35.0415	40.8987	43.5996	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	516.8251	522.1881	508.6735	479.9024	443.5840	409.4499	386.6462	381.2832	394.7978	423.5689	459.8873	494.0214	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	55.7814	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	-118.7510	(71)
Water heating gains (Table 5)	185.9005	182.8878	175.4752	156.3673	142.1190	133.4977	128.2916	133.4957	145.4397	159.2305	173.2856	184.2138	(72)
Total internal gains	863.3031	860.9104	832.9470	777.6242	721.2004	672.7441	645.9132	650.4973	682.9921	735.9979	792.2285	839.9917	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.2200	13.0723	0.6300	0.7000	0.7700	32.8394 (74)
East	13.3500	24.4329	0.6300	0.7000	0.7700	99.6845 (76)
South	6.3000	54.9219	0.6300	0.7000	0.7700	105.7446 (78)
West	17.2500	24.4329	0.6300	0.7000	0.7700	128.8058 (80)
South	0.7600	55.2632	0.6300	0.7000	1.0000	16.6698 (82)

Solar gains	383.7440	625.1607	960.5959	1388.3659	1629.6116	1799.7659	1681.8265	1473.9231	1171.0365	771.5437	472.4961	312.7642	(83)
Total gains	1247.0471	1486.0711	1793.5429	2165.9901	2350.8120	2472.5099	2327.7397	2124.4204	1854.0286	1507.5415	1264.7246	1152.7559	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	18.7879	18.8936	18.9271	18.9271	18.8936	19.0218	18.9596	19.0516	19.0516	18.9912	19.0516	18.9271	
alpha	2.2525	2.2596	2.2618	2.2618	2.2596	2.2681	2.2640	2.2701	2.2701	2.2661	2.2701	2.2618	
util living area	0.9240	0.8933	0.8256	0.7113	0.5665	0.3980	0.2961	0.3121	0.5424	0.7615	0.8872	0.9337	(86)
MIT	18.2563	18.5880	19.2834	20.0103	20.5637	20.8650	20.9512	20.9476	20.7080	20.0592	19.0638	18.1773	(87)
Th 2	19.9483	19.9536	19.9552	19.9552	19.9536	19.9599	19.9568	19.9613	19.9613	19.9584	19.9613	19.9552	(88)
util rest of house	0.9142	0.8802	0.8046	0.6777	0.5161	0.3318	0.2157	0.2259	0.4743	0.7229	0.8705	0.9250	(89)
MIT 2	16.7741	17.1891	18.0501	18.9227	19.5532	19.8644	19.9340	19.9374	19.7276	19.0114	17.7995	16.6790	(90)
Living area fraction													(91)
MIT	16.9711	17.3750	18.2140	19.0672	19.6875	19.9973	20.0692	20.0716	19.8579	19.1506	17.9675	16.8781	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9711	17.3750	18.2140	19.0672	19.6875	19.9973	20.0692	20.0716	19.8579	19.1506	17.9675	16.8781	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1090.8867	1244.0144	1365.3166	1397.6882	1180.6015	826.5641	522.9388	500.0453	865.6598	1036.0564	1046.6656	1023.4971	(95)

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Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	2394.6265	2402.2590	2203.9502	1891.5984	1393.3109	883.5668	538.0837	515.9194	994.6372	1479.3540	1959.5400	2358.2527 (97)
Space heating kWh	969.9824	778.3404	623.9434	355.6153	158.2558	0.0000	0.0000	0.0000	0.0000	329.8134	657.2696	993.0581 (98a)
Space heating requirement - total per year (kWh/year)												4866.2785
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	969.9824	778.3404	623.9434	355.6153	158.2558	0.0000	0.0000	0.0000	0.0000	329.8134	657.2696	993.0581 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4866.2785
Space heating per m2												(98c) / (4) = 27.8614 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	969.9824	778.3404	623.9434	355.6153	158.2558	0.0000	0.0000	0.0000	0.0000	329.8134	657.2696	993.0581 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	388.1482	311.4608	249.6772	142.3031	63.3276	0.0000	0.0000	0.0000	0.0000	131.9782	263.0131	397.3822 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	328.0188	270.8133	241.6715	169.6552	129.4890	102.0054	101.2204	124.3318	165.8164	230.9874	284.2665	325.9618 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	187.3323	154.6621	138.0191	96.8904	73.9515	58.2555	57.8072	71.0062	94.6981	131.9174	162.3453	186.1575 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	37.1305	29.7874	26.8203	19.6497	15.1780	12.4005	13.8459	17.9974	23.3768	30.6717	34.6436	38.1624 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-47.9090	-64.9307	-97.9611	-116.4518	-122.7228	-114.7134	-111.8927	-105.4282	-92.1118	-78.4169	-53.9609	-40.0013 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1947.2903 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1413.0426 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												299.6642 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-1046.5006 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												2693.4965 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1947.2903	26.0600	507.4639 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1413.0426	26.0600	368.2389 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	299.6642	26.0600	78.0925 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1046.5006	26.0600	-272.7181
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-272.7181 (252)
Total energy cost			701.9252 (255)

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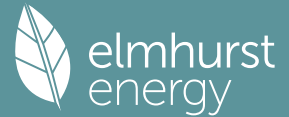
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1947.2903	0.1553	302.4484 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1413.0426	0.1456	205.7266 (264)
Space and water heating			508.1750 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	299.6642	0.1443	43.2508 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1046.5006	0.1344	-140.6024
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-140.6024 (269)
Total CO2, kg/year			421.9204 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1947.2903	1.5750	3067.0267 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1413.0426	1.5386	2174.0432 (278)
Space and water heating			5241.0699 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	299.6642	1.5338	459.6350 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1046.5006	1.4965	-1566.1309
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1566.1309 (283)
Total Primary energy kWh/year			4255.5980 (286)

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Property Reference	FURNERS LANE 7				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 7, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	4.19	TER	9.23	
Environmental	96 A	% DER < TER				54.60
CO ₂ Emissions (t/year)	0.51	DFEE	37.30	TFEE	37.73	
Compliance Check	See BREL	% DFEE < TFEE				1.14
% DPER < TPER	8.61	DPER	44.01	TPER	48.16	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.7500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.1809 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4309 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3662 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4669	0.4578	0.4486	0.4029	0.3937	0.3479	0.3479	0.3388	0.3662	0.3937	0.4120	0.4303 (22b)
Effective ac	0.6090	0.6048	0.6006	0.5811	0.5775	0.5605	0.5605	0.5574	0.5671	0.5775	0.5849	0.5926 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			21.7800	1.1450	24.9389		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			66.3500	0.1100	7.2985	75.0000	4976.2500 (28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	9.0000	1282.2300 (29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	9.0000	597.1500 (30)
Total net area of external elements Aum(A, m ²)			298.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	67.1305			(33)
GF			80.0000			9.0000	720.0000 (32c)
FF			120.0000			9.0000	1080.0000 (32c)
Internal Floor 1			66.3500			18.0000	1194.3000 (32d)
Internal Ceiling 1			66.3500			9.0000	597.1500 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	10447.0800 (34)			
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K				78.7271 (35)			
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				4.2500	0.0600	0.2550	
E10 Eaves (insulation at ceiling level)				28.9900	0.0600	1.7394	
E16 Corner (normal)				25.0000	0.0900	2.2500	

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E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500										
E2 Other lintels (including other steel lintels)	17.5100	0.0500	0.8755										
E3 Sill	16.5800	0.0500	0.8290										
E4 Jamb	36.0000	0.0500	1.8000										
E5 Ground floor (normal)	33.2400	0.1600	5.3184										
E6 Intermediate floor within a dwelling	33.2400	0.0000	0.0000										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												12.6173	(36)
Point Thermal bridges												0.0000	
Total fabric heat loss												(33) + (36) + (36a) =	79.7478 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	66.6738	66.2103	65.7561	63.6223	63.2231	61.3647	61.3647	61.0206	62.0806	63.2231	64.0307	64.8750	(38)
Average = Sum(39)m / 12 =	146.4216	145.9582	145.5039	143.3702	142.9710	141.1126	141.1126	140.7684	141.8284	142.9710	143.7786	144.6229	(39)
												143.3683	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1034	1.0999	1.0965	1.0804	1.0774	1.0634	1.0634	1.0608	1.0688	1.0774	1.0835	1.0898	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.9017 (42)
Hot water usage for mixer showers													
	91.0890	89.7201	87.7254	83.9088	81.0923	77.9513	76.1660	78.1456	80.3157	83.6881	87.5867	90.7400	(42a)
Hot water usage for baths													
	31.4602	30.9930	30.3350	29.1219	28.2135	27.2062	26.6622	27.3155	28.0269	29.1047	30.3428	31.3539	(42b)
Hot water usage for other uses													
	44.3460	42.7334	41.1208	39.5082	37.8956	36.2831	36.2831	37.8956	39.5082	41.1208	42.7334	44.3460	(42c)
Average daily hot water use (litres/day)													153.4641 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	166.8952	163.4465	159.1812	152.5389	147.2014	141.4406	139.1112	143.3567	147.8508	153.9136	160.6629	166.4399	(44)
Energy content (annual)	264.3212	232.7456	244.6556	208.8182	198.1614	173.9177	168.2429	177.5056	182.3148	208.8593	228.8937	260.6046	(45)
Distribution loss	(46)m = 0.15 x (45)m												
	39.6482	34.9118	36.6983	31.3227	29.7242	26.0877	25.2364	26.6258	27.3472	31.3289	34.3341	39.0907	(46)
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796	(64)
12Total per year (kWh/year)													3219.8760 (64)
Electric shower(s)													3220 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
	133.4668	118.5570	126.9280	113.5418	111.4687	101.9374	101.5208	104.6007	104.7294	115.0258	120.2169	132.2311	(65)

5. Internal gains (see Table 5 and 5a)													

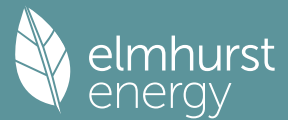
Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	157.5805	174.4642	157.5805	162.8332	157.5805	162.8332	157.5805	157.5805	162.8332	157.5805	162.8332	157.5805	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	300.9461	304.0690	296.1995	279.4461	258.2980	238.4218	225.1432	222.0204	229.8899	246.6433	267.7914	287.6676	(68)
Pumps, fans	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	(71)
Total internal gains	179.3909	176.4241	170.6022	157.6969	149.8235	141.5797	136.4527	140.5923	145.4575	154.6045	166.9679	177.7299	(72)
	707.4426	724.4822	693.9072	669.5012	635.2270	609.3596	585.7014	586.7181	604.7056	628.3533	667.1175	692.5030	(73)

6. Solar gains													

[Jan]													
North			1.4200		10.6334		0.6300		0.7000		0.7700		4.6146 (74)
East			11.5200		19.6403		0.6300		0.7000		0.7700		69.1467 (76)
South			2.2000		46.7521		0.6300		0.7000		0.7700		31.4337 (78)
West			6.6400		19.6403		0.6300		0.7000		0.7700		39.8554 (80)

Solar gains	145.0504	273.5303	431.7234	610.3341	737.3147	751.5564	716.7329	621.6814	494.9350	319.0407	178.8652	120.6466	(83)

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Total gains 852.4929 998.0125 1125.6306 1279.8353 1372.5417 1360.9160 1302.4343 1208.3995 1099.6406 947.3940 845.9826 813.1496 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.8193	19.8822	19.9443	20.2411	20.2976	20.5649	20.5649	20.6152	20.4611	20.2976	20.1836	20.0658
alpha	2.3213	2.3255	2.3296	2.3494	2.3532	2.3710	2.3710	2.3743	2.3641	2.3532	2.3456	2.3377
util living area	0.9418	0.9166	0.8769	0.7991	0.6906	0.5509	0.4298	0.4715	0.6608	0.8388	0.9186	0.9471 (86)
MIT	18.0512	18.4197	18.9784	19.7096	20.3072	20.7200	20.8884	20.8579	20.5412	19.7439	18.7893	18.0040 (87)
Th 2	19.9981	20.0009	20.0037	20.0169	20.0193	20.0308	20.0308	20.0330	20.0264	20.0193	20.0143	20.0091 (88)
util rest of house	0.9347	0.9066	0.8617	0.7739	0.6501	0.4894	0.3485	0.3897	0.6040	0.8128	0.9072	0.9406 (89)
MIT 2	16.5382	17.0032	17.7051	18.6138	19.3275	19.7960	19.9601	19.9380	19.6143	18.6768	17.4842	16.4844 (90)
Living area fraction	fLA = Living area / (4) =											0.1462 (91)
MIT	16.7594	17.2103	17.8913	18.7740	19.4708	19.9311	20.0959	20.0725	19.7498	18.8328	17.6750	16.7066 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.7594	17.2103	17.8913	18.7740	19.4708	19.9311	20.0959	20.0725	19.7498	18.8328	17.6750	16.7066 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9010	0.8681	0.8201	0.7359	0.6247	0.4826	0.3543	0.3932	0.5859	0.7736	0.8695	0.9087	(94)
Useful gains	768.0873	866.3404	923.1763	941.8808	857.4911	656.8395	461.4335	475.1893	644.2896	732.8708	735.5809	738.9456	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1824.3260	1796.7913	1657.4751	1415.6372	1110.9922	752.2872	493.3094	516.9672	801.3073	1177.0481	1520.4572	1808.7372	(97)
Space heating kWh	785.8416	625.2630	546.3183	341.1046	188.6048	0.0000	0.0000	0.0000	0.0000	330.4679	565.1109	795.9250	(98a)
Space heating requirement - total per year (kWh/year)	4178.6361												
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)	0.0000												
Space heating kWh	785.8416	625.2630	546.3183	341.1046	188.6048	0.0000	0.0000	0.0000	0.0000	330.4679	565.1109	795.9250	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4178.6361												
Space heating per m2	(98c) / (4) = 31.4893												(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)												
Fraction of space heat from main system(s)	1.0000 (202)												
Efficiency of main space heating system 1 (in %)	249.9000 (206)												
Efficiency of main space heating system 2 (in %)	0.0000 (207)												
Efficiency of secondary/supplementary heating system, %	65.0000 (208)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	785.8416	625.2630	546.3183	341.1046	188.6048	0.0000	0.0000	0.0000	0.0000	330.4679	565.1109	795.9250 (98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)	
Space heating fuel (main heating system)	314.4624	250.2053	218.6148	136.4964	75.4721	0.0000	0.0000	0.0000	0.0000	132.2401	226.1348	318.4974 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796 (64)	
Efficiency of water heater	175.1000 (216)												
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (217)	
Fuel for water heating, kWh/month	183.4930	162.3112	172.2620	150.7455	145.7090	130.8137	128.6225	133.9124	135.6093	151.8186	162.2107	181.3704 (219)	
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)	
Lighting	33.5006	26.8754	24.1983	17.7287	13.6942	11.1883	12.4923	16.2380	21.0915	27.6732	31.2568	34.4317 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)	
Annual totals kWh/year													
Space heating fuel - main system 1	1672.1233 (211)												
Space heating fuel - main system 2	0.0000 (213)												
Space heating fuel - secondary	0.0000 (215)												
Efficiency of water heater	175.1000												
Water heating fuel used	1838.8784 (219)												
Space cooling fuel	0.0000 (221)												
Electricity for pumps and fans:													
Total electricity for the above, kWh/year	0.0000 (231)												
Electricity for lighting (calculated in Appendix L)	270.3689 (232)												

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Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3781.3705 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1672.1233	0.1545	258.2657	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1838.8784	0.1410	259.2472	(264)
Space and water heating			517.5129	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	270.3689	0.1443	39.0226	(268)
Total CO2, kg/year			556.5355	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.1900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1672.1233	1.5718	2628.2773	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1838.8784	1.5213	2797.4882	(278)
Space and water heating			5425.7655	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	270.3689	1.5338	414.7009	(282)
Total Primary energy kWh/year			5840.4664	(286)
Dwelling Primary energy Rate (DPER)			44.0100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.7500 (5)

2. Ventilation rate

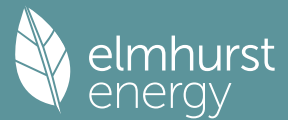
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1206 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3706 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3150 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4016	0.3937	0.3859	0.3465	0.3386	0.2992	0.2992	0.2914	0.3150	0.3386	0.3544	0.3701 (22b)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5448	0.5448	0.5424	0.5496	0.5573	0.5628	0.5685 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)

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TER Opening Type (Uw = 1.20)			21.7800	1.1450	24.9389	(27)
Ground Floor			66.3500	0.1300	8.6255	(28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	(29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	(30)
Total net area of external elements Aum(A, m2)			298.9000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	68.4575		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	4.2500	0.0600	0.2550
E10 Eaves (insulation at ceiling level)	28.9900	0.0600	1.7394
E16 Corner (normal)	25.0000	0.0900	2.2500
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500
E2 Other lintels (including other steel lintels)	17.5100	0.0500	0.8755
E3 Sill	16.5800	0.0500	0.8290
E4 Jamb	36.0000	0.0500	1.8000
E5 Ground floor (normal)	33.2400	0.1600	5.3184
E6 Intermediate floor within a dwelling	33.2400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	63.5675	63.2247	62.8886	61.3103	61.0149	59.6402	59.6402	59.3856	60.1697	61.0149	61.6124	62.2369
Average = Sum(39)m / 12 =	144.6423	144.2995	143.9635	142.3851	142.0898	140.7151	140.7151	140.4605	141.2446	142.0898	142.6872	143.3118

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0900	1.0874	1.0849	1.0730	1.0708	1.0604	1.0604	1.0585	1.0644	1.0708	1.0753	1.0800
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9017
Hot water usage for mixer showers												
Hot water usage for baths	72.8712	71.7761	70.1803	67.1270	64.8738	62.3610	60.9328	62.5165	64.2525	66.9505	70.0693	72.5920
Hot water usage for other uses	31.4602	30.9930	30.3350	29.1219	28.2135	27.2062	26.6622	27.3155	28.0269	29.1047	30.3428	31.3539
Average daily hot water use (litres/day)	44.3460	42.7334	41.1208	39.5082	37.8956	36.2831	36.2831	37.8956	39.5082	41.1208	42.7334	44.3460
Daily hot water use	148.6774	145.5025	141.6361	135.7572	130.9829	125.8503	123.8780	127.7276	131.7876	137.1760	143.1456	148.2918
Energy content (annual)	235.4687	207.1936	217.6895	185.8448	176.3282	154.7477	149.8197	158.1535	162.5073	186.1465	203.9371	232.1892
Distribution loss (46)m = 0.15 x (45)m	35.3203	31.0790	32.6534	27.8767	26.4492	23.2121	22.4730	23.7230	24.3761	27.9220	30.5906	34.8284
Water storage loss:												
Store volume												250.0000
a) If manufacturer declared loss factor is known (kWh/day):												1.8903
Temperature factor from Table 2b												0.5400
Enter (49) or (54) in (55)												1.0208
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month	290.3755	256.7868	272.5963	238.9804	231.2350	207.8833	204.7265	213.0603	215.6429	241.0533	257.0727	287.0960
WWHRS	-33.3137	-29.4629	-30.8518	-25.5465	-23.8085	-20.3731	-19.0965	-20.3072	-21.0788	-24.8495	-28.1515	-32.6968
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	257.0618	227.3239	241.7444	213.4338	207.4266	187.5102	185.6300	192.7531	194.5642	216.2038	228.9212	254.3992
12Total per year (kWh/year)												2606.9721
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Heat gains from water heating, kWh/month	122.2188	108.5665	116.3072	104.3019	102.5546	93.9621	93.7405	96.5115	96.5422	105.8192	110.3176	121.1283

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	157.5805	174.4642	157.5805	162.8332	157.5805	162.8332	157.5805	157.5805	162.8332	157.5805	162.8332	157.5805
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	300.9461	304.0690	296.1995	279.4461	258.2980	238.4218	225.1432	222.0204	229.8899	246.6433	267.7914	287.6676
Pumps, fans	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000
Water heating gains (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666
Total internal gains	164.2725	161.5572	156.3269	144.8637	137.8422	130.5029	125.9953	129.7197	134.0864	142.2300	153.2188	162.8069

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	1.4200				10.6334	0.6300		0.7000		0.7700	4.6146 (74)
East	11.5200				19.6403	0.6300		0.7000		0.7700	69.1467 (76)
South	2.2000				46.7521	0.6300		0.7000		0.7700	31.4337 (78)
West	6.6400				19.6403	0.6300		0.7000		0.7700	39.8554 (80)

Solar gains	145.0504	273.5303	431.7234	610.3341	737.3147	751.5564	716.7329	621.6814	494.9350	319.0407	178.8652	120.6466 (83)
Total gains	837.3746	983.1456	1111.3552	1267.0021	1360.5603	1349.8393	1291.9769	1197.5269	1088.2695	935.0195	832.2335	798.2266 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.0631	20.1107	20.1577	20.3811	20.4235	20.6230	20.6230	20.6604	20.5457	20.4235	20.3380	20.2493
alpha	2.3375	2.3407	2.3438	2.3587	2.3616	2.3749	2.3749	2.3774	2.3697	2.3616	2.3559	2.3500
util living area	0.9434	0.9183	0.8785	0.8009	0.6922	0.5532	0.4318	0.4741	0.6636	0.8413	0.9207	0.9488 (86)
MIT	18.0655	18.4331	18.9900	19.7128	20.3092	20.7188	20.8879	20.8567	20.5395	19.7426	18.7895	18.0086 (87)
Th 2	20.0090	20.0111	20.0132	20.0230	20.0248	20.0333	20.0333	20.0349	20.0300	20.0248	20.0211	20.0172 (88)
util rest of house	0.9365	0.9085	0.8636	0.7760	0.6520	0.4918	0.3504	0.3922	0.6070	0.8157	0.9095	0.9425 (89)
MIT 2	16.5621	17.0259	17.7252	18.6220	19.3342	19.7971	19.9621	19.9389	19.6157	18.6789	17.4884	16.4946 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	16.7819	17.2316	17.9101	18.7815	19.4767	19.9319	20.0975	20.0731	19.7508	18.8344	17.6787	16.7160 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.7819	17.2316	17.9101	18.7815	19.4767	19.9319	20.0975	20.0731	19.7508	18.8344	17.6787	16.7160 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9036	0.8706	0.8225	0.7381	0.6266	0.4848	0.3561	0.3957	0.5887	0.7766	0.8723	0.9113 (94)
Useful gains	756.6339	855.8923	914.0946	935.1925	852.5923	654.4612	460.1283	473.8069	640.7054	726.0996	725.9953	727.4408 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1805.4124	1779.4498	1642.6436	1406.9730	1104.9945	750.2728	492.1500	515.9259	798.1383	1170.0233	1509.4386	1793.6841 (97)
Space heating kWh	780.2912	620.6306	542.0405	339.6820	187.7873	0.0000	0.0000	0.0000	0.0000	330.2793	564.0792	793.2850 (98a)
Space heating requirement - total per year (kWh/year)	4158.0750											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	780.2912	620.6306	542.0405	339.6820	187.7873	0.0000	0.0000	0.0000	0.0000	330.2793	564.0792	793.2850 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4158.0750											
Space heating per m2	(98c) / (4) = 31.3344 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)

0.0000 (201)

Fraction of space heat from main system(s)

1.0000 (202)

Efficiency of main space heating system 1 (in %)

92.3000 (206)

Efficiency of main space heating system 2 (in %)

0.0000 (207)

Efficiency of secondary/supplementary heating system, %

0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	780.2912	620.6306	542.0405	339.6820	187.7873	0.0000	0.0000	0.0000	0.0000	330.2793	564.0792	793.2850 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	845.3860	672.4059	587.2594	368.0195	203.4532	0.0000	0.0000	0.0000	0.0000	357.8323	611.1367	859.4637 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	257.0618	227.3239	241.7444	213.4338	207.4266	187.5102	185.6300	192.7531	194.5642	216.2038	228.9212	254.3992 (64)
Efficiency of water heater (217)m	86.3857	86.1939	85.8149	85.0966	83.8374	79.8000	79.8000	79.8000	79.8000	85.0070	86.0000	79.8000 (216)
Fuel for water heating, kWh/month	297.5745	263.7355	281.7046	250.8135	247.4153	234.9752	232.6190	241.5452	243.8148	254.3364	266.1873	294.3312 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	32.7421	26.2669	23.6505	17.3273	13.3841	10.9350	12.2095	15.8703	20.6140	27.0467	30.5491	33.6521 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-58.7468	-81.1679	-114.3340	-125.8377	-133.3666	-123.5571	-121.9162	-116.1542	-105.7506	-91.4140	-63.9488	-50.9767 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-38.4026	-80.1319	-158.1250	-235.9045	-310.4714	-311.5219	-307.9580	-261.4954	-192.5978	-114.1832	-51.1258	-30.4268 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	4504.9567	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3109.0524	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	264.2477	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3279.5150	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4684.7418	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4504.9567	0.2100	946.0409 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3109.0524	0.2100	652.9010 (264)
Space and water heating			1598.9419 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	264.2477	0.1443	38.1391 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1187.1707	0.1350	-160.3231
PV Unit electricity exported	-2092.3443	0.1261	-263.8180
Total			-424.1410 (269)
Total CO2, kg/year			1224.8693 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.2300 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4504.9567	1.1300	5090.6011 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3109.0524	1.1300	3513.2292 (278)
Space and water heating			8603.8303 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	264.2477	1.5338	405.3119 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1187.1707	1.4991	-1779.7281
PV Unit electricity exported	-2092.3443	0.4628	-968.4101
Total			-2748.1382 (283)
Total Primary energy kWh/year			6391.1047 (286)
Target Primary Energy Rate (TPER)			48.1600 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

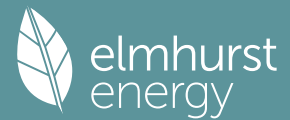
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.7500 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1206 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3706 (18)
Number of sides sheltered	2 (19)

Full SAP Calculation Printout



Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3150 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4016	0.3937	0.3859	0.3465	0.3386	0.2992	0.2992	0.2914	0.3150	0.3386	0.3544	0.3701	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5448	0.5448	0.5424	0.5496	0.5573	0.5628	0.5685	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			21.7800	1.1450	24.9389			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			66.3500	0.1100	7.2985	75.0000	4976.2500	(28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	9.0000	1282.2300	(29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	9.0000	597.1500	(30)
Total net area of external elements Aum(A, m2)			298.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.1305			(33)
GF			80.0000			9.0000	720.0000	(32c)
FF			120.0000			9.0000	1080.0000	(32c)
Internal Floor 1			66.3500			18.0000	1194.3000	(32d)
Internal Ceiling 1			66.3500			9.0000	597.1500	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 10447.0800 (34)
List of Thermal Bridges 78.7271 (35)

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	4.2500	0.0600	0.2550	
E10 Eaves (insulation at ceiling level)	28.9900	0.0600	1.7394	
E16 Corner (normal)	25.0000	0.0900	2.2500	
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500	
E2 Other lintels (including other steel lintels)	17.5100	0.0500	0.8755	
E3 Sill	16.5800	0.0500	0.8290	
E4 Jamb	36.0000	0.0500	1.8000	
E5 Ground floor (normal)	33.2400	0.1600	5.3184	
E6 Intermediate floor within a dwelling	33.2400	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				12.6173 (36)
Point Thermal Bridges				0.0000 (36a) =
Total fabric heat loss				(33) + (36) + (36a) = 79.7478 (37)

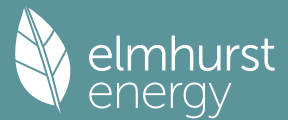
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 63.5675	Feb 63.2247	Mar 62.8886	Apr 61.3103	May 61.0149	Jun 59.6402	Jul 59.6402	Aug 59.3856	Sep 60.1697	Oct 61.0149	Nov 61.6124	Dec 62.2369 (38)
Heat transfer coeff	143.3153	142.9725	142.6365	141.0581	140.7628	139.3881	139.3881	139.1335	139.9176	140.7628	141.3602	141.9848 (39)
Average = Sum(39)m / 12 =												141.0567
HLP	Jan 1.0800	Feb 1.0774	Mar 1.0749	Apr 1.0630	May 1.0608	Jun 1.0504	Jul 1.0504	Aug 1.0485	Sep 1.0544	Oct 1.0608	Nov 1.0653	Dec 1.0700 (40)
HLP (average)												1.0630
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9017 (42)
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
	31.4602	30.9930	30.3350	29.1219	28.2135	27.2062	26.6622	27.3155	28.0269	29.1047	30.3428	31.3539 (42b)
Hot water usage for other uses												
	44.3460	42.7334	41.1208	39.5082	37.8956	36.2831	36.2831	37.8956	39.5082	41.1208	42.7334	44.3460 (42c)
Average daily hot water use (litres/day)												69.4831 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	75.8062	73.7264	71.4558	68.6301	66.1091	63.4893	62.9452	65.2111	67.5351	70.2255	73.0762	75.6998 (44)
Energy content (annual)												
	120.0585	104.9854	109.8250	93.9512	88.9956	78.0675	76.1268	80.7450	83.2775	95.2953	104.1105	118.5276 (45)
Distribution loss (46)m = 0.15 x (45)m												1153.9658
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	102.0497	89.2376	93.3512	79.8585	75.6463	66.3574	64.7078	68.6333	70.7859	81.0010	88.4939	100.7485 (62)
WWHRS												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	102.0497	89.2376	93.3512	79.8585	75.6463	66.3574	64.7078	68.6333	70.7859	81.0010	88.4939	100.7485 (64)
Total per year (kWh/year)												980.8710 (64)
Electric shower(s)												981 (64)
	58.3577	51.9972	56.7789	54.1834	55.2002	52.6556	54.4108	55.2002	54.1834	56.7789	55.7113	58.3577 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												663.8154 (64a)
Heat gains from water heating, kWh/month												
	40.1018	35.3087	37.5325	33.5105	32.7116	29.7532	29.7796	30.9584	31.2423	34.4450	36.0513	39.7765 (65)

5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	157.5805	174.4642	157.5805	162.8332	157.5805	162.8332	157.5805	157.5805	162.8332	157.5805	162.8332	157.5805 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	300.9461	304.0690	296.1995	279.4461	258.2980	238.4218	225.1432	222.0204	229.8899	246.6433	267.7914	287.6676 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666 (71)
Water heating gains (Table 5)												
	53.9003	52.5427	50.4470	46.5423	43.9672	41.3240	40.0264	41.6107	43.3921	46.2970	50.0712	53.4631 (72)
Total internal gains												
	578.9520	597.6008	570.7519	555.3466	526.3707	509.1039	489.2751	487.7366	502.6402	517.0458	547.2208	565.2362 (73)

6. Solar gains

[Jan]		Area m ²		Solar flux Table 6a W/m ²		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North		1.4200		10.6334		0.6300		0.7000		0.7700		4.6146 (74)
East		11.5200		19.6403		0.6300		0.7000		0.7700		69.1467 (76)
South		2.2000		46.7521		0.6300		0.7000		0.7700		31.4337 (78)
West		6.6400		19.6403		0.6300		0.7000		0.7700		39.8554 (80)
Solar gains												
	145.0504	273.5303	431.7234	610.3341	737.3147	751.5564	716.7329	621.6814	494.9350	319.0407	178.8652	120.6466 (83)
Total gains												
	724.0024	871.1311	1002.4753	1165.6807	1263.6854	1260.6603	1206.0080	1109.4179	997.5753	836.0865	726.0859	685.8828 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.2488	20.2974	20.3452	20.5728	20.6160	20.8193	20.8193	20.8574	20.7405	20.6160	20.5289	20.4386
alpha	2.3499	2.3532	2.3563	2.3715	2.3744	2.3880	2.3880	2.3905	2.3827	2.3744	2.3686	2.3626
util living area												
	0.9572	0.9343	0.8975	0.8226	0.7160	0.5764	0.4532	0.4994	0.6928	0.8664	0.9382	0.9619 (86)
MIT												
	17.9179	18.3000	18.8774	19.6348	20.2613	20.6964	20.8776	20.8420	20.4974	19.6488	18.6590	17.8593 (87)
Th 2												
	20.0172	20.0193	20.0214	20.0312	20.0330	20.0415	20.0415	20.0431	20.0383	20.0330	20.0293	20.0254 (88)
util rest of house												
	0.9518	0.9262	0.8844	0.7994	0.6770	0.5149	0.3700	0.4159	0.6377	0.8437	0.9291	0.9571 (89)
MIT 2												
	17.1833	17.5609	18.1285	18.8661	19.4531	19.8409	19.9802	19.9595	19.6816	18.8959	17.9266	17.1306 (90)
Living area fraction												
									fLA = Living area / (4) =			0.1462 (91)
MIT												
	17.2907	17.6689	18.2380	18.9785	19.5712	19.9660	20.1114	20.0886	19.8009	19.0059	18.0337	17.2371 (92)
Temperature adjustment												
												0.0000
adjusted MIT												
	17.2907	17.6689	18.2380	18.9785	19.5712	19.9660	20.1114	20.0886	19.8009	19.0059	18.0337	17.2371 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9307	0.9000	0.8541	0.7695	0.6562	0.5097	0.3765	0.4201	0.6224	0.8136	0.9039	0.9375 (94)
Useful gains	673.8010	783.9823	856.2053	897.0469	829.1773	642.5236	454.0188	466.0733	620.8749	680.2730	656.2963	643.0041 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	1861.7667	1825.6087	1674.2701	1421.6538	1107.9752	747.9496	489.4457	513.2016	797.6530	1183.2447	1545.5851	1851.0691 (97)
Space heating kWh												
	883.8465	699.9729	608.6403	377.7169	207.4256	0.0000	0.0000	0.0000	0.0000	374.2110	640.2880	898.8003 (98a)
Space heating requirement - total per year (kWh/year)												
												4690.9015
Solar heating kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												
												0.0000
Space heating kWh												
	883.8465	699.9729	608.6403	377.7169	207.4256	0.0000	0.0000	0.0000	0.0000	374.2110	640.2880	898.8003 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												
												4690.9015
Space heating per m ²												
										(98c) / (4) =		35.3497 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1310.2477	1031.4716	1057.4144	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7285	0.7908	0.7569	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	954.4863	815.7000	800.3288	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1402.7526	1342.0438	1232.3350	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	322.7517	391.5998	321.4126	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	80.6879	97.8999	80.3532	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												258.9410 (107)
Energy for space heating												35.3497 (99)
Energy for space cooling												1.9513 (108)
Total												37.3010 (109)
Fabric Energy Efficiency (DFEE)												37.3 (109)

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SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	331.7500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1206 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3706 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3150 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.4016	0.3937	0.3859	0.3465	0.3386	0.2992	0.2992	0.2914	0.3150	0.3386	0.3544	0.3701 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5448	0.5448	0.5424	0.5496	0.5573	0.5628	0.5685 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			21.7800	1.1450	24.9389		(27)
Ground Floor			66.3500	0.1300	8.6255		(28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446		(29a)
Joists FF	66.3500		66.3500	0.1100	7.2985		(30)
Total net area of external elements Aum(A, m ²)			298.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4575		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							78.7271 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				4.2500	0.0600	0.2550	
E10 Eaves (insulation at ceiling level)				28.9900	0.0600	1.7394	
E16 Corner (normal)				25.0000	0.0900	2.2500	
E17 Corner (inverted - internal area greater than external area)				5.0000	-0.0900	-0.4500	
E2 Other lintels (including other steel lintels)				17.5100	0.0500	0.8755	
E3 Sill				16.5800	0.0500	0.8290	
E4 Jamb				36.0000	0.0500	1.8000	
E5 Ground floor (normal)				33.2400	0.1600	5.3184	
E6 Intermediate floor within a dwelling				33.2400	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6173 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	81.0748 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	63.5675	63.2247	62.8886	61.3103	61.0149	59.6402	59.6402	59.3856	60.1697	61.0149	61.6124	62.2369 (38)
Average = Sum(39)m / 12 =	144.6423	144.2995	143.9635	142.3851	142.0898	140.7151	140.7151	140.4605	141.2446	142.0898	142.6872	143.3118 (39)
												142.3837
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0900	1.0874	1.0849	1.0730	1.0708	1.0604	1.0604	1.0585	1.0644	1.0708	1.0753	1.0800 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9017 (42)
Hot water usage for mixer showers	

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Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for other uses	31.4602	30.9930	30.3350	29.1219	28.2135	27.2062	26.6622	27.3155	28.0269	29.1047	30.3428	31.3539 (42b)
Average daily hot water use (litres/day)	44.3460	42.7334	41.1208	39.5082	37.8956	36.2831	36.2831	37.8956	39.5082	41.1208	42.7334	44.3460 (42c)
												69.4831 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	75.8062	73.7264	71.4558	68.6301	66.1091	63.4893	62.9452	65.2111	67.5351	70.2255	73.0762	75.6998 (44)
Distribution loss (46)m = 0.15 x (45)m	120.0585	104.9854	109.8250	93.9512	88.9956	78.0675	76.1268	80.7450	83.2775	95.2953	104.1105	118.5276 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	102.0497	89.2376	93.3512	79.8585	75.6463	66.3574	64.7078	68.6333	70.7859	81.0010	88.4939	100.7485 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.0497	89.2376	93.3512	79.8585	75.6463	66.3574	64.7078	68.6333	70.7859	81.0010	88.4939	100.7485 (64)
12Total per year (kWh/year)												981 (64)
Electric shower(s)	58.3577	51.9972	56.7789	54.1834	55.2002	52.6556	54.4108	55.2002	54.1834	56.7789	55.7113	58.3577 (64a)
												980.8710 (64b)
Heat gains from water heating, kWh/month	40.1018	35.3087	37.5325	33.5105	32.7116	29.7532	29.7796	30.9584	31.2423	34.4450	36.0513	39.7765 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833	145.0833 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	157.5805	174.4642	157.5805	162.8332	157.5805	162.8332	157.5805	157.5805	162.8332	157.5805	162.8332	157.5805 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.9461	304.0690	296.1995	279.4461	258.2980	238.4218	225.1432	222.0204	229.8899	246.6433	267.7914	287.6676 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083	37.5083 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666 (71)
Water heating gains (Table 5)	53.9003	52.5427	50.4470	46.5423	43.9672	41.3240	40.0264	41.6107	43.3921	46.2970	50.0712	53.4631 (72)
Total internal gains	578.9520	597.6008	570.7519	555.3466	526.3707	509.1039	489.2751	487.7366	502.6402	517.0458	547.2208	565.2362 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.4200	10.6334	0.6300		0.7000		0.7700		4.6146 (74)
East				11.5200	19.6403	0.6300		0.7000		0.7700		69.1467 (76)
South				2.2000	46.7521	0.6300		0.7000		0.7700		31.4337 (78)
West				6.6400	19.6403	0.6300		0.7000		0.7700		39.8554 (80)
Solar gains	145.0504	273.5303	431.7234	610.3341	737.3147	751.5564	716.7329	621.6814	494.9350	319.0407	178.8652	120.6466 (83)
Total gains	724.0024	871.1311	1002.4753	1165.6807	1263.6854	1260.6603	1206.0080	1109.4179	997.5753	836.0865	726.0859	685.8828 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.0631	20.1107	20.1577	20.3811	20.4235	20.6230	20.6230	20.6604	20.5457	20.4235	20.3380	20.2493
alpha	2.3375	2.3407	2.3438	2.3587	2.3616	2.3749	2.3749	2.3774	2.3697	2.3616	2.3559	2.3500
util living area	0.9573	0.9346	0.8981	0.8239	0.7181	0.5791	0.4561	0.5022	0.6950	0.8673	0.9385	0.9620 (86)
MIT	17.8906	18.2729	18.8524	19.6140	20.2466	20.6884	20.8737	20.8373	20.4869	19.6307	18.6355	17.8319 (87)
Th 2	20.0090	20.0111	20.0132	20.0230	20.0248	20.0333	20.0333	20.0349	20.0300	20.0248	20.0211	20.0172 (88)
util rest of house	0.9519	0.9265	0.8850	0.8007	0.6790	0.5172	0.3719	0.4179	0.6397	0.8446	0.9294	0.9572 (89)
MIT 2	17.1513	17.5291	18.0989	18.8406	19.4337	19.8276	19.9702	19.9490	19.6662	18.8730	17.8983	17.0984 (90)
Living area fraction	17.2594	17.6378	18.2090	18.9537	19.5526	19.9535	20.1022	20.0789	19.7862	18.9838	18.0061	17.2056 (91)
MIT	17.2594	17.6378	18.2090	18.9537	19.5526	19.9535	20.1022	20.0789	19.7862	18.9838	18.0061	17.2056 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2594	17.6378	18.2090	18.9537	19.5526	19.9535	20.1022	20.0789	19.7862	18.9838	18.0061	17.2056 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9307	0.9001	0.8545	0.7705	0.6577	0.5116	0.3783	0.4220	0.6240	0.8143	0.9040	0.9375 (94)
Ext temp.	673.8202	784.1359	856.6380	898.1497	831.1192	645.0112	456.2393	468.1698	622.4769	680.8141	656.4054	643.0044 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)

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Space heating kWh	1874.4750	1838.0600	1685.6722	1431.4963	1115.7681	753.3136	492.8192	516.7352	803.1442	1191.2517	1556.1584	1863.8543	(97)
Space heating requirement - total per year (kWh/year)	893.2872	708.2370	616.8014	384.0096	211.7788	0.0000	0.0000	0.0000	0.0000	379.7656	647.8221	908.3124	(98a)
Solar heating kWh												4750.0141	
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating kWh	893.2872	708.2370	616.8014	384.0096	211.7788	0.0000	0.0000	0.0000	0.0000	379.7656	647.8221	908.3124	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4750.0141	
Space heating per m2										(98c) / (4) =		35.7951	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1322.7215	1041.2914	1067.4996	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7241	0.7868	0.7526	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	957.7419	819.2455	803.3872	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1402.7526	1342.0438	1232.3350	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	320.4077	388.9619	319.1371	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	80.1019	97.2405	79.7843	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												257.1267	(107)
Energy for space heating												35.7951	(99)
Energy for space cooling												1.9377	(108)
Total												37.7328	(109)
Fabric Energy Efficiency (TFEE)												37.7	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.7500 (5)

2. Ventilation rate

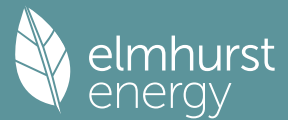
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	60.0000 / (5) = 0.1809 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4309 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3662 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4669	0.4578	0.4486	0.4029	0.3937	0.3479	0.3479	0.3388	0.3662	0.3937	0.4120	0.4303	(22b)
Effective ac	0.6090	0.6048	0.6006	0.5811	0.5775	0.5605	0.5605	0.5574	0.5671	0.5775	0.5849	0.5926	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			21.7800	1.1450	24.9389			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			66.3500	0.1100	7.2985	75.0000	4976.2500	(28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	9.0000	1282.2300	(29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	9.0000	597.1500	(30)

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Total net area of external elements Aum(A, m2)	298.9000			(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	67.1305		(33)
GF	80.0000		9.0000	720.0000 (32c)
FF	120.0000		9.0000	1080.0000 (32c)
Internal Floor 1	66.3500		18.0000	1194.3000 (32d)
Internal Ceiling 1	66.3500		9.0000	597.1500 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10447.0800		(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		78.7271		(35)

List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	4.2500	0.0600	0.2550	
E10 Eaves (insulation at ceiling level)	28.9900	0.0600	1.7394	
E16 Corner (normal)	25.0000	0.0900	2.2500	
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500	
E2 Other lintels (including other steel lintels)	17.5100	0.0500	0.8755	
E3 Sill	16.5800	0.0500	0.8290	
E4 Jamb	36.0000	0.0500	1.8000	
E5 Ground floor (normal)	33.2400	0.1600	5.3184	
E6 Intermediate floor within a dwelling	33.2400	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.6173	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =			79.7478 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	66.6738	66.2103	65.7561	63.6223	63.2231	61.3647	61.3647	61.0206	62.0806	63.2231	64.0307	64.8750
Average = Sum(39)m / 12 =	146.4216	145.9582	145.5039	143.3702	142.9710	141.1126	141.1126	140.7684	141.8284	142.9710	143.7786	144.6229
												143.3683
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1034	1.0999	1.0965	1.0804	1.0774	1.0634	1.0634	1.0608	1.0688	1.0774	1.0835	1.0898
HLP (average)												1.0804
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9017	(42)
Hot water usage for mixer showers														
Hot water usage for baths	91.0890	89.7201	87.7254	83.9088	81.0923	77.9513	76.1660	78.1456	80.3157	83.6881	87.5867	90.7400	90.7400	(42a)
Hot water usage for other uses	31.4602	30.9930	30.3350	29.1219	28.2135	27.2062	26.6622	27.3155	28.0269	29.1047	30.3428	31.3539	31.3539	(42b)
Average daily hot water use (litres/day)	44.3460	42.7334	41.1208	39.5082	37.8956	36.2831	36.2831	37.8956	39.5082	41.1208	42.7334	44.3460	44.3460	(42c)
													153.4641	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	166.8952	163.4465	159.1812	152.5389	147.2014	141.4406	139.1112	143.3567	147.8508	153.9136	160.6629	166.4399	166.4399	(44)
Energy content (annual)	264.3212	232.7456	244.6556	208.8182	198.1614	173.9177	168.2429	177.5056	182.3148	208.8593	228.8937	260.6046	260.6046	(45)
Distribution loss (46)m = 0.15 x (45)m													2549.0406	
Water storage loss:	39.6482	34.9118	36.6983	31.3227	29.7242	26.0877	25.2364	26.6258	27.3472	31.3289	34.3341	39.0907	39.0907	(46)
Store volume													250.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.7830	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796	317.5796	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796	317.5796	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000	(64a)
Heat gains from water heating, kWh/month	133.4668	118.5570	126.9280	113.5418	111.4687	101.9374	101.5208	104.6007	104.7294	115.0258	120.2169	132.2311	132.2311	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	38.2735	33.9942	27.6459	20.9298	15.6452	13.2084	14.2721	18.5514	24.8997	31.6159	36.9004	39.3373	39.3373	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	449.1733	453.8343	442.0887	417.0837	385.5194	355.8534	336.0347	331.3737	343.1193	368.1243	399.6886	429.3546	429.3546	(68)
Pumps, fans	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	(71)
Total internal gains	179.3909	176.4241	170.6022	157.6969	149.8235	141.5797	136.4527	140.5923	145.4575	154.6045	166.9679	177.7299	177.7299	(72)
	783.1827	780.5976	756.6818	712.0553	667.3331	623.9864	600.1045	603.8623	626.8214	670.6896	719.9018	762.7668	762.7668	(73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North	1.4200				10.6334	0.6300	0.7000	0.7700	4.6146 (74)			
East	11.5200				19.6403	0.6300	0.7000	0.7700	69.1467 (76)			
South	2.2000				46.7521	0.6300	0.7000	0.7700	31.4337 (78)			
West	6.6400				19.6403	0.6300	0.7000	0.7700	39.8554 (80)			

Solar gains	145.0504	273.5303	431.7234	610.3341	737.3147	751.5564	716.7329	621.6814	494.9350	319.0407	178.8652	120.6466 (83)
Total gains	928.2331	1054.1279	1188.4053	1322.3894	1404.6478	1375.5428	1316.8373	1225.5437	1121.7564	989.7303	898.7670	883.4133 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.8193	19.8822	19.9443	20.2411	20.2976	20.5649	20.5649	20.6152	20.4611	20.2976	20.1836	20.0658
alpha	2.3213	2.3255	2.3296	2.3494	2.3532	2.3710	2.3710	2.3743	2.3641	2.3532	2.3456	2.3377
util living area	0.9318	0.9081	0.8654	0.7896	0.6823	0.5468	0.4260	0.4664	0.6535	0.8277	0.9093	0.9381 (86)
MIT	18.1626	18.4960	19.0530	19.7484	20.3263	20.7246	20.8906	20.8612	20.5528	19.7884	18.8618	18.1097 (87)
Th 2	19.9981	20.0009	20.0037	20.0169	20.0193	20.0308	20.0308	20.0330	20.0264	20.0193	20.0143	20.0091 (88)
util rest of house	0.9236	0.8973	0.8493	0.7638	0.6416	0.4855	0.3452	0.3851	0.5965	0.8006	0.8968	0.9307 (89)
MIT 2	16.6776	17.0980	17.7960	18.6591	19.3481	19.8001	19.9616	19.9404	19.6258	18.7286	17.5738	16.6171 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	16.8947	17.3023	17.9797	18.8183	19.4912	19.9353	20.0974	20.0750	19.7613	18.8836	17.7621	16.8353 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.8947	17.3023	17.9797	18.8183	19.4912	19.9353	20.0974	20.0750	19.7613	18.8836	17.7621	16.8353 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8876	0.8577	0.8075	0.7265	0.6171	0.4790	0.3510	0.3888	0.5791	0.7618	0.8580	0.8964 (94)
Useful gains	823.8777	904.0737	959.6066	960.6729	866.7506	658.9191	462.2720	476.5356	649.6434	754.0100	771.0980	791.8848 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1844.1400	1810.2242	1670.3461	1421.9952	1113.9088	752.8770	493.5304	517.3284	802.9378	1184.3074	1532.9787	1827.3571 (97)
Space heating kWh	759.0752	608.9331	528.7903	332.1521	183.8857	0.0000	0.0000	0.0000	0.0000	320.1413	548.5541	770.3914 (98a)
Space heating requirement - total per year (kWh/year)	4051.9230											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	759.0752	608.9331	528.7903	332.1521	183.8857	0.0000	0.0000	0.0000	0.0000	320.1413	548.5541	770.3914 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4051.9230											
Space heating per m2	(98c) / (4) = 30.5345 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	759.0752	608.9331	528.7903	332.1521	183.8857	0.0000	0.0000	0.0000	0.0000	320.1413	548.5541	770.3914 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	303.7516	243.6707	211.6007	132.9140	73.5837	0.0000	0.0000	0.0000	0.0000	128.1077	219.5095	308.2799 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	183.4930	162.3112	172.2620	150.7455	145.7090	130.8137	128.6225	133.9124	135.6093	151.8186	162.2107	181.3704 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	33.5006	26.8754	24.1983	17.7287	13.6942	11.1883	12.4923	16.2380	21.0915	27.6732	31.2568	34.4317 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													1621.4178	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													175.1000	
Water heating fuel used													1838.8784	(219)
Space cooling fuel													0.0000	(221)

Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													270.3689	(232)

Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													3730.6650	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1621.4178	16.4900	267.3718	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1838.8784	16.4900	303.2310	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	270.3689	16.4900	44.5838	(250)
Additional standing charges			0.0000	(251)
Total energy cost			615.1867	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2463	(257)
SAP value		79.7975	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1621.4178	0.1544	250.4117	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1838.8784	0.1410	259.2472	(264)
Space and water heating			509.6589	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	270.3689	0.1443	39.0226	(268)
Total CO2, kg/year			548.6815	(272)
CO2 emissions per m2			4.1300	(273)
EI value			95.8625	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400	(1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	331.7500	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 60.0000 / (5) = 0.1809 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.4309 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3662 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Adj infilt rate	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Effective ac	0.3296	0.3021	0.2930	0.2930	0.3021	0.2655	0.2838	0.2564	0.2564	0.2747	0.2564	0.2930	(22b)
	0.5543	0.5456	0.5429	0.5429	0.5456	0.5352	0.5403	0.5329	0.5329	0.5377	0.5329	0.5429	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			21.7800	1.1450	24.9389			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			66.3500	0.1100	7.2985	75.0000	4976.2500	(28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	9.0000	1282.2300	(29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	9.0000	597.1500	(30)
Total net area of external elements Aum(A, m2)			298.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.1305			(33)
GF			80.0000			9.0000	720.0000	(32c)
FF			120.0000			9.0000	1080.0000	(32c)
Internal Floor 1			66.3500			18.0000	1194.3000	(32d)
Internal Ceiling 1			66.3500			9.0000	597.1500	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 10447.0800 (34)
List of Thermal Bridges 78.7271 (35)

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	4.2500	0.0600	0.2550	
E10 Eaves (insulation at ceiling level)	28.9900	0.0600	1.7394	
E16 Corner (normal)	25.0000	0.0900	2.2500	
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500	
E2 Other lintels (including other steel lintels)	17.5100	0.0500	0.8755	
E3 Sill	16.5800	0.0500	0.8290	
E4 Jamb	36.0000	0.0500	1.8000	
E5 Ground floor (normal)	33.2400	0.1600	5.3184	
E6 Intermediate floor within a dwelling	33.2400	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				12.6173 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	79.7478 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Heat transfer coeff 60.6856 59.7358 59.4375 59.4375 59.7358 58.5978 59.1484 58.3362 58.3362 58.8685 58.3362 59.4375 (38)
Average = Sum(39)m / 12 = 140.4334 139.4836 139.1853 139.1853 139.4836 138.3456 138.8963 138.0841 138.0841 138.6164 138.0841 139.1853 (39)
138.9223

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0583	1.0511	1.0489	1.0489	1.0511	1.0425	1.0467	1.0406	1.0406	1.0446	1.0406	1.0489	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9017 (42)
Hot water usage for mixer showers													
91.0890	89.7201	87.7254	83.9088	81.0923	77.9513	76.1660	78.1456	80.3157	83.6881	87.5867	90.7400		(42a)
Hot water usage for baths													
31.4602	30.9930	30.3350	29.1219	28.2135	27.2062	26.6622	27.3155	28.0269	29.1047	30.3428	31.3539		(42b)
Hot water usage for other uses													
44.3460	42.7334	41.1208	39.5082	37.8956	36.2831	36.2831	37.8956	39.5082	41.1208	42.7334	44.3460		(42c)
Average daily hot water use (litres/day)													153.4641 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
166.8952	163.4465	159.1812	152.5389	147.2014	141.4406	139.1112	143.3567	147.8508	153.9136	160.6629	166.4399		(44)
Energy conte	264.3212	232.7456	244.6556	208.8182	198.1614	173.9177	168.2429	177.5056	182.3148	208.8593	228.8937	260.6046	(45)
Energy content (annual)										Total = Sum(45)m =	2549.0406		
Distribution loss (46)m = 0.15 x (45)m													
39.6482	34.9118	36.6983	31.3227	29.7242	26.0877	25.2364	26.6258	27.3472	31.3289	34.3341	39.0907		(46)
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127		(56)
If cylinder contains dedicated solar storage													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127		(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624		(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(61)
Total heat required for water heating calculated for each month													
321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796		(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(63d)
Output from w/h													
321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796		(64)
Total per year (kWh/year) = Sum(64)m =													3219.8760 (64)

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Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	133.4668	118.5570	126.9280	113.5418	111.4687	101.9374	101.5208	104.6007	104.7294	115.0258	120.2169	132.2311 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.2735	33.9942	27.6459	20.9298	15.6452	13.2084	14.2721	18.5514	24.8997	31.6159	36.9004	39.3373 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.1733	453.8343	442.0887	417.0837	385.5194	355.8534	336.0347	331.3737	343.1193	368.1243	399.6886	429.3546 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666 (71)
Water heating gains (Table 5)	179.3909	176.4241	170.6022	157.6969	149.8235	141.5797	136.4527	140.5923	145.4575	154.6045	166.9679	177.7299 (72)
Total internal gains	783.1827	780.5976	756.6818	712.0553	667.3331	623.9864	600.1045	603.8623	626.8214	670.6896	719.9018	762.7668 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.4200	13.0723		0.6300		0.7000		0.7700		5.6730 (74)
East				11.5200	24.4329		0.6300		0.7000		0.7700		86.0199 (76)
South				2.2000	54.9219		0.6300		0.7000		0.7700		36.9267 (78)
West				6.6400	24.4329		0.6300		0.7000		0.7700		49.5809 (80)
Solar gains	178.2004	294.9518	460.6015	671.0509	788.0014	869.3936	812.8462	712.9079	563.9647	366.5531	220.4939	144.5011	(83)
Total gains	961.3831	1075.5494	1217.2833	1383.1062	1455.3345	1493.3799	1412.9507	1316.7702	1190.7861	1037.2427	940.3957	907.2678	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.6644	20.8051	20.8497	20.8497	20.8051	20.9762	20.8931	21.0159	21.0159	20.9352	21.0159	20.8497	
alpha	2.3776	2.3870	2.3900	2.3900	2.3870	2.3984	2.3929	2.4011	2.4011	2.3957	2.4011	2.3900	
util living area	0.9175	0.8952	0.8417	0.7488	0.6162	0.4478	0.3343	0.3454	0.5771	0.7743	0.8835	0.9255 (86)	
MIT	18.5553	18.8005	19.3803	20.0139	20.5469	20.8558	20.9491	20.9475	20.7142	20.1317	19.2745	18.5041 (87)	
Th 2	20.0351	20.0410	20.0428	20.0428	20.0410	20.0480	20.0446	20.0497	20.0497	20.0463	20.0497	20.0428 (88)	
util rest of house	0.9076	0.8830	0.8230	0.7190	0.5689	0.3817	0.2522	0.2590	0.5128	0.7389	0.8673	0.9164 (89)	
MIT 2	17.1936	17.5025	18.2246	18.9941	19.6124	19.9408	20.0188	20.0237	19.8122	19.1575	18.1097	17.1344 (90)	
Living area fraction	17.3926	17.6922	18.3935	19.1432	19.7490	20.0746	20.1548	20.1587	19.9440	19.2999	18.2800	17.3347 (92)	
MIT	17.3926	17.6922	18.3935	19.1432	19.7490	20.0746	20.1548	20.1587	19.9440	19.2999	18.2800	17.3347 (93)	
Temperature adjustment												0.0000	
adjusted MIT	17.3926	17.6922	18.3935	19.1432	19.7490	20.0746	20.1548	20.1587	19.9440	19.2999	18.2800	17.3347 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8704	0.8438	0.7834	0.6868	0.5532	0.3836	0.2620	0.2693	0.5050	0.7063	0.8282	0.8807 (94)	
Useful gains	836.7667	907.5161	953.5809	949.9680	805.1506	572.8775	370.2387	354.6354	601.3821	732.6174	778.8435	799.0093 (95)	
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)	
Heat loss rate W	1712.2538	1700.6163	1544.0555	1314.3532	969.2778	619.0409	382.6335	367.1293	696.5001	1039.6108	1391.8872	1688.9696 (97)	
Space heating kWh	651.3624	532.9634	439.3131	262.3573	122.1106	0.0000	0.0000	0.0000	0.0000	228.4031	441.3914	662.1305 (98a)	
Space heating requirement - total per year (kWh/year)												3340.0318	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)	
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	651.3624	532.9634	439.3131	262.3573	122.1106	0.0000	0.0000	0.0000	0.0000	228.4031	441.3914	662.1305 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												3340.0318	
Space heating per m ²												(98c) / (4) =	25.1698 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	651.3624	532.9634	439.3131	262.3573	122.1106	0.0000	0.0000	0.0000	0.0000	228.4031	441.3914	662.1305 (98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)	
Space heating fuel (main heating system)	260.6492	213.2707	175.7956	104.9849	48.8638	0.0000	0.0000	0.0000	0.0000	91.3978	176.6272	264.9582 (211)	
Space heating efficiency (main heating system 2)													

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	321.2963	284.2070	301.6307	263.9553	255.1364	229.0548	225.2180	234.4807	237.4519	265.8344	284.0309	317.5796	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	183.4930	162.3112	172.2620	150.7455	145.7090	130.8137	128.6225	133.9124	135.6093	151.8186	162.2107	181.3704	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	33.5006	26.8754	24.1983	17.7287	13.6942	11.1883	12.4923	16.2380	21.0915	27.6732	31.2568	34.4317	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1336.5474	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1838.8784	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												270.3689	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3445.7946	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1336.5474	26.0600	348.3042	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1838.8784	26.0600	479.2117	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	270.3689	26.0600	70.4581	(250)
Additional standing charges			0.0000	(251)
Total energy cost			897.9741	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1336.5474	0.1551	207.2577	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1838.8784	0.1410	259.2472	(264)
Space and water heating			466.5049	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	270.3689	0.1443	39.0226	(268)
Total CO2, kg/year			505.5275	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1336.5474	1.5741	2103.8755	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1838.8784	1.5213	2797.4882	(278)
Space and water heating			4901.3637	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	270.3689	1.5338	414.7009	(282)
Total Primary energy kWh/year			5316.0646	(286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:

C 80

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Current environmental impact rating:

A 96

N Solar water heating
U Solar photovoltaic panels
V2 Wind turbine

Recommended
Recommended
Not applicable

Recommended measures:
N Solar water heating
U Solar photovoltaic panels

SAP change
+ 1.8
+ 5.1

Cost change
-£ 103
-£ 261

CO2 change
-49 kg (9.7%)
-135 kg (29.6%)

Recommended measures

Solar water heating
Solar photovoltaic panels

Typical annual savings
£103
£261
£364

Energy efficiency
B 82
B 87

Environmental impact
A 96
A 97

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £898	Potential £795	Saving £103
Electricity			
Space heating	£348	£370	-£21
Water heating	£479	£355	£124
Lighting	£70	£70	£0
Generated (PV)	-£0	-£261	£261
Total cost of fuels	£898	£534	£364
Total cost of uses	£897	£534	£364
Delivered energy	26 kWh/m²	15 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	2 kg/m²	1 kg/m²
Primary energy	40 kWh/m²	24 kWh/m²	16 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.7500 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 60.0000 / (5) = 0.1809 (8)

Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
Blower Door
Yes
5.0000 (17)
0.4309 (18)
2 (19)

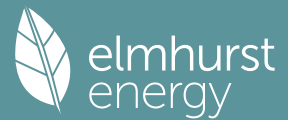
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3662 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4669	0.4578	0.4486	0.4029	0.3937	0.3479	0.3479	0.3388	0.3662	0.3937	0.4120	0.4303 (22b)
Effective ac	0.6090	0.6048	0.6006	0.5811	0.5775	0.5605	0.5605	0.5574	0.5671	0.5775	0.5849	0.5926 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K

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Windows (Uw = 1.20)			21.7800	1.1450	24.9389			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			66.3500	0.1100	7.2985	75.0000	4976.2500	(28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	9.0000	1282.2300	(29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	9.0000	597.1500	(30)
Total net area of external elements Aum(A, m2)			298.9000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	67.1305				(33)
GF			80.0000			9.0000	720.0000	(32c)
FF			120.0000			9.0000	1080.0000	(32c)
Internal Floor 1			66.3500			18.0000	1194.3000	(32d)
Internal Ceiling 1			66.3500			9.0000	597.1500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10447.0800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 78.7271 (35)

List of Thermal Bridges													
K1 Element													
E12 Gable (insulation at ceiling level)													
E10 Eaves (insulation at ceiling level)													
E16 Corner (normal)													
E17 Corner (inverted - internal area greater than external area)													
E2 Other lintels (including other steel lintels)													
E3 Sill													
E4 Jamb													
E5 Ground floor (normal)													
E6 Intermediate floor within a dwelling													
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													
Point Thermal bridges													
Total fabric heat loss													

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	66.6738	66.2103	65.7561	63.6223	63.2231	61.3647	61.3647	61.0206	62.0806	63.2231	64.0307	64.8750	(38)
Average = Sum(39)m / 12 =	146.4216	145.9582	145.5039	143.3702	142.9710	141.1126	141.1126	140.7684	141.8284	142.9710	143.7786	144.6229	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1034	1.0999	1.0965	1.0804	1.0774	1.0634	1.0634	1.0608	1.0688	1.0774	1.0835	1.0898	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9017 (42)
Hot water usage for mixer showers													
Hot water usage for baths													
Hot water usage for other uses													
Average daily hot water use (litres/day)													
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	166.8952	163.4465	159.1812	152.5389	147.2014	141.4406	139.1112	143.3567	147.8508	153.9136	160.6629	166.4399	(44)
Energy content (annual)	264.3212	232.7456	244.6556	208.8182	198.1614	173.9177	168.2429	177.5056	182.3148	208.8593	228.8937	260.6046	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	39.6482	34.9118	36.6983	31.3227	29.7242	26.0877	25.2364	26.6258	27.3472	31.3289	34.3341	39.0907	(46)
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	321.2963	284.2070	300.2349	257.2017	242.3421	216.4481	212.1910	222.3842	232.0491	264.4386	284.0309	317.5796	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.8000 (H2)
Collector linear heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0000 (H4)
Collector loop efficiency													0.9000 (H5)
Incidence angle modifier													1.0000 (H6)
Overshading factor													0.8000 (H8)
Overall heat loss coefficient of system													6.5000 (H10)
Heat loss coefficient of collector loop													3.9667 (H11)
Dedicated solar storage volume													75.0000 (H12)
Effective solar volume													75.0000 (H14)
Reference volume													225.0000 (H15)
Storage tank correction coefficient													1.3161 (H16)
Heat delivered to hot water													644.8508 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													644.8508
Solar input	-0.0000	-16.1755	-59.4857	-82.7576	-109.4877	-101.1574	-100.5336	-87.1389	-59.2730	-28.8414	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	321.2963	268.0315	240.7492	174.4441	132.8544	115.2907	111.6574	135.2453	172.7761	235.5972	284.0309	317.5796	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	133.4668	118.5570	125.8114	108.1389	101.2332	91.8520	91.0993	94.9235	100.4071	113.9092	120.2169	132.2311	(65)

5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.2735	33.9942	27.6459	20.9298	15.6452	13.2084	14.2721	18.5514	24.8997	31.6159	36.9004	39.3373	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.1733	453.8343	442.0887	417.0837	385.5194	355.8534	336.0347	331.3737	343.1193	368.1243	399.6886	429.3546	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	(71)
Water heating gains (Table 5)	179.3909	176.4241	169.1014	150.1929	136.0662	127.5722	122.4452	127.5853	139.4543	153.1037	166.9679	177.7299	(72)
Total internal gains	783.1827	780.5976	755.1810	704.5513	653.5758	609.9789	586.0970	590.8554	620.8182	669.1888	719.9018	762.7668	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.4200	10.6334	0.6300		0.7000		0.7700		4.6146 (74)
East				11.5200	19.6403	0.6300		0.7000		0.7700		69.1467 (76)
South				2.2000	46.7521	0.6300		0.7000		0.7700		31.4337 (78)
West				6.6400	19.6403	0.6300		0.7000		0.7700		39.8554 (80)
Solar gains	145.0504	273.5303	431.7234	610.3341	737.3147	751.5564	716.7329	621.6814	494.9350	319.0407	178.8652	120.6466 (83)
Total gains	928.2331	1054.1279	1186.9045	1314.8854	1390.8905	1361.5353	1302.8299	1212.5368	1115.7532	988.2295	898.7670	883.4133 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
Jan	19.8193	19.8822	19.9443	20.2411	20.2976	20.5649	20.5649	20.6152	20.4611	20.2976	20.1836	20.0658		
Feb	2.3213	2.3255	2.3296	2.3494	2.3532	2.3710	2.3710	2.3743	2.3641	2.3532	2.3456	2.3377		
util living area	0.9318	0.9081	0.8657	0.7913	0.6858	0.5507	0.4297	0.4702	0.6554	0.8281	0.9093	0.9381	(86)	
MIT	18.1626	18.4960	19.0513	19.7416	20.3182	20.7202	20.8885	20.8587	20.5497	19.7868	18.8618	18.1097	(87)	
Th 2	19.9981	20.0009	20.0037	20.0169	20.0193	20.0308	20.0308	20.0330	20.0264	20.0193	20.0143	20.0091	(88)	
util rest of house	0.9236	0.8973	0.8496	0.7655	0.6452	0.4893	0.3484	0.3886	0.5985	0.8010	0.8968	0.9307	(89)	
MIT 2	16.6776	17.0980	17.7938	18.6512	19.3394	19.7962	19.9602	19.9386	19.6227	18.7268	17.5738	16.6171	(90)	
Living area fraction	16.8947	17.3023	17.9777	18.8106	19.4825	19.9313	20.0959	20.0731	19.7583	18.8818	17.7621	16.8353	(91)	
MIT	16.8947	17.3023	17.9777	18.8106	19.4825	19.9313	20.0959	20.0731	19.7583	18.8818	17.7621	16.8353	(92)	
Temperature adjustment												0.0000		
adjusted MIT	16.8947	17.3023	17.9777	18.8106	19.4825	19.9313	20.0959	20.0731	19.7583	18.8818	17.7621	16.8353	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.8876	0.8577	0.8078	0.7281	0.6203	0.4825	0.3542	0.3922	0.5810	0.7622	0.8580	0.8964	(94)	
Ext temp.	823.8777	904.0737	958.7521	957.4040	862.8201	656.9285	461.4568	475.5182	648.2067	753.2745	771.0980	791.8848	(95)	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Space heating kWh	1844.1400	1810.2242	1670.0447	1420.8915	1112.6726	752.3125	493.3155	517.0556	802.5010	1184.0554	1532.9787	1827.3571	(97)	
Space heating requirement - total per year (kWh/year)	759.0752	608.9331	529.2017	333.7110	185.8903	0.0000	0.0000	0.0000	0.0000	320.5010	548.5541	770.3914	(98a)	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)	
Solar heating contribution - total per year (kWh/year)	759.0752	608.9331	529.2017	333.7110	185.8903	0.0000	0.0000	0.0000	0.0000	320.5010	548.5541	770.3914	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												4056.2578	(99)	
Space heating per m2												30.5671	(99)	

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													65.0000	(208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating efficiency (main heating system 1)	759.0752	608.9331	529.2017	333.7110	185.8903	0.0000	0.0000	0.0000	0.0000	320.5010	548.5541	770.3914	(98)	
Space heating fuel (main heating system)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating efficiency (main heating system 2)	303.7516	243.6707	211.7654	133.5378	74.3859	0.0000	0.0000	0.0000	0.0000	128.2517	219.5095	308.2799	(211)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	321.2963	268.0315	240.7492	174.4441	132.8544	115.2907	111.6574	135.2453	172.7761	235.5972	284.0309	317.5796	(64)	
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
(217)m													(217)	

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Fuel for water heating, kWh/month	183.4930	153.0734	137.4924	99.6254	75.8734	65.8428	63.7678	77.2389	98.6728	134.5501	162.2107	181.3704	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	33.5006	26.8754	24.1983	17.7287	13.6942	11.1883	12.4923	16.2380	21.0915	27.6732	31.2568	34.4317	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.5019	-59.8256	-91.1100	-106.3745	-115.0561	-101.7863	-100.2702	-93.9479	-82.2608	-69.5692	-44.6328	-33.6973	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1623.1524	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1433.2112	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												270.3689	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-938.0326	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2468.6999	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1623.1524	16.4900	267.6578	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1433.2112	16.4900	236.3365	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	270.3689	16.4900	44.5838	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-938.0326	16.4900	-154.6816	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-154.6816	(252)
Total energy cost			407.0886	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.8247	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	86.6314	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1623.1524	0.1544	250.6515	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1433.2112	0.1449	207.7234	(264)
Space and water heating			458.3749	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	270.3689	0.1443	39.0226	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-938.0326	0.1343	-125.9456	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-125.9456	(269)
Total CO2, kg/year			382.5488	(272)
CO2 emissions per m2			2.8800	(273)
EI value			97.1153	
EI rating			97	(274)
EI band			A	

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	66.3500 (1b)	x 2.4000 (2b)	= 159.2400 (1b) - (3b)
First floor	66.3500 (1c)	x 2.6000 (2c)	= 172.5100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.7500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.1809 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4309 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3662 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3296	0.3021	0.2930	0.2930	0.3021	0.2655	0.2838	0.2564	0.2564	0.2747	0.2564	0.2930 (22b)
Effective ac	0.5543	0.5456	0.5429	0.5429	0.5456	0.5352	0.5403	0.5329	0.5329	0.5377	0.5329	0.5429 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			21.7800	1.1450	24.9389		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			66.3500	0.1100	7.2985	75.0000	4976.2500 (28a)
Brick	166.2000	23.7300	142.4700	0.1800	25.6446	9.0000	1282.2300 (29a)
Joists FF	66.3500		66.3500	0.1100	7.2985	9.0000	597.1500 (30)
Total net area of external elements Aum(A, m ²)			298.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.1305		(33)
GF			80.0000			9.0000	720.0000 (32c)
FF			120.0000			9.0000	1080.0000 (32c)
Internal Floor 1			66.3500			18.0000	1194.3000 (32d)
Internal Ceiling 1			66.3500			9.0000	597.1500 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 10447.0800 (34)
78.7271 (35)

List of Thermal Bridges

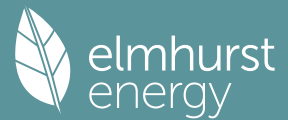
K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	4.2500	0.0600	0.2550
E10 Eaves (insulation at ceiling level)	28.9900	0.0600	1.7394
E16 Corner (normal)	25.0000	0.0900	2.2500
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500
E2 Other lintels (including other steel lintels)	17.5100	0.0500	0.8755
E3 Sill	16.5800	0.0500	0.8290
E4 Jamb	36.0000	0.0500	1.8000
E5 Ground floor (normal)	33.2400	0.1600	5.3184
E6 Intermediate floor within a dwelling	33.2400	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.6173 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	79.7478 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	60.6856	59.7358	59.4375	59.4375	59.7358	58.5978	59.1484	58.3362	58.3362	58.8685	58.3362	59.4375 (38)
Average = Sum(39)m / 12 =	140.4334	139.4836	139.1853	139.1853	139.4836	138.3456	138.8963	138.0841	138.0841	138.6164	138.0841	139.1853 (39)
												138.9223
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0583	1.0511	1.0489	1.0489	1.0511	1.0425	1.0467	1.0406	1.0406	1.0446	1.0406	1.0489 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9017 (42)
Hot water usage for mixer showers	91.0890	89.7201	87.7254	83.9088	81.0923	77.9513	76.1660	78.1456	80.3157	83.6881	87.5867	90.7400 (42a)
Hot water usage for baths	31.4602	30.9930	30.3350	29.1219	28.2135	27.2062	26.6622	27.3155	28.0269	29.1047	30.3428	31.3539 (42b)

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Hot water usage for other uses	44.3460	42.7334	41.1208	39.5082	37.8956	36.2831	36.2831	37.8956	39.5082	41.1208	42.7334	44.3460 (42c)
Average daily hot water use (litres/day)												153.4641 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	166.8952	163.4465	159.1812	152.5389	147.2014	141.4406	139.1112	143.3567	147.8508	153.9136	160.6629	166.4399 (44)
Distribution loss (46)m = 0.15 x (45)m	264.3212	232.7456	244.6556	208.8182	198.1614	173.9177	168.2429	177.5056	182.3148	208.8593	228.8937	260.6046 (45)
Water storage loss:	39.6482	34.9118	36.6983	31.3227	29.7242	26.0877	25.2364	26.6258	27.3472	31.3289	34.3341	39.0907 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												0.0103 (51)
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.7830 (52)
Volume factor from Table 2a												0.5400 (53)
Temperature factor from Table 2b												1.0875 (55)
Enter (49) or (54) in (55)												
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	321.2963	284.2070	300.2349	257.2017	242.3421	216.4481	212.1910	222.3842	232.0491	264.4386	284.0309	317.5796 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												765.8930 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												765.8930
Solar input	-1.7572	-20.9137	-66.4993	-94.4927	-119.3843	-120.2656	-116.8265	-104.3534	-72.9024	-40.9450	-7.5531	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	319.5391	263.2933	233.7356	162.7090	122.9578	96.1825	95.3645	118.0309	159.1467	223.4936	276.4778	317.5796 (64)
												Total per year (kWh/year) = Sum(64)m = 2388.5106 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	133.4668	118.5570	125.8114	108.1389	101.2332	91.8520	91.0993	94.9235	100.4071	113.9092	120.2169	132.2311 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999	174.0999 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.2735	33.9942	27.6459	20.9298	15.6452	13.2084	14.2721	18.5514	24.8997	31.6159	36.9004	39.3373 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.1733	453.8343	442.0887	417.0837	385.5194	355.8534	336.0347	331.3737	343.1193	368.1243	399.6886	429.3546 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117	55.3117 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666	-116.0666 (71)
Water heating gains (Table 5)	179.3909	176.4241	169.1014	150.1929	136.0662	127.5722	122.4452	127.5853	139.4543	153.1037	166.9679	177.7299 (72)
Total internal gains	783.1827	780.5976	755.1810	704.5513	653.5758	609.9789	586.0970	590.8554	620.8182	669.1888	719.9018	762.7668 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W
North					1.4200	13.0723	0.6300	0.7000		0.7700		5.6730 (74)
East					11.5200	24.4329	0.6300	0.7000		0.7700		86.0199 (76)
South					2.2000	54.9219	0.6300	0.7000		0.7700		36.9267 (78)
West					6.6400	24.4329	0.6300	0.7000		0.7700		49.5809 (80)
Solar gains	178.2004	294.9518	460.6015	671.0509	788.0014	869.3936	812.8462	712.9079	563.9647	366.5531	220.4939	144.5011 (83)
Total gains	961.3831	1075.5494	1215.7825	1375.6022	1441.5772	1479.3725	1398.9432	1303.7633	1184.7829	1035.7419	940.3957	907.2678 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.6644	20.8051	20.8497	20.8497	20.8051	20.9762	20.8931	21.0159	21.0159	20.9352	21.0159	20.8497
alpha	2.3776	2.3870	2.3900	2.3900	2.3870	2.3984	2.3929	2.4011	2.4011	2.3957	2.4011	2.3900
util living area	0.9175	0.8952	0.8420	0.7506	0.6198	0.4512	0.3372	0.3484	0.5790	0.7748	0.8835	0.9255 (86)
MIT	18.5553	18.8005	19.3786	20.0081	20.5409	20.8534	20.9481	20.9465	20.7120	20.1304	19.2745	18.5041 (87)
Th 2	20.0351	20.0410	20.0428	20.0428	20.0410	20.0480	20.0446	20.0497	20.0497	20.0463	20.0497	20.0428 (88)
util rest of house												

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MIT 2	0.9076	0.8830	0.8233	0.7209	0.5725	0.3847	0.2546	0.2614	0.5147	0.7394	0.8673	0.9164 (89)
Living area fraction	17.1936	17.5025	18.2226	18.9875	19.6063	19.9389	20.0183	20.0231	19.8102	19.1561	18.1097	17.1344 (90)
MIT	17.3926	17.6922	18.3916	19.1367	19.7429	20.0726	20.1542	20.1581	19.9420	19.2985	18.2800	17.3347 (91)
Temperature adjustment												0.0000 (92)
adjusted MIT	17.3926	17.6922	18.3916	19.1367	19.7429	20.0726	20.1542	20.1581	19.9420	19.2985	18.2800	17.3347 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8704	0.8438	0.7837	0.6885	0.5565	0.3865	0.2644	0.2718	0.5068	0.7068	0.8282	0.8807	(94)
Useful gains	836.7667	907.5161	952.7964	947.1663	802.2597	571.8438	369.9060	354.3023	600.4131	732.0171	778.8435	799.0093	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1712.2538	1700.6163	1543.7890	1313.4476	968.4221	618.7672	382.5494	367.0450	696.2249	1039.4154	1391.8872	1688.9696	(97)
Space heating kWh	651.3624	532.9634	439.6984	263.7225	123.6249	0.0000	0.0000	0.0000	0.0000	228.7043	441.3914	662.1305	(98a)
Space heating requirement - total per year (kWh/year)												3343.5978	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	651.3624	532.9634	439.6984	263.7225	123.6249	0.0000	0.0000	0.0000	0.0000	228.7043	441.3914	662.1305	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3343.5978	
Space heating per m2												25.1967	(99)

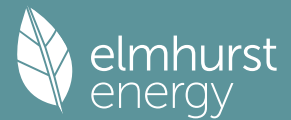
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	651.3624	532.9634	439.6984	263.7225	123.6249	0.0000	0.0000	0.0000	0.0000	228.7043	441.3914	662.1305	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	260.6492	213.2707	175.9498	105.5312	49.4697	0.0000	0.0000	0.0000	0.0000	91.5183	176.6272	264.9582	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	319.5391	263.2933	233.7356	162.7090	122.9578	96.1825	95.3645	118.0309	159.1467	223.4936	276.4778	317.5796	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	182.4895	150.3674	133.4869	92.9235	70.2215	54.9301	54.4629	67.4077	90.8890	127.6377	157.8971	181.3704	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	33.5006	26.8754	24.1983	17.7287	13.6942	11.1883	12.4923	16.2380	21.0915	27.6732	31.2568	34.4317	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-46.6621	-62.8224	-94.0986	-111.1226	-116.7751	-108.8513	-106.2557	-100.6808	-88.7691	-75.6811	-52.3874	-39.0335	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1337.9743	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1364.0837	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												270.3689	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1003.1397	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2049.2872	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year

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Space heating - main system 1	1337.9743	26.0600	348.6761 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1364.0837	26.0600	355.4802 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	270.3689	26.0600	70.4581 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1003.1397	26.0600	-261.4182
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-261.4182 (252)
Total energy cost			534.0442 (255)

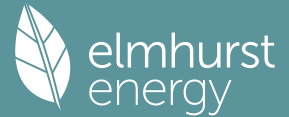
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1337.9743	0.1551	207.4558 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1364.0837	0.1458	198.8250 (264)
Space and water heating			406.2808 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	270.3689	0.1443	39.0226 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1003.1397	0.1345	-134.8876
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-134.8876 (269)
Total CO2, kg/year			321.5128 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1337.9743	1.5740	2106.0354 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1364.0837	1.5392	2099.5643 (278)
Space and water heating			4205.5997 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	270.3689	1.5338	414.7009 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1003.1397	1.4970	-1501.6549
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1501.6549 (283)
Total Primary energy kWh/year			3239.6697 (286)

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Property Reference	FURNERS LANE 8				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 8, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	4.04	TER	8.98	
Environmental	96 A	% DER < TER				55.01
CO ₂ Emissions (t/year)	0.56	DFEE	39.93	TFEE	40.34	
Compliance Check	See BREL	% DFEE < TFEE				1.03
% DPER < TPER	9.90	DPER	42.29	TPER	46.94	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

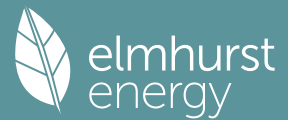
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1577 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4077	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3466 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.4419	0.4332	0.4246	0.3812	0.3726	0.3292	0.3292	0.3206	0.3466	0.3726	0.3899	0.4072 (22b)
	0.5976	0.5938	0.5901	0.5727	0.5694	0.5542	0.5542	0.5514	0.5601	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			35.9200	1.1450	41.1298		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000 (28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600 (29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500 (29a)
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400 (30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900 (30)
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400 (30)
Total net area of external elements Aum(A, m ²)			348.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609		(33)
GF			110.0000			9.0000	990.0000 (32c)
FF			130.0000			9.0000	1170.0000 (32c)
Internal Floor 1			75.1100			18.0000	1351.9800 (32d)
Internal Ceiling 1			75.1100			9.0000	675.9900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.2547 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E12 Gable (insulation at ceiling level)	14.9500	0.0600	0.8970
E10 Eaves (insulation at ceiling level)	26.1800	0.0600	1.5708
E14 Flat roof	2.7200	0.0800	0.2176
E16 Corner (normal)	39.6000	0.0900	3.5640
E17 Corner (inverted - internal area greater than external area)	19.6000	-0.0900	-1.7640
E2 Other lintels (including other steel lintels)	25.4000	0.0500	1.2700
E3 Sill	24.4700	0.0500	1.2235
E4 Jamb	57.9000	0.0500	2.8950
E5 Ground floor (normal)	39.3700	0.1600	6.2992
E6 Intermediate floor within a dwelling	38.4100	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss

(33) + (36) + (36a) = 104.3340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	75.0169	74.5410	74.0745	71.8836	71.4737	69.5654	69.5654	69.2120	70.3004	71.4737	72.3029	73.1699	(38)
Heat transfer coeff	179.3508	178.8749	178.4085	176.2175	175.8076	173.8994	173.8994	173.5460	174.6344	175.8076	176.6369	177.5038	(39)
Average = Sum(39)m / 12 =												176.2156	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1782	1.1750	1.1720	1.1576	1.1549	1.1423	1.1423	1.1400	1.1472	1.1549	1.1603	1.1660	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.9376 (42)
Hot water usage for mixer showers	91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906 (42a)
Hot water usage for baths	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122 (42b)
Hot water usage for other uses	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141 (42c)
Average daily hot water use (litres/day)												154.7338 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169 (44)
Energy content (annual)	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											2570.1301
	39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											3240.9655 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	134.1940	119.1973	127.6011	114.1162	112.0138	102.4158	101.9836	105.0890	105.2309	115.6003	120.8466	132.9480 (65)

5. Internal gains (see Table 5 and 5a)													
Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.8850	180.3370	162.8850	168.3145	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	180.3683	177.3769	171.5068	158.4947	150.5562	142.2441	137.0748	141.2486	146.1541	155.3768	167.8425	178.6935	(72)
Total internal gains	736.2553	754.0670	722.3003	696.7401	660.6786	633.4673	608.6196	609.4424	628.2220	652.9928	693.5814	720.3317	(73)

6. Solar gains													
[Jan]													
	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
North	6.4700	10.6334	0.6300	0.7000	0.7700	21.0256	(74)						
East	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(76)						
South	5.8000	46.7521	0.6300	0.7000	0.7700	82.8706	(78)						

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West		13.8100			19.6403			0.6300			0.7000			0.7700			82.8920 (80)		
		-----			-----			-----			-----			-----					
Solar gains	245.8511	453.5955	698.4836	972.0445	1168.7575	1190.8685	1135.7460	987.3732	794.5739	523.7248	301.1687	205.8726	(83)						
Total gains	982.1064	1207.6625	1420.7839	1668.7846	1829.4361	1824.3358	1744.3656	1596.8156	1422.7959	1176.7176	994.7502	926.2043	(84)						

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.6861	18.7359	18.7848	19.0184	19.0627	19.2719	19.2719	19.3112	19.1908	19.0627	18.9732	18.8806	
alpha	2.2457	2.2491	2.2523	2.2679	2.2708	2.2848	2.2848	2.2874	2.2794	2.2708	2.2649	2.2587	
util living area	0.9435	0.9126	0.8637	0.7738	0.6544	0.5143	0.3985	0.4429	0.6356	0.8284	0.9189	0.9497	(86)
MIT	17.8689	18.3056	18.9367	19.7166	20.3313	20.7317	20.8925	20.8600	20.5393	19.6960	18.6507	17.8024	(87)
Th 2	19.9375	19.9400	19.9425	19.9541	19.9563	19.9664	19.9664	19.9683	19.9625	19.9563	19.9519	19.9473	(88)
util rest of house	0.9363	0.9018	0.8467	0.7457	0.6109	0.4508	0.3167	0.3593	0.5752	0.8002	0.9070	0.9433	(89)
MIT 2	16.2788	16.8281	17.6168	18.5770	19.3019	19.7482	19.9014	19.8787	19.5587	18.5781	17.2775	16.1992	(90)
Living area fraction	fLA = Living area / (4) = 0.1378 (91)												
MIT	16.4980	17.0318	17.7987	18.7341	19.4437	19.8837	20.0380	20.0139	19.6939	18.7321	17.4668	16.4202	(92)
Temperature adjustment	0.0000												
adjusted MIT	16.4980	17.0318	17.7987	18.7341	19.4437	19.8837	20.0380	20.0139	19.6939	18.7321	17.4668	16.4202	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9015	0.8605	0.8024	0.7070	0.5871	0.4454	0.3226	0.3633	0.5577	0.7586	0.8672	0.9106	(94)
Useful gains	885.3311	1039.2302	1140.0516	1179.7878	1074.0484	812.4993	562.7932	580.0891	793.5177	892.6920	862.6615	843.3887	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2187.7170	2170.0675	2015.7806	1732.9382	1361.4070	918.8344	597.8609	627.1843	976.8847	1429.6934	1831.1582	2169.1245	(97)
Space heating kWh	968.9751	759.9226	651.5424	398.2683	213.7948	0.0000	0.0000	0.0000	0.0000	399.5291	697.3176	986.3474	(98a)
Space heating requirement - total per year (kWh/year)													5075.6974
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)													0.0000
Space heating kWh	968.9751	759.9226	651.5424	398.2683	213.7948	0.0000	0.0000	0.0000	0.0000	399.5291	697.3176	986.3474	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													5075.6974
Space heating per m2													(98c) / (4) = 33.3423 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	968.9751	759.9226	651.5424	398.2683	213.7948	0.0000	0.0000	0.0000	0.0000	399.5291	697.3176	986.3474	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	387.7452	304.0907	260.7212	159.3711	85.5521	0.0000	0.0000	0.0000	0.0000	159.8756	279.0387	394.6969	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	184.7420	163.4110	173.4179	151.7321	146.6453	131.6355	129.4174	134.7511	136.4708	152.8055	163.2922	182.6018	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													2031.0914 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													175.1000
Water heating fuel used													1850.9226 (219)
Space cooling fuel													0.0000 (221)

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Electricity for pumps and fans:
 Total electricity for the above, kWh/year 0.0000 (231)
 Electricity for lighting (calculated in Appendix L) 279.4701 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV generation 0.0000 (233)
 Wind generation 0.0000 (234)
 Hydro-electric generation (Appendix N) 0.0000 (235a)
 Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
 Appendix Q - special features
 Energy saved or generated -0.0000 (236)
 Energy used 0.0000 (237)
 Total delivered energy for all uses 4161.4841 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2031.0914	0.1546	314.0438 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1850.9226	0.1410	260.9524 (264)
Space and water heating			574.9962 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	279.4701	0.1443	40.3362 (268)
Total CO2, kg/year			615.3324 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.0400 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2031.0914	1.5724	3193.7377 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1850.9226	1.5213	2815.8381 (278)
Space and water heating			6009.5759 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	279.4701	1.5338	428.6606 (282)
Total Primary energy kWh/year			6438.2364 (286)
Dwelling Primary energy Rate (DPER)			42.2900 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
 CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1052 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3552 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3019 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3849	0.3774	0.3698	0.3321	0.3245	0.2868	0.2868	0.2792	0.3019	0.3245	0.3396	0.3547 (22b)
Effective ac	0.5741	0.5712	0.5684	0.5551	0.5527	0.5411	0.5411	0.5390	0.5456	0.5527	0.5577	0.5629 (25)

3. Heat losses and heat loss parameter

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721.0302 739.0955 707.9253 683.8192 648.6165 622.3173 598.0941 598.4983 616.7752 640.5343 679.7370 705.3036 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.4700	10.6334	0.6300	0.7000	0.7700	21.0256 (74)
East	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628 (76)
South	5.8000	46.7521	0.6300	0.7000	0.7700	82.8706 (78)
West	13.8100	19.6403	0.6300	0.7000	0.7700	82.8920 (80)
Solar gains	245.8511	453.5955	698.4836	972.0445	1168.7575	1190.8685
Total gains	966.8813	1192.6910	1406.4089	1655.8637	1817.3740	1813.1858

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	18.8369	18.8752	18.9129	19.0920	19.1259	19.2852	19.2852	19.3150	19.2235	19.1259	19.0575	18.9864
alpha	2.2558	2.2583	2.2609	2.2728	2.2751	2.2857	2.2857	2.2877	2.2816	2.2751	2.2705	2.2658
util living area	0.9450	0.9141	0.8652	0.7754	0.6560	0.5163	0.4003	0.4452	0.6381	0.8307	0.9207	0.9512 (86)
MIT	17.8740	18.3107	18.9413	19.7159	20.3308	20.7297	20.8916	20.8585	20.5364	19.6915	18.6458	17.7998 (87)
Th 2	19.9451	19.9470	19.9489	19.9577	19.9593	19.9670	19.9685	19.9641	19.9593	19.9560	19.9525	19.9525 (88)
util rest of house	0.9379	0.9035	0.8485	0.7475	0.6126	0.4528	0.3183	0.3614	0.5778	0.8027	0.9090	0.9449 (89)
MIT 2	16.2886	16.8380	17.6261	18.5787	19.3039	19.7470	19.9014	19.8778	19.5573	18.5749	17.2736	16.1983 (90)
Living area fraction									fLA = Living area / (4) =			0.1378 (91)
MIT	16.5071	17.0410	17.8073	18.7354	19.4454	19.8824	20.0379	20.0130	19.6922	18.7288	17.4627	16.4190 (92)
Temperature adjustment												0.0000
adjusted MIT	16.5071	17.0410	17.8073	18.7354	19.4454	19.8824	20.0379	20.0130	19.6922	18.7288	17.4627	16.4190 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	873.7624	1028.9132	1131.3415	1173.7106	1069.9210	810.8972	562.0745	579.2836	790.5381	886.2368	853.0638	831.7136 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2171.8378	2155.6810	2003.6666	1726.4899	1357.2023	917.9783	597.4327	626.8906	974.9270	1424.3846	1822.3500	2156.8251 (97)
Space heating kWh	965.7681	757.1880	649.0099	398.0011	213.7373	0.0000	0.0000	0.0000	0.0000	400.3820	697.8861	985.8830 (98a)
Space heating requirement - total per year (kWh/year)												5067.8555
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	965.7681	757.1880	649.0099	398.0011	213.7373	0.0000	0.0000	0.0000	0.0000	400.3820	697.8861	985.8830 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5067.8555
Space heating per m2										(98c) / (4) =		33.2908 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	965.7681	757.1880	649.0099	398.0011	213.7373	0.0000	0.0000	0.0000	0.0000	400.3820	697.8861	985.8830 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	1046.3360	820.3554	703.1526	431.2038	231.5680	0.0000	0.0000	0.0000	0.0000	433.7833	756.1063	1068.1289 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	258.7345	228.7945	243.2903	214.7601	208.6885	188.6220	186.7116	193.8936	195.7344	217.5384	230.3757	256.0499 (64)
Efficiency of water heater												79.8000 (216)
(217)m	86.7331	86.5353	86.1508	85.4234	84.1135	79.8000	79.8000	79.8000	79.8000	85.4089	86.3821	86.7821 (217)
Fuel for water heating, kWh/month	298.3111	264.3944	282.4005	251.4066	248.1036	236.3684	233.9744	242.9744	245.2812	254.7024	266.6936	295.0491 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	33.8443	27.1511	24.4466	17.9106	13.8347	11.3031	12.6205	16.4046	21.3079	27.9571	31.5775	34.7849 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-66.7341	-91.4457	-127.7690	-139.4456	-146.8080	-135.6370	-133.7868	-127.8989	-117.1848	-102.3589	-72.3488	-57.9947 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233b)m	-46.1847	-96.0365	-188.9159	-281.0150	-369.0743	-370.0645	-365.8650	-311.0512	-229.5918	-136.6110	-61.4048	-36.6223	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												5490.6344	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3119.6596	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												273.1428	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-3811.8492	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5157.5876	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5490.6344	0.2100	1153.0332	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3119.6596	0.2100	655.1285	(264)
Space and water heating			1808.1617	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	273.1428	0.1443	39.4229	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1319.4124	0.1352	-178.4236	
PV Unit electricity exported	-2492.4369	0.1262	-314.4789	
Total			-492.9025	(269)
Total CO2, kg/year			1366.6114	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.9800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5490.6344	1.1300	6204.4168	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3119.6596	1.1300	3525.2154	(278)
Space and water heating			9729.6322	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	273.1428	1.5338	418.9556	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1319.4124	1.4998	-1978.8831	
PV Unit electricity exported	-2492.4369	0.4632	-1154.3831	
Total			-3133.2662	(283)
Total Primary energy kWh/year			7145.4224	(286)
Target Primary Energy Rate (TPER)			46.9400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)	
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 380.3740 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

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Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											
Pressure test	Air changes per hour											
Pressure Test Method	40.0000 / (5) = 0.1052 (8)											
Measured/design AP50	Yes											
Infiltration rate	Blower Door											
Number of sides sheltered	5.0000 (17)											
	0.3552 (18)											
	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3019 (21)											
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.3849	0.3774	0.3698	0.3321	0.3245	0.2868	0.2868	0.2792	0.3019	0.3245	0.3396	0.3547 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.5741	0.5712	0.5684	0.5551	0.5527	0.5411	0.5411	0.5390	0.5456	0.5527	0.5577	0.5629 (25)

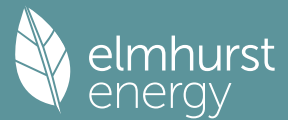
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)					
Solid Doors			1.9500	1.0000	1.9500			(26)					
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)					
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)					
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)					
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400	(30)					
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)					
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400	(30)					
Total net area of external elements Aum(A, m2)			348.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609			(33)					
GF			110.0000			9.0000	990.0000	(32c)					
FF			130.0000			9.0000	1170.0000	(32c)					
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)					
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E12 Gable (insulation at ceiling level)				14.9500	0.0600	0.8970							
E10 Eaves (insulation at ceiling level)				26.1800	0.0600	1.5708							
E14 Flat roof				2.7200	0.0800	0.2176							
E16 Corner (normal)				39.6000	0.0900	3.5640							
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900	-1.7640							
E2 Other lintels (including other steel lintels)				25.4000	0.0500	1.2700							
E3 Sill				24.4700	0.0500	1.2235							
E4 Jamb				57.9000	0.0500	2.8950							
E5 Ground floor (normal)				39.3700	0.1600	6.2992							
E6 Intermediate floor within a dwelling				38.4100	0.0000	0.0000							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1731	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	104.3340	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 72.0599	Feb 71.6989	Mar 71.3450	Apr 69.6827	May 69.3716	Jun 67.9238	Jul 67.9238	Aug 67.6557	Sep 68.4815	Oct 69.3716	Nov 70.0008	Dec 70.6586	(38)
Heat transfer coeff	176.3939	176.0328	175.6789	174.0166	173.7056	172.2578	172.2578	171.9897	172.8155	173.7056	174.3348	174.9926	(39)
Average = Sum(39)m / 12 =												174.0151	
HLP	Jan 1.1587	Feb 1.1564	Mar 1.1540	Apr 1.1431	May 1.1411	Jun 1.1316	Jul 1.1316	Aug 1.1298	Sep 1.1352	Oct 1.1411	Nov 1.1452	Dec 1.1495	(40)
HLP (average)												1.1431	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9376 (42)											
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	31.6122 (42b)
Hot water usage for other uses												
44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	44.7141 (42c)
Average daily hot water use (litres/day)	70.0581 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
76.4336	74.3365	72.0472	69.1980	66.6562	64.0147	63.4661	65.7508	68.0940	70.8067	73.6810	76.3263	76.3263 (44)
Energy conte	121.0521	105.8542	110.7338	94.7287	89.7321	78.7135	76.7568	81.4132	83.9667	96.0840	104.9721	119.5086 (45)
Energy content (annual)	Total = Sum(45)m = 1163.5157											
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823	101.5823 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823 (64)

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12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 988.9883 (64)										
Electric shower(s)	989 (64)										
58.8404	52.4273	57.2486	54.6316	55.6568	53.0912	54.8609	55.6568	54.6316	57.2486	56.1721	58.8404 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 669.3063 (64a)											
Heat gains from water heating, kWh/month											
40.4337	35.6008	37.8431	33.7878	32.9823	29.9994	30.0260	31.2145	31.5008	34.7300	36.3496	40.1057 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.8850	180.3370	162.8850	168.3145	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	54.3463	52.9774	50.8644	46.9274	44.3310	41.6658	40.3576	41.9550	43.7512	46.6801	50.4855	53.9055	(72)
Total internal gains	607.2334	626.6675	598.6579	582.1728	551.4534	532.8891	511.9024	510.1487	525.8191	541.2961	573.2245	592.5436	(73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	

North						6.4700	10.6334		0.6300	0.7000	0.7700		21.0256 (74)	
East						9.8400	19.6403		0.6300	0.7000	0.7700		59.0628 (76)	
South						5.8000	46.7521		0.6300	0.7000	0.7700		82.8706 (78)	
West						13.8100	19.6403		0.6300	0.7000	0.7700		82.8920 (80)	

Solar gains	245.8511	453.5955	698.4836	972.0445	1168.7575	1190.8685	1135.7460	987.3732	794.5739	523.7248	301.1687	205.8726 (83)		
Total gains	853.0844	1080.2630	1297.1414	1554.2174	1720.2109	1723.7576	1647.6484	1497.5220	1320.3930	1065.0209	874.3933	798.4162 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.9994	19.0384	19.0767	19.2589	19.2934	19.4556	19.4556	19.4859	19.3928	19.2934	19.2238	19.1515
alpha	2.2666	2.2692	2.2718	2.2839	2.2862	2.2970	2.2970	2.2991	2.2929	2.2862	2.2816	2.2768
util living area	0.9564	0.9276	0.8810	0.7926	0.6736	0.5325	0.4148	0.4629	0.6601	0.8511	0.9353	0.9620 (86)
MIT	17.7513	18.2029	18.8536	19.6590	20.2984	20.7153	20.8851	20.8488	20.5061	19.6175	18.5381	17.6753 (87)
Th 2	19.9532	19.9551	19.9569	19.9658	19.9674	19.9751	19.9751	19.9766	19.9722	19.9674	19.9641	19.9606 (88)
util rest of house	0.9507	0.9184	0.8657	0.7660	0.6309	0.4687	0.3313	0.3777	0.6008	0.8256	0.9255	0.9570 (89)
MIT 2	16.9787	17.4236	18.0604	18.8376	19.4285	19.7932	19.9204	19.9002	19.6311	18.8187	17.7660	16.9082 (90)
Living area fraction	FLA = Living area / (4) = 0.1378 (91)											
MIT	17.0852	17.5310	18.1697	18.9508	19.5484	19.9203	20.0533	20.0309	19.7517	18.9288	17.8724	17.0139 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.0852	17.5310	18.1697	18.9508	19.5484	19.9203	20.0533	20.0309	19.7517	18.9288	17.8724	17.0139 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9284	0.8897	0.8328	0.7354	0.6117	0.4650	0.3380	0.3825	0.5865	0.7936	0.8983	0.9365	(94)	
Useful gains	791.9681	961.0580	1080.2065	1142.9773	1052.1982	801.5833	556.9355	572.8618	774.3832	845.1857	785.4769	747.7183	(95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Heat loss rate W	2255.2284	2223.4678	2050.1200	1748.9999	1363.3148	916.4586	594.8618	624.4826	976.6937	1446.7511	1877.9975	2242.3457	(97)	
Space heating kWh	1088.6657	848.3393	721.6156	436.3363	231.4708	0.0000	0.0000	0.0000	0.0000	447.5646	786.6148	1112.0028	(98a)	
Space heating requirement - total per year (kWh/year)	5672.6100													
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)	
Solar heating contribution - total per year (kWh/year)	0.0000													
Space heating kWh	1088.6657	848.3393	721.6156	436.3363	231.4708	0.0000	0.0000	0.0000	0.0000	447.5646	786.6148	1112.0028	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)	5672.6100													
Space heating per m2											(98c) / (4) =		37.2634	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1619.2232	1274.7076	1307.1215	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7575	0.8143	0.7797	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1226.5339	1037.9601	1019.1438	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1944.0149	1858.1585	1685.9489	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	516.5863	610.2276	496.1030	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											1.0000 (105)
Intermittency factor (Table 10b)												

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Space cooling kWh	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	129.1466	152.5569	124.0258	0.0000	0.0000	0.0000 (107)
Energy for space heating											405.7292 (107)
Energy for space cooling											37.2634 (99)
Total											2.6652 (108)
Fabric Energy Efficiency (DFEE)											39.9287 (109)
											39.9 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	Air changes per hour	
Pressure test	40.0000 / (5) =	
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	
Infiltration rate	5.0000 (17)	
Number of sides sheltered	0.3552 (18)	
	2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	
	0.8500 (20)	
	0.3019 (21)	
Wind speed	Jan 5.1000	Feb 5.0000
Wind factor	Mar 4.9000	Apr 4.4000
Adj infilt rate	May 4.3000	Jun 3.8000
	Jul 3.8000	Aug 3.7000
	Sep 4.0000	Oct 4.3000
	Nov 4.5000	Dec 4.7000 (22)
	1.2750	1.2500
	1.2250	1.1000
	1.0750	0.9500
	0.9500	0.9250
	0.3849	0.3774
	0.3698	0.3321
	0.3245	0.2868
	0.2868	0.2792
	0.3019	0.3245
	0.3396	0.3547 (22b)
		0.0000 (23b)
		0.0000 (23c)
		0.5629 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			35.9200	1.1450	41.1298		(27)
Ground Floor			77.0400	0.1300	10.0152		(28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692		(29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450		(29a)
Joists GF	0.9600		0.9600	0.1100	0.1056		(30)
Joists FF	75.1100		75.1100	0.1100	8.2621		(30)
Flat	0.9600		0.9600	0.1100	0.1056		(30)
Total net area of external elements Aum(A, m ²)			348.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.6825		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.2547 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				14.9500	0.0600	0.8970	
E10 Eaves (insulation at ceiling level)				26.1800	0.0600	1.5708	
E14 Flat roof				2.7200	0.0800	0.2176	
E16 Corner (normal)				39.6000	0.0900	3.5640	
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900	-1.7640	
E2 Other lintels (including other steel lintels)				25.4000	0.0500	1.2700	
E3 Sill				24.4700	0.0500	1.2235	
E4 Jamb				57.9000	0.0500	2.8950	
E5 Ground floor (normal)				39.3700	0.1600	6.2992	
E6 Intermediate floor within a dwelling				38.4100	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						16.1731	(36)
Point Thermal bridges						0.0000	(36a) =
Total fabric heat loss						105.8556	(33) + (36) + (36a) =
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	Jan 72.0599	Feb 71.6989	Mar 71.3450	Apr 69.6827	May 69.3716	Jun 67.9238	Jul 67.9238
Heat transfer coeff						Aug 67.6557	Sep 68.4815
						Oct 69.3716	Nov 70.0008
						Dec 70.6586	(38)

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Average = Sum(39)m / 12 =	177.9155	177.5544	177.2005	175.5382	175.2272	173.7794	173.7794	173.5113	174.3371	175.2272	175.8564	176.5142 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1687	1.1664	1.1640	1.1531	1.1511	1.1416	1.1416	1.1398	1.1452	1.1511	1.1552	1.1595 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9376 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122 (42b)
Hot water usage for other uses	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141 (42c)
Average daily hot water use (litres/day)												70.0581 (43)
Daily hot water use	76.4336	74.3365	72.0472	69.1980	66.6562	64.0147	63.4661	65.7508	68.0940	70.8067	73.6810	76.3263 (44)
Energy content (annual)	121.0521	105.8542	110.7338	94.7287	89.7321	78.7135	76.7568	81.4132	83.9667	96.0840	104.9721	119.5086 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823 (64)
12Total per year (kWh/year)												988.9883 (64)
Electric shower(s)	58.8404	52.4273	57.2486	54.6316	55.6568	53.0912	54.8609	55.6568	54.6316	57.2486	56.1721	58.8404 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												669.3063 (64a)
Heat gains from water heating, kWh/month	40.4337	35.6008	37.8431	33.7878	32.9823	29.9994	30.0260	31.2145	31.5008	34.7300	36.3496	40.1057 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.8850	180.3370	162.8850	168.3145	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046 (71)
Water heating gains (Table 5)	54.3463	52.9774	50.8644	46.9274	44.3310	41.6658	40.3576	41.9550	43.7512	46.6801	50.4855	53.9055 (72)
Total internal gains	607.2334	626.6675	598.6579	582.1728	551.4534	532.8891	511.9024	510.1487	525.8191	541.2961	573.2245	592.5436 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					6.4700	10.6334	0.6300	0.7000			0.7700	21.0256 (74)
East					9.8400	19.6403	0.6300	0.7000			0.7700	59.0628 (76)
South					5.8000	46.7521	0.6300	0.7000			0.7700	82.8706 (78)
West					13.8100	19.6403	0.6300	0.7000			0.7700	82.8920 (80)
Solar gains	245.8511	453.5955	698.4836	972.0445	1168.7575	1190.8685	1135.7460	987.3732	794.5739	523.7248	301.1687	205.8726 (83)
Total gains	853.0844	1080.2630	1297.1414	1554.2174	1720.2109	1723.7576	1647.6484	1497.5220	1320.3930	1065.0209	874.3933	798.4162 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	18.8369	18.8752	18.9129	19.0920	19.1259	19.2852	19.2852	19.3150	19.2235	19.1259	19.0575	18.9864
alpha	2.2558	2.2583	2.2609	2.2728	2.2751	2.2857	2.2857	2.2877	2.2816	2.2751	2.2705	2.2658
util living area	0.9565	0.9279	0.8817	0.7940	0.6757	0.5350	0.4173	0.4654	0.6623	0.8521	0.9355	0.9621 (86)
MIT	17.7256	18.1771	18.8298	19.6394	20.2850	20.7083	20.8817	20.8446	20.4963	19.6003	18.5158	17.6495 (87)
Th 2	19.9451	19.9470	19.9489	19.9577	19.9593	19.9670	19.9670	19.9685	19.9641	19.9593	19.9560	19.9525 (88)
util rest of house	0.9508	0.9187	0.8664	0.7673	0.6328	0.4707	0.3329	0.3794	0.6026	0.8265	0.9257	0.9571 (89)
MIT 2	16.9485	17.3933	18.0321	18.8135	19.4106	19.7808	19.9108	19.8902	19.6166	18.7970	17.7392	16.8779 (90)

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Living area fraction									fLA = Living area / (4) =		0.1378 (91)
MIT	17.0556	17.5014	18.1421	18.9274	19.5311	19.9086	20.0446	20.0217	19.7378	18.9077	17.8462 (92)
Temperature adjustment											0.0000
adjusted MIT	17.0556	17.5014	18.1421	18.9274	19.5311	19.9086	20.0446	20.0217	19.7378	18.9077	17.8462 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9284	0.8898	0.8332	0.7364	0.6132	0.4668	0.3396	0.3842	0.5880	0.7942	0.8984	0.9365	(94)
Useful gains	791.9831	961.2608	1080.8236	1144.5264	1054.8231	804.6893	559.5277	575.3259	776.3951	845.8806	785.5986	747.7097	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2269.4135	2237.4268	2062.9801	1760.1850	1372.2174	922.5319	598.6003	628.4066	982.8844	1455.7318	1889.7898	2256.5988	(97)
Space heating kWh	1099.2082	857.5835	730.7244	443.2742	236.1413	0.0000	0.0000	0.0000	0.0000	453.7293	795.0177	1122.6135	(98a)
Space heating requirement - total per year (kWh/year)												5738.2921	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1099.2082	857.5835	730.7244	443.2742	236.1413	0.0000	0.0000	0.0000	0.0000	453.7293	795.0177	1122.6135	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5738.2921	
Space heating per m2										(98c) / (4) =		37.6949	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1633.5263	1285.9675	1318.6857	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7536	0.8108	0.7759	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1231.0127	1042.6262	1023.1901	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1944.0149	1858.1585	1685.9489	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	513.3615	606.7560	493.0926	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	128.3404	151.6890	123.2732	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												403.3025	(107)
Energy for space heating												37.6949	(99)
Energy for space cooling												2.6493	(108)
Total												40.3442	(109)
Fabric Energy Efficiency (TFEE)												40.3	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)	
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	380.3740 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1577 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4077	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3466 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													

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Effective ac	0.4419	0.4332	0.4246	0.3812	0.3726	0.3292	0.3292	0.3206	0.3466	0.3726	0.3899	0.4072 (22b)
	0.5976	0.5938	0.5901	0.5727	0.5694	0.5542	0.5542	0.5514	0.5601	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)					
Solid Doors			1.9500	1.0000	1.9500			(26)					
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)					
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)					
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)					
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400	(30)					
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)					
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400	(30)					
Total net area of external elements Aum(A, m2)			348.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609			(33)					
GF			110.0000			9.0000	990.0000	(32c)					
FF			130.0000			9.0000	1170.0000	(32c)					
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)					
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E12 Gable (insulation at ceiling level)				14.9500	0.0600		0.8970						
E10 Eaves (insulation at ceiling level)				26.1800	0.0600		1.5708						
E14 Flat roof				2.7200	0.0800		0.2176						
E16 Corner (normal)				39.6000	0.0900		3.5640						
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900		-1.7640						
E2 Other lintels (including other steel lintels)				25.4000	0.0500		1.2700						
E3 Sill				24.4700	0.0500		1.2235						
E4 Jamb				57.9000	0.0500		2.8950						
E5 Ground floor (normal)				39.3700	0.1600		6.2992						
E6 Intermediate floor within a dwelling				38.4100	0.0000		0.0000						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.1731 (36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	104.3340	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 75.0169	Feb 74.5410	Mar 74.0745	Apr 71.8836	May 71.4737	Jun 69.5654	Jul 69.5654	Aug 69.2120	Sep 70.3004	Oct 71.4737	Nov 72.3029	Dec 73.1699	(38)
Heat transfer coeff	179.3508	178.8749	178.4085	176.2175	175.8076	173.8994	173.8994	173.5460	174.6344	175.8076	176.6369	177.5038	(39)
Average = Sum(39)m / 12 =												176.2156	
HLP	Jan 1.1782	Feb 1.1750	Mar 1.1720	Apr 1.1576	May 1.1549	Jun 1.1423	Jul 1.1423	Aug 1.1400	Sep 1.1472	Oct 1.1549	Nov 1.1603	Dec 1.1660	(40)
HLP (average)												1.1576	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9376 (42)
Hot water usage for mixer showers													
	91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906	(42a)
Hot water usage for baths													
	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	(42b)
Hot water usage for other uses													
	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	(42c)
Average daily hot water use (litres/day)												154.7338	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169	(44)
Energy conte	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607	(45)
Energy content (annual)										Total = Sum(45)m =		2570.1301	
Distribution loss (46)m = 0.15 x (45)m													
	39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141	(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(64)
								Total per year (kWh/year) = Sum(64)m =				3240.9655	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month													
	134.1940	119.1973	127.6011	114.1162	112.0138	102.4158	101.9836	105.0890	105.2309	115.6003	120.8466	132.9480	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	180.3683	177.3769	171.5068	158.4947	150.5562	142.2441	137.0748	141.2486	146.1541	155.3768	167.8425	178.6935	(72)
Total internal gains	819.2424	816.8293	791.7934	745.0068	697.7350	652.0701	626.7333	630.3289	654.4003	700.3975	752.1965	797.4003	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North					6.4700	10.6334	0.6300		0.7000		0.7700		21.0256 (74)	
East					9.8400	19.6403	0.6300		0.7000		0.7700		59.0628 (76)	
South					5.8000	46.7521	0.6300		0.7000		0.7700		82.8706 (78)	
West					13.8100	19.6403	0.6300		0.7000		0.7700		82.8920 (80)	
Solar gains	245.8511	453.5955	698.4836	972.0445	1168.7575	1190.8685	1135.7460	987.3732	794.5739	523.7248	301.1687	205.8726	(83)	
Total gains	1065.0935	1270.4248	1490.2769	1717.0513	1866.4924	1842.9386	1762.4793	1617.7021	1448.9742	1224.1224	1053.3652	1003.2729	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.6861	18.7359	18.7848	19.0184	19.0627	19.2719	19.2719	19.3112	19.1908	19.0627	18.9732	18.8806
alpha	2.2457	2.2491	2.2523	2.2679	2.2708	2.2848	2.2848	2.2874	2.2794	2.2708	2.2649	2.2587
util living area	0.9345	0.9046	0.8532	0.7651	0.6472	0.5105	0.3951	0.4384	0.6289	0.8182	0.9104	0.9417 (86)
MIT	17.9729	18.3771	19.0039	19.7509	20.3476	20.7358	20.8944	20.8630	20.5499	19.7369	18.7191	17.9014 (87)
Th 2	19.9375	19.9400	19.9425	19.9541	19.9563	19.9664	19.9664	19.9683	19.9625	19.9563	19.9519	19.9473 (88)
util rest of house	0.9263	0.8930	0.8353	0.7365	0.6034	0.4472	0.3138	0.3554	0.5684	0.7889	0.8975	0.9343 (89)
MIT 2	16.4090	16.9166	17.6981	18.6165	19.3191	19.7518	19.9026	19.8808	19.5690	18.6254	17.3618	16.3235 (90)
Living area fraction	fLA = Living area / (4) = 0.1378 (91)											
MIT	16.6245	17.1179	17.8781	18.7729	19.4608	19.8874	20.0393	20.0161	19.7042	18.7786	17.5489	16.5409 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.6245	17.1179	17.8781	18.7729	19.4608	19.8874	20.0393	20.0161	19.7042	18.7786	17.5489	16.5409 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8891	0.8508	0.7909	0.6985	0.5805	0.4421	0.3198	0.3595	0.5516	0.7480	0.8565	0.8992	(94)
Useful gains	946.9574	1080.8668	1178.7326	1199.4317	1083.4106	814.7215	563.6573	581.4845	799.2734	915.6102	902.1856	902.1349	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2210.4082	2185.4690	2029.9457	1739.7745	1364.4104	919.4764	598.0939	627.5677	978.6820	1437.8636	1845.6616	2190.5611	(97)
Space heating kWh	940.0074	742.2926	633.3025	389.0468	209.0639	0.0000	0.0000	0.0000	0.0000	388.5565	679.3027	958.5891	(98a)
Space heating requirement - total per year (kWh/year)												4940.1616	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	940.0074	742.2926	633.3025	389.0468	209.0639	0.0000	0.0000	0.0000	0.0000	388.5565	679.3027	958.5891	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4940.1616	
Space heating per m2											(98c) / (4) =	32.4520	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	940.0074	742.2926	633.3025	389.0468	209.0639	0.0000	0.0000	0.0000	0.0000	388.5565	679.3027	958.5891 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	376.1534	297.0359	253.4224	155.6810	83.6590	0.0000	0.0000	0.0000	0.0000	155.4848	271.8298	383.5891 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (217)
Fuel for water heating, kWh/month												

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	184.7420	163.4110	173.4179	151.7321	146.6453	131.6355	129.4174	134.7511	136.4708	152.8055	163.2922	182.6018	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1976.8554	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1850.9226	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												279.4701	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												4107.2481	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1976.8554	16.4900	325.9835	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1850.9226	16.4900	305.2171	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	279.4701	16.4900	46.0846	(250)
Additional standing charges			0.0000	(251)
Total energy cost			677.2852	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2362	(257)
SAP value		79.9606	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1976.8554	0.1546	305.6350	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1850.9226	0.1410	260.9524	(264)
Space and water heating			566.5874	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	279.4701	0.1443	40.3362	(268)
Total CO2, kg/year			606.9236	(272)
CO2 emissions per m2			3.9900	(273)
EI value			95.8765	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)

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Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 380.3740 (5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		5 * 10 =	50.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1577 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.4077 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3466 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate	0.3119	0.2859	0.2773	0.2773	0.2859	0.2513	0.2686	0.2426	0.2426	0.2599	0.2426	0.2773	(22b)
Effective ac	0.5486	0.5409	0.5384	0.5384	0.5409	0.5316	0.5361	0.5294	0.5294	0.5338	0.5294	0.5384	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400	(30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400	(30)
Total net area of external elements Aum(A, m2)			348.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		88.1609			(33)
GF			110.0000			9.0000	990.0000	(32c)
FF			130.0000			9.0000	1170.0000	(32c)
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) = 12064.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								79.2547 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E12 Gable (insulation at ceiling level)				14.9500	0.0600		0.8970	
E10 Eaves (insulation at ceiling level)				26.1800	0.0600		1.5708	
E14 Flat roof				2.7200	0.0800		0.2176	
E16 Corner (normal)				39.6000	0.0900		3.5640	
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900		-1.7640	
E2 Other lintels (including other steel lintels)				25.4000	0.0500		1.2700	
E3 Sill				24.4700	0.0500		1.2235	
E4 Jamb				57.9000	0.0500		2.8950	
E5 Ground floor (normal)				39.3700	0.1600		6.2992	
E6 Intermediate floor within a dwelling				38.4100	0.0000		0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1731	(36)
Point Thermal bridges							(36a) =	0.0000
Total fabric heat loss							(33) + (36) + (36a) =	104.3340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	68.8681	67.8928	67.5865	67.5865	67.8928	66.7243	67.2897	66.4557	66.4557	67.0022	66.4557	67.5865 (38)
Heat transfer coeff	173.2021	172.2267	171.9205	171.9205	172.2267	171.0582	171.6236	170.7897	170.7897	171.3362	170.7897	171.9205 (39)
Average = Sum(39)m / 12 =												171.6503
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1378	1.1314	1.1293	1.1293	1.1314	1.1237	1.1274	1.1219	1.1219	1.1255	1.1219	1.1293 (40)
HLP (average)												1.1276
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9376 (42)
Hot water usage for mixer showers												
	91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906 (42a)
Hot water usage for baths												
	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122 (42b)
Hot water usage for other uses												
	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141 (42c)
Average daily hot water use (litres/day)												154.7338 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169 (44)
Energy conte	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607 (45)
Energy content (annual)												Total = Sum(45)m = 2570.1301

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Distribution loss (46)m = 0.15 x (45)m												
39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141	(46)
Water storage loss:												
Store volume											250.0000	(47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)											0.0103	(51)
Volume factor from Table 2a											0.7830	(52)
Temperature factor from Table 2b											0.5400	(53)
Enter (49) or (54) in (55)											1.0875	(55)
Total storage loss												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000	(64a)
Heat gains from water heating, kWh/month												
134.1940	119.1973	127.6011	114.1162	112.0138	102.4158	101.9836	105.0890	105.2309	115.6003	120.8466	132.9480	(65)

5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts												
(66)m	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)												
180.3683	177.3769	171.5068	158.4947	150.5562	142.2441	137.0748	141.2486	146.1541	155.3768	167.8425	178.6935	(72)
Total internal gains												
819.2424	816.8293	791.7934	745.0068	697.7350	652.0701	626.7333	630.3289	654.4003	700.3975	752.1965	797.4003	(73)

6. Solar gains												

[Jan]			Area		Solar flux		g		FF		Access	Gains
			m2		Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
North			6.4700		13.0723		0.6300		0.7000		0.7700	25.8480 (74)
East			9.8400		24.4329		0.6300		0.7000		0.7700	73.4753 (76)
South			5.8000		54.9219		0.6300		0.7000		0.7700	97.3521 (78)
West			13.8100		24.4329		0.6300		0.7000		0.7700	103.1193 (80)

Solar gains	299.7948	485.9255	741.8494	1066.6283	1248.6618	1377.8596	1288.0169	1130.8920	902.2464	598.1916	368.5813	244.7069 (83)
Total gains	1119.0372	1302.7548	1533.6428	1811.6351	1946.3967	2029.9298	1914.7502	1761.2209	1556.6466	1298.5891	1120.7777	1042.1072 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.3495	19.4591	19.4938	19.4938	19.4591	19.5920	19.5275	19.6228	19.6228	19.5602	19.6228	19.4938
alpha	2.2900	2.2973	2.2996	2.2996	2.2973	2.3061	2.3018	2.3082	2.3082	2.3040	2.3082	2.2996
util living area												
0.9195	0.8913	0.8282	0.7209	0.5796	0.4115	0.3061	0.3204	0.5501	0.7616	0.8829	0.9289	(86)
MIT	18.3736	18.6741	19.3255	20.0174	20.5619	20.8632	20.9510	20.9481	20.7129	20.0923	19.1480	18.3020 (87)
Th 2	19.9701	19.9753	19.9769	19.9769	19.9753	19.9815	19.9785	19.9830	19.9830	19.9801	19.9830	19.9769 (88)
util rest of house												
0.9093	0.8782	0.8076	0.6882	0.5298	0.3449	0.2250	0.2339	0.4827	0.7235	0.8659	0.9198	(89)
MIT 2	16.9301	17.3065	18.1140	18.9471	19.5704	19.8836	19.9552	19.9589	19.7513	19.0638	17.9138	16.8447 (90)
Living area fraction												
MIT	17.1291	17.4950	18.2810	19.0946	19.7071	20.0186	20.0924	20.0952	19.8838	19.2055	18.0839	17.0455 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1291	17.4950	18.2810	19.0946	19.7071	20.0186	20.0924	20.0952	19.8838	19.2055	18.0839	17.0455 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.8702	0.8361	0.7655	0.6560	0.5157	0.3475	0.2343	0.2438	0.4756	0.6892	0.8240	0.8825	(94)
Useful gains	973.7568	1089.2035	1174.0512	1188.4890	1003.6688	705.3071	448.6683	429.3557	740.3868	895.0090	923.5548	919.6731 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W												
2066.1382	2065.8588	1887.8574	1615.1250	1189.5797	755.8425	462.0848	443.2312	851.1855	1268.8360	1688.0636	2036.4911	(97)
Space heating kWh												
812.7318	656.3124	531.0718	307.1780	138.3177	0.0000	0.0000	0.0000	0.0000	278.1273	550.4463	830.9126	(98a)
Space heating requirement - total per year (kWh/year)												4105.0978
Solar heating kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000

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Space heating kWh	812.7318	656.3124	531.0718	307.1780	138.3177	0.0000	0.0000	0.0000	0.0000	278.1273	550.4463	830.9126 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4105.0978
Space heating per m2											(98c) / (4) =	26.9664 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	812.7318	656.3124	531.0718	307.1780	138.3177	0.0000	0.0000	0.0000	0.0000	278.1273	550.4463	830.9126 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	325.2228	262.6300	212.5137	122.9204	55.3492	0.0000	0.0000	0.0000	0.0000	111.2954	220.2666	332.4980 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	184.7420	163.4110	173.4179	151.7321	146.6453	131.6355	129.4174	134.7511	136.4708	152.8055	163.2922	182.6018 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1642.6962 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1850.9226 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												279.4701 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3773.0889 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1642.6962	26.0600	428.0866 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1850.9226	26.0600	482.3504 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	279.4701	26.0600	72.8299 (250)
Additional standing charges			0.0000 (251)
Total energy cost			983.2670 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1642.6962	0.1552	255.0240 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1850.9226	0.1410	260.9524 (264)
Space and water heating			515.9765 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	279.4701	0.1443	40.3362 (268)
Total CO2, kg/year			556.3126 (272)

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13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	1642.6962	1.5748	2586.8611 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1850.9226	1.5213	2815.8381 (278)
Space and water heating			5402.6992 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	279.4701	1.5338	428.6606 (282)
Total Primary energy kWh/year			5831.3598 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO ₂ change
N Solar water heating	+ 1.6	-£ 103	-49 kg (8.8%)
U Solar photovoltaic panels	+ 4.7	-£ 267	-138 kg (27.2%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£103	0.32 kg/m ²	B 82 A 96
Solar photovoltaic panels	£267	0.90 kg/m ²	B 86 A 97
Total Savings	£370	1.23 kg/m ²	

Potential energy efficiency rating: B 86
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £983	Potential £881	Saving £103
Electricity			
Space heating	£428	£449	-£21
Water heating	£482	£358	£124
Lighting	£73	£73	£0
Generated (PV)	-£0	-£267	£267
Total cost of fuels	£983	£614	£370
Total cost of uses	£983	£613	£370
Delivered energy	25 kWh/m ²	15 kWh/m ²	9 kWh/m ²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO ₂ emissions per m ²	4 kg/m ²	2 kg/m ²	1 kg/m ²
Primary energy	38 kWh/m ²	24 kWh/m ²	14 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.1577 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.4077 (18)
2 (19)

Shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 (20)$$
$$(21) = (18) \times (20) = 0.3466 (21)$$

Infiltration rate adjusted to include shelter factor

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4419	0.4332	0.4246	0.3812	0.3726	0.3292	0.3292	0.3206	0.3466	0.3726	0.3899	0.4072	(22b)
Effective ac	0.5976	0.5938	0.5901	0.5727	0.5694	0.5542	0.5542	0.5514	0.5601	0.5694	0.5760	0.5829	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)
Joists GF			0.9600	0.1100	0.1056	9.0000	8.6400	(30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)
Flat			0.9600	0.1300	0.1248	9.0000	8.6400	(30)
Total net area of external elements Aum(A, m2)			348.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609			(33)
GF			110.0000			9.0000	990.0000	(32c)
FF			130.0000			9.0000	1170.0000	(32c)
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)

Heat capacity Cm = Sum(A x k)

$$(28)...(30) + (32) + (32a)...(32e) = 12064.9500 (34)$$

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

$$79.2547 (35)$$

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	14.9500	0.0600	0.8970	
E10 Eaves (insulation at ceiling level)	26.1800	0.0600	1.5708	
E14 Flat roof	2.7200	0.0800	0.2176	
E16 Corner (normal)	39.6000	0.0900	3.5640	
E17 Corner (inverted - internal area greater than external area)	19.6000	-0.0900	-1.7640	
E2 Other lintels (including other steel lintels)	25.4000	0.0500	1.2700	
E3 Sill	24.4700	0.0500	1.2235	
E4 Jamb	57.9000	0.0500	2.8950	
E5 Ground floor (normal)	39.3700	0.1600	6.2992	
E6 Intermediate floor within a dwelling	38.4100	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

$$16.1731 (36)$$

Point Thermal bridges

$$(36a) = 0.0000$$

Total fabric heat loss

$$(33) + (36) + (36a) = 104.3340 (37)$$

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	75.0169	74.5410	74.0745	71.8836	71.4737	69.5654	69.5654	69.2120	70.3004	71.4737	72.3029	73.1699	(38)
Heat transfer coeff	179.3508	178.8749	178.4085	176.2175	175.8076	173.8994	173.8994	173.5460	174.6344	175.8076	176.6369	177.5038	(39)
Average = Sum(39)m / 12 =												176.2156	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1782	1.1750	1.1720	1.1576	1.1549	1.1423	1.1423	1.1400	1.1472	1.1549	1.1603	1.1660	(40)
HLP (average)												1.1576	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9376 (42)
Hot water usage for mixer showers													
91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906		(42a)
Hot water usage for baths													
31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122		(42b)
Hot water usage for other uses													
44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141		(42c)
Average daily hot water use (litres/day)												154.7338	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169	(44)
Energy conte	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607	(45)
Energy content (annual)										Total = Sum(45)m =		2570.1301	
Distribution loss (46)m = 0.15 x (45)m													
39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141		(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
323.4832	286.1326	302.2591	258.9293	243.9816	217.8870	213.5830	223.8528	233.5575	266.1667	285.9247	319.7358		(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)

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Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												645.6697 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												645.6697
Solar input	-0.0000	-16.1744	-59.5270	-82.8499	-109.6591	-101.3233	-100.7026	-87.2595	-59.3262	-28.8476	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	323.4832	269.9582	242.7320	176.0794	134.3224	116.5637	112.8804	136.5933	174.2313	237.3191	285.9247	319.7358 (64)
												Total per year (kWh/year) = Sum(64)m = 2529.8234 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month												
	134.1940	119.1973	126.4845	108.7133	101.7784	92.3304	91.5621	95.4118	100.9086	114.4837	120.8466	132.9480 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)													
	180.3683	177.3769	170.0060	150.9907	136.7989	128.2367	123.0673	128.2417	140.1509	153.8760	167.8425	178.6935	(72)
Total internal gains	819.2424	816.8293	790.2926	737.5028	683.9776	638.0627	612.7259	617.3220	648.3971	698.8967	752.1965	797.4003	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					6.4700	10.6334		0.6300	0.7000	0.7700		21.0256 (74)	
East					9.8400	19.6403		0.6300	0.7000	0.7700		59.0628 (76)	
South					5.8000	46.7521		0.6300	0.7000	0.7700		82.8706 (78)	
West					13.8100	19.6403		0.6300	0.7000	0.7700		82.8920 (80)	
Solar gains	245.8511	453.5955	698.4836	972.0445	1168.7575	1190.8685	1135.7460	987.3732	794.5739	523.7248	301.1687	205.8726 (83)	
Total gains	1065.0935	1270.4248	1488.7761	1709.5473	1852.7351	1828.9312	1748.4718	1604.6952	1442.9710	1222.6216	1053.3652	1003.2729 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.6861	18.7359	18.7848	19.0184	19.0627	19.2719	19.2719	19.3112	19.1908	19.0627	18.9732	18.8806	
alpha	2.2457	2.2491	2.2523	2.2679	2.2708	2.2848	2.2848	2.2874	2.2794	2.2708	2.2649	2.2587	
util living area	0.9345	0.9046	0.8534	0.7664	0.6499	0.5133	0.3977	0.4412	0.6304	0.8185	0.9104	0.9417	(86)
MIT	17.9729	18.3771	19.0025	19.7457	20.3416	20.7327	20.8929	20.8612	20.5475	19.7356	18.7191	17.9014	(87)
Th 2	19.9375	19.9400	19.9425	19.9541	19.9563	19.9664	19.9664	19.9683	19.9625	19.9563	19.9519	19.9473	(88)
util rest of house	0.9263	0.8930	0.8355	0.7379	0.6062	0.4499	0.3160	0.3578	0.5699	0.7893	0.8975	0.9343	(89)
MIT 2	16.4090	16.9166	17.6964	18.6105	19.3127	19.7491	19.9017	19.8795	19.5667	18.6240	17.3618	16.3235	(90)
Living area fraction													
MIT	16.6245	17.1179	17.8764	18.7669	19.4545	19.8846	20.0383	20.0148	19.7018	18.7772	17.5489	16.5409	(91)
Temperature adjustment													
adjusted MIT	16.6245	17.1179	17.8764	18.7669	19.4545	19.8846	20.0383	20.0148	19.7018	18.7772	17.5489	16.5409	(92)
													0.0000
													16.5409 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8891	0.8508	0.7912	0.6998	0.5829	0.4446	0.3220	0.3618	0.5530	0.7483	0.8565	0.8992	(94)
Useful gains	946.9574	1080.8668	1177.9115	1196.4163	1079.9674	813.0525	562.9910	580.6205	797.9683	914.8969	902.1856	902.1349	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2210.4082	2185.4690	2029.6455	1738.7273	1363.3075	918.9944	597.9143	627.3304	978.2752	1437.6099	1845.6616	2190.5611	(97)
Space heating kWh	940.0074	742.2926	633.6901	390.4639	210.8050	0.0000	0.0000	0.0000	0.0000	388.8985	679.3027	958.5891	(98a)
Space heating requirement - total per year (kWh/year)													4944.0493
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)													0.0000
Space heating kWh	940.0074	742.2926	633.6901	390.4639	210.8050	0.0000	0.0000	0.0000	0.0000	388.8985	679.3027	958.5891	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													4944.0493
Space heating per m ²													(98c) / (4) = 32.4775 (99)

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	940.0074	742.2926	633.6901	390.4639	210.8050	0.0000	0.0000	0.0000	0.0000	388.8985	679.3027	958.5891	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	376.1534	297.0359	253.5775	156.2480	84.3557	0.0000	0.0000	0.0000	0.0000	155.6216	271.8298	383.5891	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	323.4832	269.9582	242.7320	176.0794	134.3224	116.5637	112.8804	136.5933	174.2313	237.3191	285.9247	319.7358	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	184.7420	154.1737	138.6248	100.5593	76.7118	66.5698	64.4662	78.0087	99.5039	135.5334	163.2922	182.6018	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-40.0034	-60.8149	-92.9390	-108.8081	-117.8106	-104.0971	-102.5408	-95.8168	-83.5804	-70.7814	-45.2676	-34.1020	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1978.4111	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1444.7878	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												279.4701	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-956.5620	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2826.1070	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1978.4111	16.4900	326.2400 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1444.7878	16.4900	238.2455 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	279.4701	16.4900	46.0846 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.5620	16.4900	-157.7371
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-157.7371 (252)
Total energy cost			466.0250 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	0.8506 (257)
SAP value	86.2113
SAP rating (Section 12)	86 (258)
SAP band	B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1978.4111	0.1546	305.8504 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1444.7878	0.1449	209.3706 (264)
Space and water heating			515.2210 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	279.4701	0.1443	40.3362 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.5620	0.1342	-128.4034
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-128.4034 (269)
Total CO2, kg/year			438.2508 (272)
CO2 emissions per m2			2.8800 (273)
EI value			97.0225
EI rating			97 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

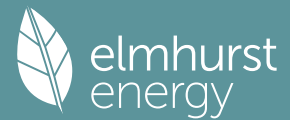
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.1577 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4077 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3466 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3119	0.2859	0.2773	0.2773	0.2859	0.2513	0.2686	0.2426	0.2426	0.2599	0.2426	0.2773 (22b)
Effective ac	0.5486	0.5409	0.5384	0.5384	0.5409	0.5316	0.5361	0.5294	0.5294	0.5338	0.5294	0.5384 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			35.9200	1.1450	41.1298		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000 (28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600 (29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500 (29a)
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400 (30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900 (30)
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400 (30)
Total net area of external elements Aum(A, m2)			348.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609		(33)
GF			110.0000			9.0000	990.0000 (32c)
FF			130.0000			9.0000	1170.0000 (32c)
Internal Floor 1			75.1100			18.0000	1351.9800 (32d)
Internal Ceiling 1			75.1100			9.0000	675.9900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				14.9500	0.0600	0.8970	
E10 Eaves (insulation at ceiling level)				26.1800	0.0600	1.5708	
E14 Flat roof				2.7200	0.0800	0.2176	
E16 Corner (normal)				39.6000	0.0900	3.5640	
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900	-1.7640	

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E2 Other lintels (including other steel lintels)	25.4000	0.0500	1.2700	
E3 Sill	24.4700	0.0500	1.2235	
E4 Jamb	57.9000	0.0500	2.8950	
E5 Ground floor (normal)	39.3700	0.1600	6.2992	
E6 Intermediate floor within a dwelling	38.4100	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.1731	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	104.3340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	68.8681	67.8928	67.5865	67.5865	67.8928	66.7243	67.2897	66.4557	66.4557	67.0022	66.4557	67.5865	(38)
Average = Sum(39)m / 12 =	173.2021	172.2267	171.9205	171.9205	172.2267	171.0582	171.6236	170.7897	170.7897	171.3362	170.7897	171.9205	(39)
												171.6503	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1378	1.1314	1.1293	1.1293	1.1314	1.1237	1.1274	1.1219	1.1219	1.1255	1.1219	1.1293	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9376	(42)
Hot water usage for mixer showers														
Hot water usage for baths	91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906	(42a)	
Hot water usage for other uses	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	(42b)	
Average daily hot water use (litres/day)	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	(42c)	
												154.7338	(43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy content (annual)	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169	(44)	
Distribution loss (46)m = 0.15 x (45)m	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607	(45)	
Water storage loss:														
Store volume	39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141	(46)	
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.7830	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)	
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	323.4832	286.1326	302.2591	258.9293	243.9816	217.8870	213.5830	223.8528	233.5575	266.1667	285.9247	319.7358	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Aperture area of solar collector													3.0000	(H1)
Zero-loss collector efficiency													0.8000	(H2)
Collector linear heat loss coefficient													1.8000	(H3)
Collector 2nd order heat loss coefficient													0.0000	(H4)
Collector loop efficiency													0.9000	(H5)
Incidence angle modifier													1.0000	(H6)
Overshading factor													0.8000	(H8)
Overall heat loss coefficient of system													6.5000	(H10)
Heat loss coefficient of collector loop													3.9667	(H11)
Dedicated solar storage volume													75.0000	(H12)
Effective solar volume													75.0000	(H14)
Reference volume													225.0000	(H15)
Storage tank correction coefficient													1.3161	(H16)
Heat delivered to hot water													766.9681	(H24)
Heat delivered to space heating													0.0000	(H29)
Solar input													766.9681	
Solar input	-1.7466	-20.9163	-66.5500	-94.6101	-119.5844	-120.4956	-117.0516	-104.5221	-72.9819	-40.9657	-7.5439	-0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h	321.7366	265.2163	235.7091	164.3193	124.3972	97.3914	96.5314	119.3307	160.5756	225.2009	278.3808	319.7358	(64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)	
Heat gains from water heating, kWh/month	134.1940	119.1973	126.4845	108.7133	101.7784	92.3304	91.5621	95.4118	100.9086	114.4837	120.8466	132.9480	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)	
Pumps, fans	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)	
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)	
Water heating gains (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)	
Total internal gains	180.3683	177.3769	170.0060	150.9907	136.7989	128.2367	123.0673	128.2417	140.1509	153.8760	167.8425	178.6935	(72)	
	819.2424	816.8293	790.2926	737.5028	683.9776	638.0627	612.7259	617.3220	648.3971	698.8967	752.1965	797.4003	(73)	

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6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	6.4700				13.0723	0.6300	0.7000	0.7700	0.7700	25.8480 (74)
East	9.8400				24.4329	0.6300	0.7000	0.7700	0.7700	73.4753 (76)
South	5.8000				54.9219	0.6300	0.7000	0.7700	0.7700	97.3521 (78)
West	13.8100				24.4329	0.6300	0.7000	0.7700	0.7700	103.1193 (80)
Solar gains	299.7948	485.9255	741.8494	1066.6283	1248.6618	1377.8596	1288.0169	1130.8920	902.2464	244.7069 (83)
Total gains	1119.0372	1302.7548	1532.1420	1804.1311	1932.6394	2015.9223	1900.7428	1748.2140	1550.6434	1042.1072 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.3495	19.4591	19.4938	19.4938	19.4591	19.5920	19.5275	19.6228	19.6228	19.5602	19.6228	19.4938
alpha	2.2900	2.2973	2.2996	2.2996	2.2973	2.3061	2.3018	2.3082	2.3082	2.3040	2.3082	2.2996
util living area	0.9195	0.8913	0.8285	0.7223	0.5822	0.4138	0.3081	0.3225	0.5515	0.7620	0.8829	0.9289 (86)
MIT	18.3736	18.6741	19.3242	20.0130	20.5575	20.8615	20.9503	20.9473	20.7112	20.0913	19.1480	18.3020 (87)
Th 2	19.9701	19.9753	19.9769	19.9769	19.9753	19.9815	19.9785	19.9830	19.9830	19.9801	19.9830	19.9769 (88)
util rest of house	0.9093	0.8782	0.8079	0.6896	0.5324	0.3470	0.2265	0.2355	0.4841	0.7239	0.8659	0.9198 (89)
MIT 2	16.9301	17.3065	18.1125	18.9421	19.5661	19.8824	19.9548	19.9585	19.7499	19.0626	17.9138	16.8447 (90)
Living area fraction	fLA = Living area / (4) =											0.1378 (91)
MIT	17.1291	17.4950	18.2794	19.0897	19.7027	20.0173	20.0920	20.0948	19.8824	19.2044	18.0839	17.0455 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1291	17.4950	18.2794	19.0897	19.7027	20.0173	20.0920	20.0948	19.8824	19.2044	18.0839	17.0455 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8702	0.8361	0.7658	0.6573	0.5180	0.3495	0.2359	0.2454	0.4769	0.6896	0.8240	0.8825 (94)
Useful gains	973.7568	1089.2035	1173.2996	1185.9395	1001.1864	704.4767	448.4065	429.0838	739.5262	894.4324	923.5548	919.6731 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	2066.1382	2065.8588	1887.5916	1614.2771	1188.8302	755.6178	462.0168	443.1604	850.9345	1268.6409	1688.0636	2036.4911 (97)
Space heating kWh	812.7318	656.3124	531.4333	308.4031	139.6070	0.0000	0.0000	0.0000	0.0000	278.4111	550.4463	830.9126 (98a)
Space heating requirement - total per year (kWh/year)												4108.2575
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	812.7318	656.3124	531.4333	308.4031	139.6070	0.0000	0.0000	0.0000	0.0000	278.4111	550.4463	830.9126 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4108.2575
Space heating per m2												(98c) / (4) = 26.9872 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	812.7318	656.3124	531.4333	308.4031	139.6070	0.0000	0.0000	0.0000	0.0000	278.4111	550.4463	830.9126 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	325.2228	262.6300	212.6584	123.4106	55.8651	0.0000	0.0000	0.0000	0.0000	111.4090	220.2666	332.4980 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	321.7366	265.2163	235.7091	164.3193	124.3972	97.3914	96.5314	119.3307	160.5756	225.2009	278.3808	319.7358 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	183.7445	151.4656	134.6140	93.8431	71.0435	55.6204	55.1293	68.1500	91.7051	128.6128	158.9839	182.6018 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-47.3170	-63.9160	-96.0627	-113.7503	-119.6215	-111.6342	-108.9214	-102.9130	-90.3334	-77.0327	-53.2008	-39.5457 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1											1643.9606	(211)
Space heating fuel - main system 2											0.0000	(213)
Space heating fuel - secondary											0.0000	(215)
Efficiency of water heater											175.1000	
Water heating fuel used											1375.5140	(219)
Space cooling fuel											0.0000	(221)

Electricity for pumps and fans:												
pump for solar water heating											80.0000	(230g)
Total electricity for the above, kWh/year											80.0000	(231)
Electricity for lighting (calculated in Appendix L)											279.4701	(232)

Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation											-1024.2487	(233)
Wind generation											0.0000	(234)
Hydro-electric generation (Appendix N)											0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)											0.0000	(235)
Appendix Q - special features												
Energy saved or generated											-0.0000	(236)
Energy used											0.0000	(237)
Total delivered energy for all uses											2354.6960	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1643.9606	26.0600	428.4161	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1375.5140	26.0600	358.4589	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	279.4701	26.0600	72.8299	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1024.2487	26.0600	-266.9192	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-266.9192	(252)
Total energy cost			613.6338	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1643.9606	0.1552	255.1998	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1375.5140	0.1457	200.4547	(264)
Space and water heating			455.6545	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	279.4701	0.1443	40.3362	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1024.2487	0.1344	-137.6822	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-137.6822	(269)
Total CO2, kg/year			369.4055	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1643.9606	1.5747	2588.7759	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1375.5140	1.5391	2117.0215	(278)
Space and water heating			4705.7974	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	279.4701	1.5338	428.6606	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1024.2487	1.4968	-1533.0900	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1533.0900	(283)
Total Primary energy kWh/year			3722.3920	(286)

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Property Reference	FURNERS LANE 9				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 9, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	79 C	DER	4.64	TER	9.33	
Environmental	96 A	% DER < TER				50.27
CO ₂ Emissions (t/year)	0.49	DFEE	40.47	TFEE	41.02	
Compliance Check	See BREL	% DFEE < TFEE				1.36
% DPER < TPER	1.03	DPER	48.72	TPER	49.23	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1492 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3992 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500 (28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100 (29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200 (29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700 (29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400 (30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300 (30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000 (30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200 (30)
Total net area of external elements Aum(A, m ²)			311.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			50.0000			9.0000	450.0000 (32c)
Internal Floor 1			32.5700			18.0000	586.2600 (32d)
Internal Ceiling 1			32.5700			9.0000	293.1300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10252.2300 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.8642 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 80.2579 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591
Heat transfer coeff	132.7648	132.4433	132.1281	130.6480	130.3711	129.0819	129.0819	128.8432	129.5785	130.3711	130.9313	131.5170
Average = Sum(39)m / 12 =												130.6467

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1605	1.1577	1.1550	1.1420	1.1396	1.1283	1.1283	1.1263	1.1327	1.1396	1.1445	1.1496
HLP (average)												1.1420
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												151.2443 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Energy conte	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Energy content (annual)										Total = Sum(45)m =		2512.1698
Distribution loss (46)m = 0.15 x (45)m	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)

Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3183.0051 (64)

12Total per year (kWh/year)												3183 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453 (72)
Total internal gains	670.7790	686.4638	657.7369	634.4499	602.2809	577.7060	555.5062	556.7039	573.6539	596.2370	632.8311	656.8877 (73)

6. Solar gains

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[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North			2.2000	10.6334	0.6300	0.7000	0.7700	7.1493 (74)
East			3.6300	19.6403	0.6300	0.7000	0.7700	21.7884 (76)
South			2.7000	46.7521	0.6300	0.7000	0.7700	38.5777 (78)
West			8.7300	19.6403	0.6300	0.7000	0.7700	52.4003 (80)
West			0.5400	25.9287	0.6300	0.7000	1.0000	5.5572 (82)

Solar gains	125.4729	233.0903	361.6459	505.4735	608.2430	619.5994	591.0062	513.7464	412.3193	269.9748	154.0251	104.8460 (83)
Total gains	796.2519	919.5541	1019.3828	1139.9235	1210.5240	1197.3054	1146.5124	1070.4502	985.9733	866.2118	786.8562	761.7337 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538
alpha	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436
util living area	0.9452	0.9222	0.8865	0.8152	0.7112	0.5719	0.4471	0.4880	0.6759	0.8474	0.9230	0.9502 (86)
MIT	18.2262	18.5651	19.0790	19.7575	20.3292	20.7290	20.8939	20.8651	20.5643	19.8132	18.9163	18.1749 (87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605 (88)
util rest of house	0.9377	0.9119	0.8709	0.7891	0.6684	0.5052	0.3579	0.3986	0.6149	0.8201	0.9110	0.9434 (89)
MIT 2	16.7163	17.1435	17.7885	18.6299	19.3102	19.7581	19.9146	19.8944	19.5939	18.7171	17.5993	16.6563 (90)
Living area fraction									fLA = Living area / (4) =			0.2213 (91)
MIT	17.0504	17.4581	18.0741	18.8795	19.5357	19.9730	20.1313	20.1093	19.8087	18.9597	17.8908	16.9924 (92)
Temperature adjustment												0.0000
adjusted MIT	17.0504	17.4581	18.0741	18.8795	19.5357	19.9730	20.1313	20.1093	19.8087	18.9597	17.8908	16.9924 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9084	0.8784	0.8350	0.7564	0.6483	0.5048	0.3720	0.4107	0.6039	0.7869	0.8782	0.9156 (94)
Useful gains	723.3025	807.7338	851.1526	862.2450	784.7230	604.4409	426.5226	439.5910	595.4398	681.6584	691.0453	697.4063 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1692.8105	1663.2375	1529.2708	1303.7995	1021.5511	693.5529	455.8320	477.9116	739.7246	1089.8630	1412.8534	1682.4216 (97)
Space heating kWh	721.3140	574.8985	504.5199	317.9192	176.2001	0.0000	0.0000	0.0000	0.0000	303.7042	519.7018	732.8513 (98a)
Space heating requirement - total per year (kWh/year)												3851.1090
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	721.3140	574.8985	504.5199	317.9192	176.2001	0.0000	0.0000	0.0000	0.0000	303.7042	519.7018	732.8513 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3851.1090
Space heating per m2										(98c) / (4) =		33.6635 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	721.3140	574.8985	504.5199	317.9192	176.2001	0.0000	0.0000	0.0000	0.0000	303.7042	519.7018	732.8513 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	288.6410	230.0514	201.8887	127.2186	70.5083	0.0000	0.0000	0.0000	0.0000	121.5303	207.9639	293.2578 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1541.0600	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1817.8213	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.8419	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3610.7232	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1541.0600	0.1544	237.9767	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1817.8213	0.1410	256.2660	(264)
Space and water heating			494.2427	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Total CO2, kg/year			530.5913	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1541.0600	1.5717	2422.1015	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1817.8213	1.5213	2765.4070	(278)
Space and water heating			5187.5085	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	251.8419	1.5338	386.2835	(282)
Total Primary energy kWh/year			5573.7920	(286)
Dwelling Primary energy Rate (DPER)			48.7200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

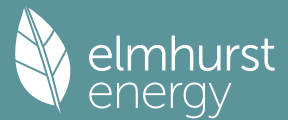
	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)	
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1492 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3992	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

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Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0200	1.0000	2.0200			(26)
TER Opening Type (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
Rooflight W			0.5400	1.4151	0.7642			(27a)
Ground Floor			81.8300	0.1300	10.6379			(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442			(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484			(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214			(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186			(30)
Joists FF	18.7700		18.7700	0.1100	2.0647			(30)
Rafters	17.9400	0.5400	17.4000	0.1100	1.9140			(30)
D Flat	1.7800		1.7800	0.1100	0.1958			(30)
Total net area of external elements Aum(A, m2)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.7925			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E16 Corner (normal)	14.4000	0.0900	1.2960	
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166	
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320	
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536	
R6 Flat ceiling	30.0000	0.0600	1.8000	
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080	
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980	
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655	
E3 Sill	12.3500	0.0500	0.6175	
E4 Jamb	32.9600	0.0500	1.6480	
E5 Ground floor (normal)	43.7400	0.1600	6.9984	
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000	
R1 Head of roof window	0.5500	0.0800	0.0440	
R2 Sill of roof window	0.5500	0.0600	0.0330	
R3 Jamb of roof window	1.9600	0.0800	0.1568	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.9034 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 81.6959 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591	(38)
Average = Sum(39)m / 12 =	134.2028	133.8813	133.5662	132.0860	131.8091	130.5199	130.5199	130.2812	131.0165	131.8091	132.3693	132.9550	(39)
												132.0847	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1731	1.1703	1.1675	1.1546	1.1522	1.1409	1.1409	1.1388	1.1452	1.1522	1.1571	1.1622	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers												
	71.8174	70.7381	69.1654	66.1563	63.9356	61.4592	60.0516	61.6124	63.3233	65.9823	69.0560	71.5422 (42a)
Hot water usage for baths												
	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses												
	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												134.6910 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
Energy conte	146.5267	143.3978	139.5874	133.7935	129.0883	124.0300	122.0861	125.8800	129.8813	135.1917	141.0749	146.1468	(44)
Energy content (annual)	232.0625	204.1966	214.5407	183.1566	173.7777	152.5093	147.6526	155.8658	160.1566	183.4539	200.9871	228.8305	(45)
										Total = Sum(45)m =		2237.1898	

Water storage loss:

Store volume 250.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):

Temperature factor from Table 2b 1.8903 (48)

Enter (49) or (54) in (55) 0.5400 (49)

Total storage loss 1.0208 (55)

31.6444 28.5820 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 30.6236 31.6444 30.6236 31.6444 (56)

If cylinder contains dedicated solar storage 31.6444 28.5820 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 30.6236 31.6444 30.6236 31.6444 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 286.9693 253.7898 269.4475 236.2922 228.6845 205.6449 202.5594 210.7726 213.2922 238.3607 254.1227 283.7373 (62)

WWHRS -32.8319 -29.0368 -30.4057 -25.1771 -23.4642 -20.0784 -18.8203 -20.0135 -20.7739 -24.4902 -27.7444 -32.2239 (63a)

PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h 254.1374 224.7530 239.0418 211.1151 205.2203 185.5665 183.7390 190.7590 192.5183 213.8705 226.3783 251.5134 (64)

12Total per year (kWh/year) 2578.6125 2579 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month 121.0862 107.5699 115.2602 103.4080 101.7065 93.2178 93.0199 95.7508 95.7606 104.9238 109.3367 120.0116 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	162.7503	160.0743	154.9196	143.6223	136.7023	129.4692	125.0268	128.6973	133.0008	141.0267	151.8565	161.3059 (72)
Total internal gains	655.8471	671.7797	643.6359	621.7702	590.4407	566.7573	545.1678	545.9564	562.4151	584.0093	619.2487	642.1484 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W	
North					2.2000	10.6334	0.6300	0.7000		0.7700	7.1493 (74)	
East					3.6300	19.6403	0.6300	0.7000		0.7700	21.7884 (76)	
South					2.7000	46.7521	0.6300	0.7000		0.7700	38.5777 (78)	
West					8.7300	19.6403	0.6300	0.7000		0.7700	52.4003 (80)	
West					0.5400	25.9287	0.6300	0.7000		1.0000	5.5572 (82)	
Solar gains	125.4729	233.0903	361.6459	505.4735	608.2430	619.5994	591.0062	513.7464	412.3193	269.9748	154.0251	104.8460 (83)
Total gains	781.3200	904.8701	1005.2817	1127.2437	1198.6837	1186.3567	1136.1740	1059.7027	974.7344	853.9841	773.2738	746.9943 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.2204	21.2714	21.3216	21.5605	21.6058	21.8192	21.8192	21.8592	21.7365	21.6058	21.5144	21.4196
alpha	2.4147	2.4181	2.4214	2.4374	2.4404	2.4546	2.4546	2.4573	2.4491	2.4404	2.4343	2.4280
util living area	0.9474	0.9250	0.8900	0.8199	0.7172	0.5787	0.4537	0.4952	0.6829	0.8522	0.9260	0.9523 (86)
MIT	18.1704	18.5119	19.0317	19.7207	20.3045	20.7162	20.8879	20.8577	20.5459	19.7784	18.8687	18.1187 (87)
Th 2	19.9416	19.9438	19.9461	19.9565	19.9584	19.9676	19.9676	19.9693	19.9641	19.9584	19.9545	19.9504 (88)
util rest of house	0.9402	0.9149	0.8748	0.7941	0.6744	0.5113	0.3629	0.4043	0.6218	0.8253	0.9143	0.9458 (89)
MIT 2	16.6407	17.0714	17.7244	18.5797	19.2756	19.7376	19.9009	19.8796	19.5676	18.6695	17.5344	16.5802 (90)
Living area fraction	16.9793	17.3902	18.0137	18.8323	19.5033	19.9542	20.1194	20.0961	19.7841	18.9149	17.8297	16.9207 (91)
MIT	16.9793	17.3902	18.0137	18.8323	19.5033	19.9542	20.1194	20.0961	19.7841	18.9149	17.8297	16.9207 (92)
Temperature adjustment	16.9793	17.3902	18.0137	18.8323	19.5033	19.9542	20.1194	20.0961	19.7841	18.9149	17.8297	16.9207 (93)
adjusted MIT	16.9793	17.3902	18.0137	18.8323	19.5033	19.9542	20.1194	20.0961	19.7841	18.9149	17.8297	16.9207 (93)

8. Space heating requirement

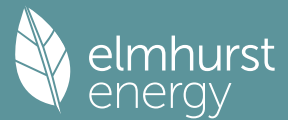
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9112	0.8815	0.8386	0.7607	0.6533	0.5104	0.3770	0.4162	0.6098	0.7915	0.8816	0.9183 (94)
Useful gains	711.9420	797.6799	843.0315	857.4678	783.1257	605.4902	428.3601	441.0605	594.4113	675.9483	681.7410	685.9379 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1701.5971	1672.2072	1537.8466	1311.9120	1028.5497	698.8252	459.3495	481.5278	744.7107	1095.9772	1420.2896	1691.2826 (97)
Space heating kWh	736.3034	587.6823	516.9425	327.1998	182.5955	0.0000	0.0000	0.0000	0.0000	312.5015	531.7550	747.9764 (98a)
Space heating requirement - total per year (kWh/year)												3942.9565
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	736.3034	587.6823	516.9425	327.1998	182.5955	0.0000	0.0000	0.0000	0.0000	312.5015	531.7550	747.9764 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3942.9565
Space heating per m2												34.4664 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	736.3034	587.6823	516.9425	327.1998	182.5955	0.0000	0.0000	0.0000	0.0000	312.5015	531.7550	747.9764 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	797.7285	636.7089	560.0677	354.4960	197.8283	0.0000	0.0000	0.0000	0.0000	338.5715	576.1159	810.3753 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating
Water heating requirement

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Efficiency of water heater (217)m	254.1374	224.7530	239.0418	211.1151	205.2203	185.5665	183.7390	190.7590	192.5183	213.8705	226.3783	251.5134 (64)
Fuel for water heating, kWh/month	86.3025	86.1133	85.7423	85.0387	83.7988	79.8000	79.8000	79.8000	79.8000	84.9091	85.9069	79.8000 (216)
Space cooling fuel requirement (221)m	294.4728	260.9969	278.7910	248.2577	244.8965	232.5394	230.2494	239.0464	241.2510	251.8817	263.5157	86.3493 (217)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	291.2742 (219)
Lighting	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	0.0000 (221)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	30.4985	24.4670	22.0298	16.1400	12.4670	10.1856	11.3728	14.7828	19.2014	25.1933	28.4558	7.3041 (231)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-66.9766	-89.9167	-123.1181	-131.6124	-136.3731	-125.2777	-123.6217	-119.2822	-111.0057	-99.3793	-71.9660	7.0685 (232)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	31.3461 (233a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Annual totals kWh/year	-52.8387	-109.0157	-212.9079	-314.5272	-411.0160	-411.3088	-406.5457	-346.4762	-256.9499	-154.1854	-69.9564	-41.9555 (233b)
Space heating fuel - main system 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Space heating fuel - main system 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Space heating fuel - secondary	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233d)
Efficiency of water heater	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
Water heating fuel used	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
Space cooling fuel	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
Electricity for pumps and fans:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
Total electricity for the above, kWh/year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
Electricity for lighting (calculated in Appendix L)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
Energy saving/generation technologies (Appendices M ,N and Q)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
PV generation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
Wind generation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
Hydro-electric generation (Appendix N)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
Electricity generated - Micro CHP (Appendix N)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
Appendix Q - special features	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
Energy saved or generated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
Energy used	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)
Total delivered energy for all uses	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233c)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4271.8921	0.2100	897.0974 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3077.1727	0.2100	646.2063 (264)
Space and water heating			1543.3036 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	246.1401	0.1443	35.5256 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1256.9694	0.1357	-170.5285
PV Unit electricity exported	-2787.6833	0.1264	-352.3251
Total			-522.8537 (269)
Total CO2, kg/year			1067.9048 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.3300 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4271.8921	1.1300	4827.2381 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3077.1727	1.1300	3477.2052 (278)
Space and water heating			8304.4433 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	246.1401	1.5338	377.5379 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1256.9694	1.5015	-1887.2887
PV Unit electricity exported	-2787.6833	0.4639	-1293.3356
Total			-3180.6243 (283)
Total Primary energy kWh/year			5631.4577 (286)
Target Primary Energy Rate (TPER)			49.2300 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

Number of open chimneys	0	* 80 =	0.0000 (6a)									
Number of open flues	0	* 20 =	0.0000 (6b)									
Number of chimneys / flues attached to closed fire	0	* 10 =	0.0000 (6c)									
Number of flues attached to solid fuel boiler	0	* 20 =	0.0000 (6d)									
Number of flues attached to other heater	0	* 35 =	0.0000 (6e)									
Number of blocked chimneys	0	* 20 =	0.0000 (6f)									
Number of intermittent extract fans	4	* 10 =	40.0000 (7a)									
Number of passive vents	0	* 10 =	0.0000 (7b)									
Number of flueless gas fires	0	* 40 =	0.0000 (7c)									
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1492 (8)									
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	5.0000 (17)											
Infiltration rate	0.3992 (18)											
Number of sides sheltered	2 (19)											
Shelter factor	(20) =	1 - [0.075 x (19)] =	0.8500 (20)									
Infiltration rate adjusted to include shelter factor	(21) =	(18) x (20) =	0.3393 (21)									
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infiltr rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500 (28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100 (29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200 (29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700 (29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400 (30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300 (30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000 (30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200 (30)
Total net area of external elements Aum(A, m2)			311.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			50.0000			9.0000	450.0000 (32c)
Internal Floor 1			32.5700			18.0000	586.2600 (32d)
Internal Ceiling 1			32.5700			9.0000	293.1300 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10252.2300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.6174 (35)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 10252.2300 (34)
Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 89.6174 (35)

List of Thermal Bridges

K1 Element

E16 Corner (nor

E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	16.8642 (36)

Point Thermal bridges

$$\text{Total fabric heat loss} \quad (33) + (36) + (36a) = 80.2579 \quad (37)$$

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1960												
1961												
1962												
1963												
1964												
1965												
1966												
1967												
1968												
1969												
1970												
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2017												
2018												
2019												
2020												
2021												
2022												
2023												

(38)m	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591	(38)

[illegible]

132.7648	132.4433	132.1281	130.6480	130.3711	129.0819	129.0819	128.8432	129.5785	130.3711	130.9313	131.5170	(39)

Average = $\text{Sum}(39)m / 12 = 130.6467$

WT P	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1 1605	1 1577	1 1550	1 1420	1 1396	1 1293	1 1293	1 1263	1 1327	1 1396	1 1445	1 1496 (10)

[illegible][illegible]

Days in month	31	28	31	30	31	30	31	31	30	31	30	31

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)

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Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												68.4778 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	74.7093	72.6597	70.4220	67.6372	65.1527	62.5708	62.0345	64.2676	66.5579	69.2094	72.0189	74.6045 (44)
Energy content (annual)	118.3213	103.4664	108.2360	92.5919	87.7080	76.9380	75.0254	79.5768	82.0726	93.9165	102.6041	116.8127 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908 (64)
12Total per year (kWh/year)												966.6793 (64)
Electric shower(s)	57.5138	51.2452	55.9578	53.3999	54.4019	51.8941	53.6239	54.4019	53.3999	55.9578	54.9056	57.5138 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												654.2157 (64a)
Heat gains from water heating, kWh/month	39.5217	34.7979	36.9896	33.0257	32.2384	29.3229	29.3489	30.5105	30.7904	33.9467	35.5298	39.2011 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	53.1206	51.7826	49.7172	45.8691	43.3312	40.7262	39.4474	41.0088	42.7644	45.6273	49.3469	52.6897 (72)
Total internal gains	543.2174	560.4880	535.4334	521.0170	494.0696	478.0143	459.5884	458.2678	472.1787	485.6099	513.7391	530.5322 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.2000	10.6334		0.6300		0.7000		0.7700		7.1493 (74)
East				3.6300	19.6403		0.6300		0.7000		0.7700		21.7884 (76)
South				2.7000	46.7521		0.6300		0.7000		0.7700		38.5777 (78)
West				8.7300	19.6403		0.6300		0.7000		0.7700		52.4003 (80)
West				0.5400	25.9287		0.6300		0.7000		1.0000		5.5572 (82)
Solar gains	125.4729	233.0903	361.6459	505.4735	608.2430	619.5994	591.0062	513.7464	412.3193	269.9748	154.0251		104.8460 (83)
Total gains	668.6903	793.5784	897.0793	1026.4906	1102.3126	1097.6137	1050.5947	972.0142	884.4981	755.5847	667.7642		635.3781 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538
util living area	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436
	0.9614	0.9414	0.9097	0.8431	0.7437	0.6055	0.4790	0.5245	0.7152	0.8786	0.9440	0.9656 (86)
MIT	18.0185	18.3737	18.9127	19.6358	20.2505	20.6905	20.8759	20.8410	20.4997	19.6793	18.7336	17.9652 (87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605 (88)
util rest of house	0.9560	0.9332	0.8966	0.8195	0.7027	0.5383	0.3860	0.4318	0.6563	0.8552	0.9348	0.9608 (89)
MIT 2	17.2268	17.5780	18.1085	18.8138	19.3896	19.7797	19.9193	19.9000	19.6285	18.8708	17.9448	17.1798 (90)
Living area fraction	17.4021	17.7541	18.2865	18.9957	19.5801	19.9813	20.1311	20.1082	19.8213	19.0497	18.1194	17.3537 (91)
MIT	17.4021	17.7541	18.2865	18.9957	19.5801	19.9813	20.1311	20.1082	19.8213	19.0497	18.1194	17.3537 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4021	17.7541	18.2865	18.9957	19.5801	19.9813	20.1311	20.1082	19.8213	19.0497	18.1194	17.3537 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9373	0.9101	0.8699	0.7930	0.6852	0.5386	0.4008	0.4444	0.6463	0.8292	0.9125	0.9435 (94)
Ext temp.	626.7873	722.2665	780.3751	814.0512	755.3484	591.1337	421.1029	431.9624	571.6858	626.5097	609.3440	599.4602 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
	1739.4914	1702.4423	1557.3258	1318.9830	1027.3381	694.6299	455.7964	477.7811	741.3605	1101.6018	1442.7879	1729.9309 (97)
Space heating kWh												

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827.8519	658.6782	578.0513	363.5509	202.3604	0.0000	0.0000	0.0000	0.0000	353.4685	600.0796	841.0702 (98a)
Space heating requirement - total per year (kWh/year)											4425.1109
Solar heating kWh											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)											0.0000
827.8519	658.6782	578.0513	363.5509	202.3604	0.0000	0.0000	0.0000	0.0000	353.4685	600.0796	841.0702 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											4425.1109
Space heating per m2											(98c) / (4) = 38.6810 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1213.3698	955.2060	979.2080	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7113	0.7772	0.7436	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	863.1232	742.4010	728.1071	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1211.5320	1159.9076	1071.9707	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	250.8544	310.6249	255.8345	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	62.7136	77.6562	63.9586	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												204.3284 (107)
Energy for space heating												38.6810 (99)
Energy for space cooling												1.7861 (108)
Total												40.4671 (109)
Fabric Energy Efficiency (DFEE)												40.5 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	40.0000 / (5) = 0.1492 (8)
Pressure Test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3992 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.0200	1.0000	2.0200		(26)
TER Opening Type (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Rooflight W			0.5400	1.4151	0.7642		(27a)
Ground Floor			81.8300	0.1300	10.6379		(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442		(29a)

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Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	(30)
Rafters	17.9400	0.5400	17.4000	0.1100	1.9140	(30)
D Flat	1.7800		1.7800	0.1100	0.1958	(30)
Total net area of external elements Aum(A, m2)			311.1600			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	64.7925		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	14.4000	0.0900	1.2960
E16 Corner (normal)	38.6100	0.0600	2.3166
E10 Eaves (insulation at ceiling level)	4.8000	-0.0900	-0.4320
E17 Corner (inverted - internal area greater than external area)	22.5600	0.0600	1.3536
R8 Roof to wall (rafter)	30.0000	0.0600	1.8000
R6 Flat ceiling	2.6000	0.0800	0.2080
E13 Gable (insulation at rafter level)	3.3000	0.0600	0.1980
E12 Gable (insulation at ceiling level)	13.3100	0.0500	0.6655
E2 Other lintels (including other steel lintels)	12.3500	0.0500	0.6175
E3 Sill	32.9600	0.0500	1.6480
E4 Jamb	43.7400	0.1600	6.9984
E5 Ground floor (normal)	27.3400	0.0000	0.0000
E6 Intermediate floor within a dwelling	0.5500	0.0800	0.0440
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	1.9600	0.0800	0.1568
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.9034 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 81.6959 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591
Heat transfer coeff	134.2028	133.8813	133.5662	132.0860	131.8091	130.5199	130.5199	130.2812	131.0165	131.8091	132.3693	132.9550
Average = Sum(39)m / 12 =												132.0847

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1731	1.1703	1.1675	1.1546	1.1522	1.1409	1.1409	1.1388	1.1452	1.1522	1.1571	1.1622
HLP (average)												1.1546
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths												
31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022	(42b)
Hot water usage for other uses												
43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023	(42c)
Average daily hot water use (litres/day)												68.4778
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	74.7093	72.6597	70.4220	67.6372	65.1527	62.5708	62.0345	64.2676	66.5579	69.2094	72.0189	74.6045
Energy conte	118.3213	103.4664	108.2360	92.5919	87.7080	76.9380	75.0254	79.5768	82.0726	93.9165	102.6041	116.8127
Energy content (annual)										Total = Sum(45)m =		1137.2698
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		966.6793
Electric shower(s)	57.5138	51.2452	55.9578	53.3999	54.4019	51.8941	53.6239	54.4019	53.3999	55.9578	54.9056	57.5138
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												654.2157
Heat gains from water heating, kWh/month	39.5217	34.7979	36.9896	33.0257	32.2384	29.3229	29.3489	30.5105	30.7904	33.9467	35.5298	39.2011

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	(71)
Water heating gains (Table 5)												
53.1206	51.7826	49.7172	45.8691	43.3312	40.7262	39.4474	41.0088	42.7644	45.6273	49.3469	52.6897	(72)
Total internal gains	543.2174	560.4880	535.4334	521.0170	494.0696	478.0143	459.5884	458.2678	472.1787	485.6099	513.7391	530.5322

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6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					2.2000	10.6334		0.6300	0.7000	0.7700		7.1493 (74)
East					3.6300	19.6403		0.6300	0.7000	0.7700		21.7884 (76)
South					2.7000	46.7521		0.6300	0.7000	0.7700		38.5777 (78)
West					8.7300	19.6403		0.6300	0.7000	0.7700		52.4003 (80)
West					0.5400	25.9287		0.6300	0.7000	1.0000		5.5572 (82)
Solar gains	125.4729	233.0903	361.6459	505.4735	608.2430	619.5994	591.0062	513.7464	412.3193	269.9748	154.0251	104.8460 (83)
Total gains	668.6903	793.5784	897.0793	1026.4906	1102.3126	1097.6137	1050.5947	972.0142	884.4981	755.5847	667.7642	635.3781 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.2204	21.2714	21.3216	21.5605	21.6058	21.8192	21.8192	21.8592	21.7365	21.6058	21.5144	21.4196
alpha	2.4147	2.4181	2.4214	2.4374	2.4404	2.4546	2.4546	2.4573	2.4491	2.4404	2.4343	2.4280
util living area	0.9616	0.9417	0.9103	0.8445	0.7460	0.6087	0.4824	0.5278	0.7178	0.8796	0.9443	0.9657 (86)
MIT	17.9871	18.3426	18.8841	19.6117	20.2334	20.6810	20.8712	20.8354	20.4874	19.6584	18.7066	17.9337 (87)
Th 2	19.9416	19.9438	19.9461	19.9565	19.9584	19.9676	19.9676	19.9693	19.9641	19.9584	19.9545	19.9504 (88)
util rest of house	0.9561	0.9335	0.8972	0.8209	0.7049	0.5409	0.3882	0.4342	0.6586	0.8562	0.9351	0.9609 (89)
MIT 2	17.1896	17.5410	18.0739	18.7839	19.3666	19.7638	19.9071	19.8872	19.6102	18.8441	17.9119	17.1423 (90)
Living area fraction	17.3661	17.7184	18.2532	18.9671	19.5584	19.9668	20.1205	20.0971	19.8044	19.0243	18.0878	17.3175 (92)
MIT	17.3661	17.7184	18.2532	18.9671	19.5584	19.9668	20.1205	20.0971	19.8044	19.0243	18.0878	17.3175 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3661	17.7184	18.2532	18.9671	19.5584	19.9668	20.1205	20.0971	19.8044	19.0243	18.0878	17.3175 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9374	0.9103	0.8703	0.7940	0.6870	0.5409	0.4031	0.4467	0.6482	0.8299	0.9127	0.9435 (94)
Useful gains	626.7974	722.4021	780.7671	815.0824	757.2373	593.6856	423.4722	434.1895	573.3223	627.0416	609.4448	599.4525 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1753.5031	1716.1461	1569.8355	1329.7262	1035.8099	700.4720	459.4990	481.6570	747.3640	1110.4012	1454.4435	1744.0317 (97)
Space heating kWh	838.2691	667.7960	587.0669	370.5435	207.2580	0.0000	0.0000	0.0000	0.0000	359.6195	608.3990	851.5669 (98a)
Space heating requirement - total per year (kWh/year)												4490.5188
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	838.2691	667.7960	587.0669	370.5435	207.2580	0.0000	0.0000	0.0000	0.0000	359.6195	608.3990	851.5669 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4490.5188
Space heating per m2												39.2528 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1226.8873	965.8475	990.1371	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7060	0.7723	0.7384	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	866.2366	745.9041	731.1137	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1211.5320	1159.9076	1071.9707	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	248.6127	308.0186	253.5976	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	62.1532	77.0047	63.3994	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												202.5572 (107)
Energy for space heating												39.2528 (99)
Energy for space cooling												1.7706 (108)
Total												41.0234 (109)
Fabric Energy Efficiency (TFEE)												41.0 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.8300 (1b)	x	2.4000 (2b)
First floor	32.5700 (1c)	x	2.2000 (2c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		

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Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 268.0460 (5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		4 * 10 =	40.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1492 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3992 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3393 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500 (28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100 (29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200 (29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700 (29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400 (30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300 (30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000 (30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200 (30)
Total net area of external elements Aum(A, m2)			311.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			50.0000			9.0000	450.0000 (32c)
Internal Floor 1			32.5700			18.0000	586.2600 (32d)
Internal Ceiling 1			32.5700			9.0000	293.1300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
List of Thermal Bridges

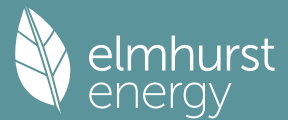
K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.8642 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 80.2579 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591 (38)
Average = Sum(39)m / 12 =	132.7648	132.4433	132.1281	130.6480	130.3711	129.0819	129.0819	128.8432	129.5785	130.3711	130.9313	131.5170 (39)
												130.6467
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1605	1.1577	1.1550	1.1420	1.1396	1.1283	1.1283	1.1263	1.1327	1.1396	1.1445	1.1496 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers												
	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278 (42a)
Hot water usage for baths												
	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses												

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Average daily hot water use (litres/day)	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c) 151.2443 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Distribution loss (46)m = 0.15 x (45)m	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Water storage loss:	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	(71)
Water heating gains (Table 5)	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453	(72)
Total internal gains	742.5067	739.8983	717.4078	675.3570	633.5455	592.7733	570.4214	574.1857	595.7333	637.0802	683.3167	723.5706	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.2000	10.6334		0.6300		0.7000		0.7700		7.1493 (74)
East				3.6300	19.6403		0.6300		0.7000		0.7700		21.7884 (76)
South				2.7000	46.7521		0.6300		0.7000		0.7700		38.5777 (78)
West				8.7300	19.6403		0.6300		0.7000		0.7700		52.4003 (80)
West				0.5400	25.9287		0.6300		0.7000		1.0000		5.5572 (82)
Solar gains	125.4729	233.0903	361.6459	505.4735	608.2430	619.5994	591.0062	513.7464	412.3193	269.9748	154.0251		104.8460 (83)
Total gains	867.9797	972.9886	1079.0536	1180.8305	1241.7886	1212.3728	1161.4276	1087.9320	1008.0526	907.0550	837.3418		828.4166 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538	
alpha	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436	
util living area	0.9351	0.9136	0.8748	0.8052	0.7021	0.5671	0.4425	0.4820	0.6676	0.8357	0.9135	0.9411	(86)
MIT	18.3380	18.6426	19.1555	19.7985	20.3500	20.7343	20.8964	20.8689	20.5769	19.8590	18.9900	18.2811	(87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605	(88)
util rest of house	0.9265	0.9023	0.8581	0.7783	0.6589	0.5005	0.3539	0.3931	0.6064	0.8071	0.9003	0.9333	(89)
MIT 2	16.8561	17.2394	17.8813	18.6775	19.3324	19.7627	19.9162	19.8970	19.6062	18.7703	17.6899	16.7895	(90)
Living area fraction	17.1841	17.5500	18.1633	18.9256	19.5576	19.9778	20.1331	20.1121	19.8210	19.0112	17.9776	17.1196	(91)
MIT	17.1841	17.5500	18.1633	18.9256	19.5576	19.9778	20.1331	20.1121	19.8210	19.0112	17.9776	17.1196	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1841	17.5500	18.1633	18.9256	19.5576	19.9778	20.1331	20.1121	19.8210	19.0112	17.9776	17.1196	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8950	0.8678	0.8219	0.7462	0.6396	0.5005	0.3680	0.4054	0.5962	0.7745	0.8665	0.9033	(94)
	776.8563	844.3807	886.8471	881.1791	794.3069	606.7364	427.4450	441.0359	600.9976	702.5455	725.5423	748.2898	(95)

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Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1710.5530	1675.4078	1541.0543	1309.8256	1024.4066	694.1715	456.0636	478.2802	741.3222	1096.5820	1424.2210	1699.1468 (97)
Space heating kWh	694.6703	558.4502	486.7301	308.6255	171.1942	0.0000	0.0000	0.0000	0.0000	293.1631	503.0487	707.4376 (98a)
Space heating requirement - total per year (kWh/year)												3723.3198
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	694.6703	558.4502	486.7301	308.6255	171.1942	0.0000	0.0000	0.0000	0.0000	293.1631	503.0487	707.4376 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3723.3198
Space heating per m2										(98c) / (4) =		32.5465 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	694.6703	558.4502	486.7301	308.6255	171.1942	0.0000	0.0000	0.0000	0.0000	293.1631	503.0487	707.4376 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	277.9793	223.4695	194.7699	123.4996	68.5051	0.0000	0.0000	0.0000	0.0000	117.3122	201.3000	283.0883 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1489.9239 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1817.8213 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												251.8419 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3559.5871 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1489.9239	16.4900	245.6884 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1817.8213	16.4900	299.7587 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	251.8419	16.4900	41.5287 (250)
Additional standing charges			0.0000 (251)
Total energy cost			586.9759 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.3257 (257)

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SAP value
SAP rating (Section 12)
SAP band

78.5109
79 (258)
C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year	
Space heating - main system 1	1489.9239	0.1544	230.0628	(261)
Total CO ₂ associated with community systems			0.0000	(373)
Water heating (other fuel)	1817.8213	0.1410	256.2660	(264)
Space and water heating			486.3288	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Total CO ₂ , kg/year			522.6774	(272)
CO ₂ emissions per m ²			4.5700	(273)
EI value			95.6061	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920	(1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	268.0460 (5)

2. Ventilation rate

	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1492 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3992	(18)
Number of sides sheltered	2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate	0.3054	0.2800	0.2715	0.2715	0.2800	0.2460	0.2630	0.2375	0.2375	0.2545	0.2375	0.2715	(22b)
Effective ac	0.5466	0.5392	0.5368	0.5368	0.5392	0.5303	0.5346	0.5282	0.5282	0.5324	0.5282	0.5368	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight W			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)
Total net area of external elements Aum(A, m ²)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			50.0000			9.0000	450.0000	(32c)
Internal Floor 1			32.5700			18.0000	586.2600	(32d)
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10252.2300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		89.6174 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.8642 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss		(33) + (36) + (36a) =	80.2579 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.3529	47.6940	47.4871	47.4871	47.6940	46.9046	47.2866	46.7232	46.7232	47.0924	46.7232	47.4871	(38)
Heat transfer coeff	128.6108	127.9519	127.7450	127.7450	127.9519	127.1625	127.5445	126.9810	126.9810	127.3503	126.9810	127.7450	(39)
Average = Sum(39)m / 12 =												127.5625	
HLP	1.1242	1.1185	1.1167	1.1167	1.1185	1.1116	1.1149	1.1100	1.1100	1.1132	1.1100	1.1167	(40)
HLP (average)												1.1151	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8388 (42)
Hot water usage for mixer showers													
89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278	(42a)	
Hot water usage for baths													
31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022	(42b)	
Hot water usage for other uses													
43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023	(42c)	
Average daily hot water use (litres/day)												151.2443	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use													
164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323	(44)	
Energy conte	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m												2512.1698	
39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252	(46)	
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)	
If cylinder contains dedicated solar storage													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month													
317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h													
317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100	(64)	
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777	(65)	

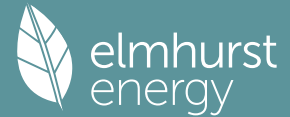
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453 (72)
Total internal gains	742.5067	739.8983	717.4078	675.3570	633.5455	592.7733	570.4214	574.1857	595.7333	637.0802	683.3167	723.5706 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains

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	m2	Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	W
North	2.2000	13.0723	0.6300	0.7000	0.7700	8.7891 (74)
East	3.6300	24.4329	0.6300	0.7000	0.7700	27.1052 (76)
South	2.7000	54.9219	0.6300	0.7000	0.7700	45.3191 (78)
West	8.7300	24.4329	0.6300	0.7000	0.7700	65.1869 (80)
West	0.5400	32.4879	0.6300	0.7000	1.0000	6.9630 (82)

Solar gains	153.3634	250.2120	384.6055	554.9005	649.7558	716.6865	670.0997	588.5242	468.6410	308.9167	188.9310	124.9233 (83)
Total gains	895.8701	990.1103	1102.0133	1230.2575	1283.3013	1309.4599	1240.5211	1162.7098	1064.3743	945.9969	872.2477	848.4939 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.1431	22.2571	22.2932	22.2932	22.2571	22.3953	22.3282	22.4273	22.4273	22.3623	22.4273	22.2932
alpha	2.4762	2.4838	2.4862	2.4862	2.4838	2.4930	2.4885	2.4952	2.4952	2.4908	2.4952	2.4862
util living area	0.9219	0.9021	0.8535	0.7676	0.6382	0.4687	0.3498	0.3600	0.5941	0.7851	0.8894	0.9293 (86)
MIT	18.6847	18.9030	19.4417	20.0391	20.5572	20.8592	20.9515	20.9502	20.7254	20.1733	19.3604	18.6326 (87)
Th 2	19.9811	19.9858	19.9873	19.9873	19.9858	19.9914	19.9887	19.9927	19.9927	19.9901	19.9927	19.9873 (88)
util rest of house	0.9115	0.8894	0.8341	0.7363	0.5873	0.3957	0.2588	0.2644	0.5242	0.7475	0.8723	0.9198 (89)
MIT 2	17.3099	17.5843	18.2544	18.9786	19.5766	19.8916	19.9662	19.9703	19.7729	19.1592	18.1686	17.2489 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.6142	17.8762	18.5171	19.2133	19.7936	20.1058	20.1843	20.1871	19.9837	19.3837	18.4324	17.5551 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6142	17.8762	18.5171	19.2133	19.7936	20.1058	20.1843	20.1871	19.9837	19.3837	18.4324	17.5551 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8788	0.8550	0.7995	0.7088	0.5768	0.4044	0.2771	0.2836	0.5235	0.7209	0.8382	0.8883 (94)
Useful gains	787.2877	846.5848	881.0821	871.9754	740.1791	529.4944	343.7043	329.7441	557.2111	681.9509	731.1375	753.7535 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	1596.5971	1583.5541	1432.9346	1215.2795	894.8498	572.9665	355.1236	341.2167	645.5393	965.7831	1299.3229	1578.3080 (97)
Space heating kWh	602.1262	495.2433	410.5783	247.1790	115.0750	0.0000	0.0000	0.0000	0.0000	211.1712	409.0935	613.4685 (98a)
Space heating requirement - total per year (kWh/year)	3103.9350											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	602.1262	495.2433	410.5783	247.1790	115.0750	0.0000	0.0000	0.0000	0.0000	211.1712	409.0935	613.4685 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3103.9350											
Space heating per m2	(98c) / (4) = 27.1323 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	602.1262	495.2433	410.5783	247.1790	115.0750	0.0000	0.0000	0.0000	0.0000	211.1712	409.0935	613.4685 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	240.9469	198.1766	164.2970	98.9111	46.0484	0.0000	0.0000	0.0000	0.0000	84.5023	163.7029	245.4856 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	1242.0708	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	175.1000	
Water heating fuel used	1817.8213	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	251.8419	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3311.7341	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1242.0708	26.0600	323.6837	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1817.8213	26.0600	473.7242	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	251.8419	26.0600	65.6300	(250)
Additional standing charges			0.0000	(251)
Total energy cost			863.0379	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1242.0708	0.1550	192.5683	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1817.8213	0.1410	256.2660	(264)
Space and water heating			448.8343	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Total CO2, kg/year			485.1829	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1242.0708	1.5740	1955.0175	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1817.8213	1.5213	2765.4070	(278)
Space and water heating			4720.4245	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	251.8419	1.5338	386.2835	(282)
Total Primary energy kWh/year			5106.7080	(286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:	C 79
Current environmental impact rating:	A 96

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.9	-£ 102	-49 kg (10.1%)
U Solar photovoltaic panels	+ 5.6	-£ 256	-132 kg (30.3%)

Recommended measures	Typical annual savings	Energy efficiency impact	Environmental impact
Solar water heating	£102	0.43 kg/m²	C 80 A 96
Solar photovoltaic panels	£256	1.16 kg/m²	B 86 A 97
Total Savings	£358	1.58 kg/m²	

Potential energy efficiency rating:	B 86
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£863	£761	£102
Space heating	£324	£345	-£21
Water heating	£474	£350	£123
Lighting	£66	£66	£0
Generated (PV)	-£0	-£256	£256

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Total cost of fuels	£863	£505	£358
Total cost of uses	£864	£505	£358
Delivered energy	29 kWh/m²	17 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	3 kg/m²	2 kg/m²
Primary energy	45 kWh/m²	27 kWh/m²	18 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

2. Ventilation rate

											m3 per hour		
Number of open chimneys											0 * 80 =	0.0000 (6a)	
Number of open flues											0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)	
Number of blocked chimneys											0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans											4 * 10 =	40.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =										40.0000 / (5) =	0.1492 (8)	
Pressure test											Yes		
Pressure Test Method											Blower Door		
Measured/design AP50											5.0000 (17)		
Infiltration rate											0.3992 (18)		
Number of sides sheltered											2 (19)		
											(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Shelter factor											(21) = (18) x (20) =		0.3393 (21)
Infiltration rate adjusted to include shelter factor													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)	
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)	

3. Heat losses and heat loss parameter

Element	Gross m²	Openings m²	NetArea m²	U-value W/m²K	A x U W/K	K-value kJ/m²K	A x K kJ/K
Windows (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500 (28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100 (29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200 (29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700 (29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400 (30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300 (30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000 (30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200 (30)
Total net area of external elements Aum(A, m²)			311.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			50.0000			9.0000	450.0000 (32c)
Internal Floor 1			32.5700			18.0000	586.2600 (32d)
Internal Ceiling 1			32.5700			9.0000	293.1300 (32e)

Heat capacity Cm = Sum (A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 10252.2300 (34)
89.6174 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												151.2443 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Energy content	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Energy content (annual)	Total = Sum(45)m =											2512.1698
Distribution loss (46)m = 0.15 x (45)m	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage												
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	317.4729	280.8404	296.6962	254.1813	239.4759	213.9326	209.7575	219.8167	229.4119	261.4175	280.7200	313.8100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												643.3954 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												643.3954
Solar input	-0.0000	-16.1775	-59.4121	-82.5934	-109.1830	-100.8626	-100.2334	-86.9245	-59.1784	-28.8304	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	317.4729	264.6629	237.2840	171.5879	130.2929	113.0700	109.5240	132.8922	170.2335	232.5871	280.7200	313.8100 (64)
Total per year (kWh/year) = Sum(64)m =												2474.1373 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	132.1956	117.4376	124.6348	107.1346	100.2802	91.0156	90.2901	94.0698	99.5302	112.9047	119.1160	130.9777 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	177.6822	174.7584	167.5199	148.7980	134.7852	126.4105	121.3577	126.4379	138.2364	151.7536	165.4389	176.0453 (72)
Total internal gains	742.5067	739.8983	715.9070	667.8530	619.7882	578.7659	556.4139	561.1787	589.7301	635.5794	683.3167	723.5706 (73)

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[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.2000	10.6334	0.6300	0.7000	0.7700	7.1493 (74)
East	3.6300	19.6403	0.6300	0.7000	0.7700	21.7884 (76)
South	2.7000	46.7521	0.6300	0.7000	0.7700	38.5777 (78)
West	8.7300	19.6403	0.6300	0.7000	0.7700	52.4003 (80)
West	0.5400	25.9287	0.6300	0.7000	1.0000	5.5572 (82)

Solar gains	125.4729	233.0903	361.6459	505.4735	608.2430	619.5994	591.0062	513.7464	412.3193	269.9748	154.0251	104.8460 (83)
Total gains	867.9797	972.9886	1077.5528	1173.3265	1228.0312	1198.3653	1147.4201	1074.9251	1002.0494	905.5542	837.3418	828.4166 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538
alpha	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436
util living area	0.9351	0.9136	0.8751	0.8070	0.7061	0.5716	0.4468	0.4864	0.6699	0.8362	0.9135	0.9411 (86)
MIT	18.3380	18.6426	19.1536	19.7911	20.3409	20.7294	20.8940	20.8661	20.5735	19.8574	18.9900	18.2811 (87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605 (88)
util rest of house	0.9265	0.9023	0.8584	0.7802	0.6631	0.5048	0.3576	0.3971	0.6087	0.8076	0.9003	0.9333 (89)
MIT 2	16.8561	17.2394	17.8790	18.6689	19.3227	19.7584	19.9147	19.8951	19.6029	18.7683	17.6899	16.7895 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.1841	17.5500	18.1611	18.9173	19.5481	19.9733	20.1315	20.1100	19.8177	19.0094	17.9776	17.1196 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.1841	17.5500	18.1611	18.9173	19.5481	19.9733	20.1315	20.1100	19.8177	19.0094	17.9776	17.1196 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8950	0.8678	0.8222	0.7481	0.6434	0.5045	0.3718	0.4093	0.5983	0.7750	0.8665	0.9033 (94)
Useful gains	776.8563	844.3807	885.9672	877.7559	790.1325	604.6043	426.5796	439.9662	599.5060	701.7932	725.5423	748.2898 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1710.5530	1675.4078	1540.7642	1308.7384	1023.1648	693.5970	455.8463	478.0074	740.8942	1096.3406	1424.2210	1699.1468 (97)
Space heating kWh	694.6703	558.4502	487.1690	310.3074	173.3760	0.0000	0.0000	0.0000	0.0000	293.5432	503.0487	707.4376 (98a)
Space heating requirement - total per year (kWh/year)	3728.0024											
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	694.6703	558.4502	487.1690	310.3074	173.3760	0.0000	0.0000	0.0000	0.0000	293.5432	503.0487	707.4376 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3728.0024											
Space heating per m2	(98c) / (4) =											
	32.5874 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	694.6703	558.4502	487.1690	310.3074	173.3760	0.0000	0.0000	0.0000	0.0000	293.5432	503.0487	707.4376 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	277.9793	223.4695	194.9456	124.1726	69.3782	0.0000	0.0000	0.0000	0.0000	117.4643	201.3000	283.0883 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.4729	264.6629	237.2840	171.5879	130.2929	113.0700	109.5240	132.8922	170.2335	232.5871	280.7200	313.8100 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	181.3095	151.1496	135.5134	97.9942	74.4105	64.5745	62.5494	75.8950	97.2207	132.8310	160.3198	179.2176 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-39.1818	-59.1489	-89.7419	-104.3392	-112.3304	-99.0713	-97.5974	-91.7305	-80.6820	-68.6088	-44.2142	-33.4508 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1491.7977	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1412.9853	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.8419	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-920.0972	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2316.5277	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1491.7977	16.4900	245.9974	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1412.9853	16.4900	233.0013	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	251.8419	16.4900	41.5287	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-920.0972	16.4900	-151.7240	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-151.7240	(252)
Total energy cost			381.9954	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8627	(257)
SAP value		86.0152	
SAP rating (Section 12)		86	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1491.7977	0.1544	230.3218	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1412.9853	0.1450	204.8452	(264)
Space and water heating			435.1670	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-920.0972	0.1344	-123.6276	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-123.6276	(269)
Total CO2, kg/year			358.9850	(272)
CO2 emissions per m2			3.1400	(273)
EI value			96.9822	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)	
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	268.0460	(5)

2. Ventilation rate

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			m3 per hour
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000	Air changes per hour	(8)
Pressure test			0.1492	(8)
Pressure Test Method			Yes	
Measured/design AP50			Blower Door	
Infiltration rate			5.0000	(17)
Number of sides sheltered			0.3992	(18)
			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500		(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393		(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Adj infilt rate	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Effective ac	0.3054	0.2800	0.2715	0.2715	0.2800	0.2460	0.2630	0.2375	0.2375	0.2545	0.2375	0.2715	(22b)
	0.5466	0.5392	0.5368	0.5368	0.5392	0.5303	0.5346	0.5282	0.5282	0.5324	0.5282	0.5368	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight W			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)
Total net area of external elements Aum (A, m2)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			50.0000			9.0000	450.0000	(32c)
Internal Floor 1			32.5700			18.0000	586.2600	(32d)
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)

Heat capacity Cm = Sum (A x k)	(28)...(30) + (32) + (32a)...(32e) =	10252.2300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		89.6174	(35)

List of Thermal Bridges	K1 Element	Length	Psi-value	Total	
E16 Corner (normal)		14.4000	0.0900	1.2960	
E10 Eaves (insulation at ceiling level)		38.6100	0.0600	2.3166	
E17 Corner (inverted - internal area greater than external area)		4.8000	-0.0900	-0.4320	
R8 Roof to wall (rafter)		22.5600	0.0600	1.3536	
R6 Flat ceiling		30.0000	0.0600	1.8000	
E13 Gable (insulation at rafter level)		2.6000	0.0800	0.2080	
E12 Gable (insulation at ceiling level)		3.3000	0.0600	0.1980	
E2 Other lintels (including other steel lintels)		13.3100	0.0500	0.6655	
E3 Sill		12.3500	0.0500	0.6175	
E4 Jamb		32.9600	0.0500	1.6480	
E5 Ground floor (normal)		43.7400	0.1600	6.9984	
E6 Intermediate floor within a dwelling		27.3400	0.0000	0.0000	
R1 Head of roof window		0.5500	0.0600	0.0330	
R2 Sill of roof window		0.5500	0.0800	0.0440	
R3 Jamb of roof window		1.9600	0.0600	0.1176	

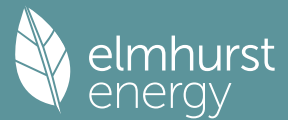
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.8642	(36)
Point Thermal bridges			0.0000	(36a)
Total fabric heat loss	(33) + (36) + (36a) =		80.2579	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	48.3529	47.6940	47.4871	47.4871	47.6940	46.9046	47.2866	46.7232	46.7232	47.0924	46.7232	47.4871	(38)
Average = Sum(39)m / 12 =	128.6108	127.9519	127.7450	127.7450	127.9519	127.1625	127.5445	126.9810	126.9810	127.3503	126.9810	127.7450	(39)
												127.5625	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1242	1.1185	1.1167	1.1167	1.1185	1.1116	1.1149	1.1100	1.1100	1.1132	1.1100	1.1167	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

												2.8388 (42)
Assumed occupancy												
Hot water usage for mixer showers	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												151.2443 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Energy content	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Energy content (annual)	Total = Sum(45)m =											2512.1698

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Distribution loss (46)m = 0.15 x (45)m	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
33.7127 30.4501 33.7127 32.6252 33.7127 32.6252 33.7127 33.7127 32.6252 33.7127 32.6252 33.7127 (56)												
If cylinder contains dedicated solar storage												
33.7127 30.4501 33.7127 32.6252 33.7127 32.6252 33.7127 33.7127 32.6252 33.7127 32.6252 33.7127 (57)												
Primary loss 23.2624 21.0112 21.8667 15.7584 10.4681 9.9053 10.2355 11.1660 17.1091 21.8667 22.5120 23.2624 (59)												
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)												
Total heat required for water heating calculated for each month												
317.4729 280.8404 296.6962 254.1813 239.4759 213.9326 209.7575 219.8167 229.4119 261.4175 280.7200 313.8100 (62)												
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)												
PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)												
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												763.9825 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												763.9825
Solar input -1.7760 -20.9090 -66.4092 -94.2840 -119.0285 -119.8568 -116.4267 -104.0535 -72.7611 -40.9082 -7.5696 -0.0000 (63c)												
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)												
Output from w/h												
315.6969 259.9314 230.2870 159.8973 120.4473 94.0757 93.3308 115.7632 156.6508 220.5093 273.1504 313.8100 (64)												
Electric shower(s)												
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)												
Heat gains from water heating, kWh/month												
132.1956 117.4376 124.6348 107.1346 100.2802 91.0156 90.2901 94.0698 99.5302 112.9047 119.1160 130.9777 (65)												

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
35.6508 31.6647 25.7515 19.4955 14.5731 12.3033 13.2941 17.2802 23.1934 29.4494 34.3718 36.6417 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
414.5257 418.8272 407.9876 384.9114 355.7818 328.4041 310.1142 305.8127 316.6523 339.7285 368.8580 396.2357 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 (69)													
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)	
Losses e.g. evaporation (negative values) (Table 5)													
-113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 (71)													
Water heating gains (Table 5)													
177.6822 174.7584 167.5199 148.7980 134.7852 126.4105 121.3577 126.4379 138.2364 151.7536 165.4389 176.0453 (72)													
Total internal gains													
742.5067 739.8983 715.9070 667.8530 619.7882 578.7659 556.4139 561.1787 589.7301 635.5794 683.3167 723.5706 (73)													

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					2.2000	13.0723	0.6300	0.7000	0.7700	8.7891 (74)		
East					3.6300	24.4329	0.6300	0.7000	0.7700	27.1052 (76)		
South					2.7000	54.9219	0.6300	0.7000	0.7700	45.3191 (78)		
West					8.7300	24.4329	0.6300	0.7000	0.7700	65.1869 (80)		
West					0.5400	32.4879	0.6300	0.7000	1.0000	6.9630 (82)		
Solar gains	153.3634	250.2120	384.6055	554.9005	649.7558	716.6865	670.0997	588.5242	468.6410	308.9167	188.9310	124.9233 (83)
Total gains	895.8701	990.1103	1100.5125	1222.7535	1269.5440	1295.4524	1226.5136	1149.7029	1058.3711	944.4961	872.2477	848.4939 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	22.1431	22.2571	22.2932	22.2932	22.2571	22.3953	22.3282	22.4273	22.4273	22.3623	22.4273	22.2932	
alpha	2.4762	2.4838	2.4862	2.4862	2.4838	2.4930	2.4885	2.4952	2.4952	2.4908	2.4952	2.4862	
util living area	0.9219	0.9021	0.8539	0.7696	0.6423	0.4726	0.3534	0.3636	0.5963	0.7856	0.8894	0.9293 (86)	
MIT	18.6847	18.9030	19.4399	20.0327	20.5504	20.8565	20.9504	20.9491	20.7230	20.1720	19.3604	18.6326 (87)	
Th 2	19.9811	19.9858	19.9873	19.9873	19.9858	19.9914	19.9887	19.9927	19.9927	19.9901	19.9927	19.9873 (88)	
util rest of house	0.9115	0.8894	0.8345	0.7384	0.5915	0.3993	0.2616	0.2672	0.5264	0.7480	0.8723	0.9198 (89)	
MIT 2	17.3099	17.5843	18.2522	18.9713	19.5698	19.8895	19.9657	19.9697	19.7708	19.1577	18.1686	17.2489 (90)	
Living area fraction									fLA = Living area / (4) =			0.2213 (91)	
MIT	17.6142	17.8762	18.5151	19.2062	19.7868	20.1035	20.1836	20.1865	19.9816	19.3822	18.4324	17.5551 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.6142	17.8762	18.5151	19.2062	19.7868	20.1035	20.1836	20.1865	19.9816	19.3822	18.4324	17.5551 (93)	

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8788	0.8550	0.7999	0.7107	0.5806	0.4079	0.2799	0.2865	0.5255	0.7214	0.8382	0.8893	(94)
Useful gains	787.2877	846.5848	880.2686	869.0092	737.0697	528.3678	343.3467	329.3893	556.1900	681.3326	731.1375	753.7535	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1596.5971	1583.5541	1432.6742	1214.3709	893.9740	572.6816	355.0366	341.1304	645.2636	965.5933	1299.3229	1578.3080	(97)
Space heating kWh	602.1262	495.2433	410.9898	248.6604	116.7368	0.0000	0.0000	0.0000	0.0000	211.4899	409.0935	613.4685	(98a)
Space heating requirement - total per year (kWh/year)												3107.8086	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	602.1262	495.2433	410.9898	248.6604	116.7368	0.0000	0.0000	0.0000	0.0000	211.4899	409.0935	613.4685	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3107.8086	
Space heating per m2										(98c) / (4) =		27.1662	(99)

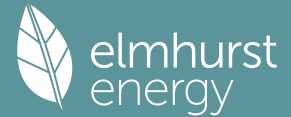
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	602.1262	495.2433	410.9898	248.6604	116.7368	0.0000	0.0000	0.0000	0.0000	211.4899	409.0935	613.4685	(98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating fuel (main heating system)	240.9469	198.1766	164.4617	99.5040	46.7134	0.0000	0.0000	0.0000	0.0000	84.6298	163.7029	245.4856	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	315.6969	259.9314	230.2870	159.8973	120.4473	94.0757	93.3308	115.7632	156.6508	220.5093	273.1504	313.8100	(64)	
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
Fuel for water heating, kWh/month	180.2952	148.4474	131.5174	91.3177	68.7877	53.7269	53.3014	66.1126	89.4636	125.9334	155.9968	179.2176	(219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)	
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-46.2598	-62.1214	-92.7015	-108.9121	-113.8613	-105.5870	-103.1224	-98.0354	-86.8985	-74.5655	-51.8573	-38.7327	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1												1243.6209	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												175.1000		
Water heating fuel used												1344.1178	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
pump for solar water heating												80.0000	(230g)	
Total electricity for the above, kWh/year												80.0000	(231)	
Electricity for lighting (calculated in Appendix L)												251.8419	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation												-982.6551	(233)	
Wind generation												0.0000	(234)	
Hydro-electric generation (Appendix N)												0.0000	(235a)	
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)	
Appendix Q - special features														
Energy saved or generated												-0.0000	(236)	
Energy used												0.0000	(237)	
Total delivered energy for all uses												1936.9255	(238)	

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1243.6209	26.0600	324.0876	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1344.1178	26.0600	350.2771	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	251.8419	26.0600	65.6300	(250)
Additional standing charges			0.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-982.6551	26.0600	-256.0799
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-256.0799 (252)
Total energy cost			504.7628 (255)

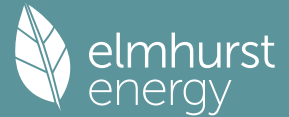
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1243.6209	0.1550	192.7834 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1344.1178	0.1458	195.9781 (264)
Space and water heating			388.7615 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	251.8419	0.1443	36.3486 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-982.6551	0.1346	-132.2506
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-132.2506 (269)
Total CO2, kg/year			303.9564 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1243.6209	1.5739	1957.3634 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1344.1178	1.5394	2069.0696 (278)
Space and water heating			4026.4330 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	251.8419	1.5338	386.2835 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-982.6551	1.4974	-1471.4319
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1471.4319 (283)
Total Primary energy kWh/year			3062.3086 (286)

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Property Reference	FURNERS LANE 10				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 10, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	78 C	DER	4.65	TER	9.37	
Environmental	96 A	% DER < TER				50.37
CO ₂ Emissions (t/year)	0.49	DFEE	40.63	TFEE	41.18	
Compliance Check	See BREL	% DFEE < TFEE				1.35
% DPER < TPER	1.20	DPER	48.82	TPER	49.41	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	268.0460 (5)

2. Ventilation rate

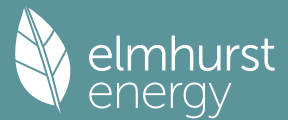
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1492 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3992 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500 (28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100 (29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200 (29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700 (29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400 (30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300 (30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000 (30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200 (30)
Total net area of external elements Aum(A, m ²)			311.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			50.0000			9.0000	450.0000 (32c)
Internal Floor 1			32.5700			18.0000	586.2600 (32d)
Internal Ceiling 1			32.5700			9.0000	293.1300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10252.2300 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.8642 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 80.2579 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591
Heat transfer coeff	132.7648	132.4433	132.1281	130.6480	130.3711	129.0819	129.0819	128.8432	129.5785	130.3711	130.9313	131.5170
Average = Sum(39)m / 12 =												130.6467

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1605	1.1577	1.1550	1.1420	1.1396	1.1283	1.1283	1.1263	1.1327	1.1396	1.1445	1.1496
HLP (average)												1.1420
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												151.2443 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Energy conte	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Energy content (annual)										Total = Sum(45)m =		2512.1698
Distribution loss (46)m = 0.15 x (45)m	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)

Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3183.0051 (64)

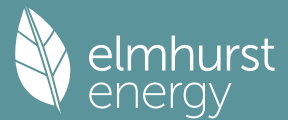
12Total per year (kWh/year)												3183 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453 (72)
Total internal gains	670.7790	686.4638	657.7369	634.4499	602.2809	577.7060	555.5062	556.7039	573.6539	596.2370	632.8311	656.8877 (73)

6. Solar gains

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[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North		2.7000	10.6334	0.6300	0.7000	0.7700	8.7742 (74)
East		3.6300	19.6403	0.6300	0.7000	0.7700	21.7884 (76)
South		2.2000	46.7521	0.6300	0.7000	0.7700	31.4337 (78)
West		8.7300	19.6403	0.6300	0.7000	0.7700	52.4003 (80)
West		0.5400	25.9287	0.6300	0.7000	1.0000	5.5572 (82)

Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274 (83)
Total gains	790.7327	910.9592	1009.7554	1131.5543	1204.3880	1192.6353	1141.4185	1063.4749	976.7485	857.2885	780.3925	756.9152 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538
alpha	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436
util living area	0.9459	0.9236	0.8883	0.8173	0.7130	0.5734	0.4487	0.4904	0.6793	0.8500	0.9242	0.9508 (86)
MIT	18.2174	18.5524	19.0664	19.7490	20.3250	20.7274	20.8930	20.8636	20.5588	19.8029	18.9068	18.1671 (87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605 (88)
util rest of house	0.9386	0.9134	0.8730	0.7914	0.6703	0.5066	0.3593	0.4008	0.6185	0.8229	0.9123	0.9441 (89)
MIT 2	16.7053	17.1277	17.7732	18.6199	19.3057	19.7566	19.9140	19.8933	19.5887	18.7051	17.5875	16.6465 (90)
Living area fraction									fLA = Living area /	(4) =		0.2213 (91)
MIT	17.0400	17.4431	18.0594	18.8698	19.5313	19.9715	20.1307	20.1081	19.8034	18.9481	17.8795	16.9831 (92)
Temperature adjustment												0.0000
adjusted MIT	17.0400	17.4431	18.0594	18.8698	19.5313	19.9715	20.1307	20.1081	19.8034	18.9481	17.8795	16.9831 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9094	0.8801	0.8371	0.7585	0.6500	0.5062	0.3734	0.4128	0.6072	0.7897	0.8797	0.9164 (94)
Useful gains	719.0944	801.7306	845.2559	858.2879	782.8009	603.7177	426.2007	438.9988	593.0586	676.9788	686.5404	693.6583 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1691.4190	1661.2445	1527.3213	1302.5364	1020.9766	693.3577	455.7511	477.7602	739.0377	1088.3531	1411.3693	1681.1922 (97)
Space heating kWh	723.4095	577.5934	507.4567	319.8589	177.2027	0.0000	0.0000	0.0000	0.0000	306.0625	521.8768	734.7252 (98a)
Space heating requirement - total per year (kWh/year)												3868.1856
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	723.4095	577.5934	507.4567	319.8589	177.2027	0.0000	0.0000	0.0000	0.0000	306.0625	521.8768	734.7252 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3868.1856
Space heating per m2										(98c) / (4) =		33.8128 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)

0.0000 (201)

Fraction of space heat from main system(s)

1.0000 (202)

Efficiency of main space heating system 1 (in %)

249.9000 (206)

Efficiency of main space heating system 2 (in %)

0.0000 (207)

Efficiency of secondary/supplementary heating system, %

0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	723.4095	577.5934	507.4567	319.8589	177.2027	0.0000	0.0000	0.0000	0.0000	306.0625	521.8768	734.7252 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	289.4796	231.1298	203.0639	127.9948	70.9094	0.0000	0.0000	0.0000	0.0000	122.4740	208.8343	294.0077 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating

Water heating requirement

317.4729 280.8404 298.0919 260.9349 252.2702 226.5393 222.7844 231.9131 234.8148 262.8133 280.7200 313.8100 (64)

Efficiency of water heater (217)m 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 (216)

Fuel for water heating, kWh/month 181.3095 160.3886 170.2409 149.0205 144.0721 129.3771 127.2327 132.4461 134.1032 150.0932 160.3198 179.2176 (219)

Space cooling fuel requirement (221)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (221)

Pumps and Fa 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (231)

Lighting 31.2050 25.0338 22.5401 16.5139 12.7558 10.4216 11.6363 15.1252 19.6462 25.7769 29.1149 32.0722 (232)

Electricity generated by PVs (Appendix M) (negative quantity) (233a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (233a)

Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (234a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235c)

Electricity generated by PVs (Appendix M) (negative quantity) (233b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (233b)

Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1547.8934	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1817.8213	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.8419	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3617.5566	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1547.8934	0.1544	239.0117	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1817.8213	0.1410	256.2660	(264)
Space and water heating			495.2777	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Total CO2, kg/year			531.6263	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1547.8934	1.5717	2432.7675	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1817.8213	1.5213	2765.4070	(278)
Space and water heating			5198.1746	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	251.8419	1.5338	386.2835	(282)
Total Primary energy kWh/year			5584.4580	(286)
Dwelling Primary energy Rate (DPER)			48.8200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

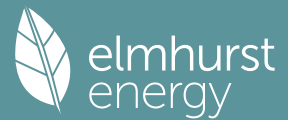
	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920	(1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	268.0460 (5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1492 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3992	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

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Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0200	1.0000	2.0200			(26)
TER Opening Type (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
Rooflight W			0.5400	1.4151	0.7642			(27a)
Ground Floor			81.8300	0.1300	10.6379			(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442			(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484			(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214			(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186			(30)
Joists FF	18.7700		18.7700	0.1100	2.0647			(30)
Rafters	17.9400	0.5400	17.4000	0.1100	1.9140			(30)
D Flat	1.7800		1.7800	0.1100	0.1958			(30)
Total net area of external elements Aum(A, m2)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.7925			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E16 Corner (normal)	14.4000	0.0900	1.2960	
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166	
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320	
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536	
R6 Flat ceiling	30.0000	0.0600	1.8000	
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080	
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980	
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655	
E3 Sill	12.3500	0.0500	0.6175	
E4 Jamb	32.9600	0.0500	1.6480	
E5 Ground floor (normal)	43.7400	0.1600	6.9984	
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000	
R1 Head of roof window	0.5500	0.0800	0.0440	
R2 Sill of roof window	0.5500	0.0600	0.0330	
R3 Jamb of roof window	1.9600	0.0800	0.1568	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.9034 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 81.6959 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591	(38)
Average = Sum(39)m / 12 =	134.2028	133.8813	133.5662	132.0860	131.8091	130.5199	130.5199	130.2812	131.0165	131.8091	132.3693	132.9550	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1731	1.1703	1.1675	1.1546	1.1522	1.1409	1.1409	1.1388	1.1452	1.1522	1.1571	1.1622	(40)
HLP (average)												1.1546	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8388 (42)
Hot water usage for mixer showers													
71.8174	70.7381	69.1654	66.1563	63.9356	61.4592	60.0516	61.6124	63.3233	65.9823	69.0560	71.5422	71.5422	(42a)
Hot water usage for baths													
31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022	30.9022	(42b)
Hot water usage for other uses													
43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023	43.7023	(42c)
Average daily hot water use (litres/day)													134.6910 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.5267	143.3978	139.5874	133.7935	129.0883	124.0300	122.0861	125.8800	129.8813	135.1917	141.0749	146.1468	(44)
Energy conte	232.0625	204.1966	214.5407	183.1566	173.7777	152.5093	147.6526	155.8658	160.1566	183.4539	200.9871	228.8305	(45)
Energy content (annual)										Total = Sum(45)m =		2237.1898	

Distribution loss (46)m = 0.15 x (45)m

34.8094	30.6295	32.1811	27.4735	26.0667	22.8764	22.1479	23.3799	24.0235	27.5181	30.1481	34.3246	34.3246	(46)

Water storage loss:

Store volume 250.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):

Temperature factor from Table 2b 1.8903 (48)

Enter (49) or (54) in (55) 0.5400 (49)

Total storage loss 1.0208 (55)

31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	(56)

If cylinder contains dedicated solar storage

31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	(57)

Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

286.9693	253.7898	269.4475	236.2922	228.6845	205.6449	202.5594	210.7726	213.2922	238.3607	254.1227	283.7373	283.7373	(62)

WWHRS	-32.8319	-29.0368	-30.4057	-25.1771	-23.4642	-20.0784	-18.8203	-20.0135	-20.7739	-24.4902	-27.7444	-32.2239	(63a)

PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)

FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h	254.1374	224.7530	239.0418	211.1151	205.2203	185.5665	183.7390	190.7590	192.5183	213.8705	226.3783	251.5134	(64)

12Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 2578.6125 (64)

Electric shower(s) 2579 (64)

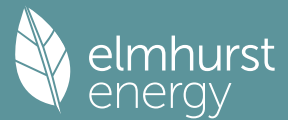
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

121.0862	107.5699	115.2602	103.4080	101.7065	93.2178	93.0199	95.7508	95.7606	104.9238	109.3367	120.0116	120.0116	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	162.7503	160.0743	154.9196	143.6223	136.7023	129.4692	125.0268	128.6973	133.0008	141.0267	151.8565	161.3059 (72)
Total internal gains	655.8471	671.7797	643.6359	621.7702	590.4407	566.7573	545.1678	545.9564	562.4151	584.0093	619.2487	642.1484 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				2.7000	10.6334	0.6300	0.7000	0.7700	8.7742 (74)			
East				3.6300	19.6403	0.6300	0.7000	0.7700	21.7884 (76)			
South				2.2000	46.7521	0.6300	0.7000	0.7700	31.4337 (78)			
West				8.7300	19.6403	0.6300	0.7000	0.7700	52.4003 (80)			
West				0.5400	25.9287	0.6300	0.7000	1.0000	5.5572 (82)			
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	403.0945	261.0515	147.5615	100.0274 (83)	
Total gains	775.8008	896.2752	995.6544	1118.8745	1192.5477	1181.6866	1131.0801	1052.7274	965.5096	845.0608	766.8101	742.1758 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.2204	21.2714	21.3216	21.5605	21.6058	21.8192	21.8192	21.8592	21.7365	21.6058	21.5144	21.4196
alpha	2.4147	2.4181	2.4214	2.4374	2.4404	2.4546	2.4546	2.4573	2.4491	2.4404	2.4343	2.4280
util living area	0.9482	0.9263	0.8919	0.8220	0.7190	0.5803	0.4553	0.4976	0.6864	0.8547	0.9271	0.9529 (86)
MIT	18.1616	18.4991	19.0190	19.7121	20.3002	20.7145	20.8870	20.8560	20.5404	19.7679	18.8590	18.1109 (87)
Th 2	19.9416	19.9438	19.9461	19.9565	19.9584	19.9676	19.9676	19.9693	19.9641	19.9584	19.9545	19.9504 (88)
util rest of house	0.9410	0.9164	0.8768	0.7963	0.6763	0.5128	0.3643	0.4065	0.6254	0.8281	0.9156	0.9464 (89)
MIT 2	16.6297	17.0556	17.7089	18.5696	19.2710	19.7360	19.9004	19.8785	19.5621	18.6573	17.5225	16.5704 (90)
Living area fraction	16.9688	17.3751	17.9988	18.8224	19.4988	19.9526	20.1187	20.0948	19.7786	18.9031	17.8183	16.9113 (91)
MIT	16.9688	17.3751	17.9988	18.8224	19.4988	19.9526	20.1187	20.0948	19.7786	18.9031	17.8183	16.9113 (92)
Temperature adjustment	16.9688	17.3751	17.9988	18.8224	19.4988	19.9526	20.1187	20.0948	19.7786	18.9031	17.8183	16.9113 (93)
adjusted MIT	16.9688	17.3751	17.9988	18.8224	19.4988	19.9526	20.1187	20.0948	19.7786	18.9031	17.8183	16.9113 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9122	0.8832	0.8407	0.7628	0.6550	0.5118	0.3784	0.4184	0.6131	0.7942	0.8831	0.9191 (94)
Useful gains	707.6953	791.6131	837.0579	853.4406	781.1534	604.7380	428.0209	440.4376	591.9515	671.1862	677.1846	682.1568 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1700.1848	1670.1800	1535.8565	1310.6142	1027.9538	698.6200	459.2635	481.3671	743.9931	1094.4266	1418.7786	1690.0354 (97)
Space heating kWh	738.4122	590.3970	519.9062	329.1650	183.6195	0.0000	0.0000	0.0000	0.0000	314.8909	533.9477	749.8616 (98a)
Space heating requirement - total per year (kWh/year)												3960.2000
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	738.4122	590.3970	519.9062	329.1650	183.6195	0.0000	0.0000	0.0000	0.0000	314.8909	533.9477	749.8616 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3960.2000
Space heating per m ²												34.6171 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	738.4122	590.3970	519.9062	329.1650	183.6195	0.0000	0.0000	0.0000	0.0000	314.8909	533.9477	749.8616 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	800.0132	639.6500	563.2786	356.6251	198.9377	0.0000	0.0000	0.0000	0.0000	341.1603	578.4915	812.4178 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating
Water heating requirement

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Efficiency of water heater (217)m	254.1374	224.7530	239.0418	211.1151	205.2203	185.5665	183.7390	190.7590	192.5183	213.8705	226.3783	251.5134 (64)
Fuel for water heating, kWh/month	86.3077	86.1219	85.7538	85.0518	83.8113	79.8000	79.8000	79.8000	79.8000	84.9259	85.9150	79.8000 (216)
Space cooling fuel requirement (221)m	294.4552	260.9706	278.7535	248.2194	244.8601	232.5394	230.2494	239.0464	241.2510	251.8319	263.4910	86.3538 (217)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	291.2591 (219)
Lighting	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	0.0000 (221)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	30.4985	24.4670	22.0298	16.1400	12.4670	10.1856	11.3728	14.7828	19.2014	25.1933	28.4558	7.0685 (231)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-66.9766	-89.9167	-123.1181	-131.6124	-136.3731	-125.2777	-123.6217	-119.2822	-111.0057	-99.3793	-71.9660	31.3461 (232)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Annual totals kWh/year	-52.8387	-109.0157	-212.9079	-314.5272	-411.0160	-411.3088	-406.5457	-346.4762	-256.9499	-154.1854	-69.9564	-41.9555 (233b)
Space heating fuel - main system 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Space heating fuel - main system 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Space heating fuel - secondary	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (211)
Efficiency of water heater	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Water heating fuel used	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space cooling fuel	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	79.8000
Electricity for pumps and fans:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3076.9270 (219)
Total electricity for the above, kWh/year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Electricity for lighting (calculated in Appendix L)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	86.0000 (231)
Energy saving/generation technologies (Appendices M ,N and Q)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	246.1401 (232)
PV generation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-4044.6528 (233)
Wind generation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235)
Appendix Q - special features	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0000 (236)
Energy saved or generated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (237)
Energy used	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3654.9885 (238)
Total delivered energy for all uses	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4290.5742	0.2100	901.0206 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3076.9270	0.2100	646.1547 (264)
Space and water heating			1547.1753 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	246.1401	0.1443	35.5256 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1256.9694	0.1357	-170.5285
PV Unit electricity exported	-2787.6833	0.1264	-352.3251
Total			-522.8537 (269)
Total CO2, kg/year			1071.7765 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.3700 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4290.5742	1.1300	4848.3488 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3076.9270	1.1300	3476.9275 (278)
Space and water heating			8325.2764 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	246.1401	1.5338	377.5379 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1256.9694	1.5015	-1887.2887
PV Unit electricity exported	-2787.6833	0.4639	-1293.3356
Total			-3180.6243 (283)
Total Primary energy kWh/year			5652.2907 (286)
Target Primary Energy Rate (TPER)			49.4100 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

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2. Ventilation rate

m3 per hour												
Number of open chimneys	0	*	80	=	0.0000	(6a)						
Number of open flues	0	*	20	=	0.0000	(6b)						
Number of chimneys / flues attached to closed fire	0	*	10	=	0.0000	(6c)						
Number of flues attached to solid fuel boiler	0	*	20	=	0.0000	(6d)						
Number of flues attached to other heater	0	*	35	=	0.0000	(6e)						
Number of blocked chimneys	0	*	20	=	0.0000	(6f)						
Number of intermittent extract fans	4	*	10	=	40.0000	(7a)						
Number of passive vents	0	*	10	=	0.0000	(7b)						
Number of flueless gas fires	0	*	40	=	0.0000	(7c)						
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =				40.0000	/	(5)	=	0.1492	(8)		
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	5.0000											
Infiltration rate	0.3992											
Number of sides sheltered	2											
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500							
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3393							
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)					
Solid Doors			2.0200	1.0000	2.0200			(26)					
Rooflight W			0.5400	1.1450	0.6183			(27a)					
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)					
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)					
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)					
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)					
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)					
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)					
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)					
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)					
Total net area of external elements Aum(A, m2)			311.1600					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.3937			(33)					
GF			100.0000			9.0000	900.0000	(32c)					
FF			50.0000			9.0000	450.0000	(32c)					
Internal Floor 1			32.5700			18.0000	586.2600	(32d)					
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10252.2300	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.6174	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E16 Corner (normal)				14.4000	0.0900		1.2960						
E10 Eaves (insulation at ceiling level)				38.6100	0.0600		2.3166						
E17 Corner (inverted - internal area greater than external area)				4.8000	-0.0900		-0.4320						
R8 Roof to wall (rafter)				22.5600	0.0600		1.3536						
R6 Flat ceiling				30.0000	0.0600		1.8000						
E13 Gable (insulation at rafter level)				2.6000	0.0800		0.2080						
E12 Gable (insulation at ceiling level)				3.3000	0.0600		0.1980						
E2 Other lintels (including other steel lintels)				13.3100	0.0500		0.6655						
E3 Sill				12.3500	0.0500		0.6175						
E4 Jamb				32.9600	0.0500		1.6480						
E5 Ground floor (normal)				43.7400	0.1600		6.9984						
E6 Intermediate floor within a dwelling				27.3400	0.0000		0.0000						
R1 Head of roof window				0.5500	0.0600		0.0330						
R2 Sill of roof window				0.5500	0.0800		0.0440						
R3 Jamb of roof window				1.9600	0.0600		0.1176						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.8642	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	80.2579	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 52.5069	Feb 52.1854	Mar 51.8703	Apr 50.3901	May 50.1132	Jun 48.8240	Jul 48.8240	Aug 48.5853	Sep 49.3206	Oct 50.1132	Nov 50.6734	Dec 51.2591	(38)
Heat transfer coeff	132.7648	132.4433	132.1281	130.6480	130.3711	129.0819	129.0819	128.8432	129.5785	130.3711	130.9313	131.5170	(39)
Average = Sum(39)m / 12 =												130.6467	
HLP	Jan 1.1605	Feb 1.1577	Mar 1.1550	Apr 1.1420	May 1.1396	Jun 1.1283	Jul 1.1283	Aug 1.1263	Sep 1.1327	Oct 1.1396	Nov 1.1445	Dec 1.1496	(40)
HLP (average)												1.1420	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8388											
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022

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Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												68.4778 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	74.7093	72.6597	70.4220	67.6372	65.1527	62.5708	62.0345	64.2676	66.5579	69.2094	72.0189	74.6045 (44)
Energy content (annual)	118.3213	103.4664	108.2360	92.5919	87.7080	76.9380	75.0254	79.5768	82.0726	93.9165	102.6041	116.8127 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908 (64)
12Total per year (kWh/year)												966.6793 (64)
Electric shower(s)	57.5138	51.2452	55.9578	53.3999	54.4019	51.8941	53.6239	54.4019	53.3999	55.9578	54.9056	57.5138 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												654.2157 (64a)
Heat gains from water heating, kWh/month	39.5217	34.7979	36.9896	33.0257	32.2384	29.3229	29.3489	30.5105	30.7904	33.9467	35.5298	39.2011 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	53.1206	51.7826	49.7172	45.8691	43.3312	40.7262	39.4474	41.0088	42.7644	45.6273	49.3469	52.6897 (72)
Total internal gains	543.2174	560.4880	535.4334	521.0170	494.0696	478.0143	459.5884	458.2678	472.1787	485.6099	513.7391	530.5322 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.7000	10.6334		0.6300		0.7000		0.7700		8.7742 (74)
East				3.6300	19.6403		0.6300		0.7000		0.7700		21.7884 (76)
South				2.2000	46.7521		0.6300		0.7000		0.7700		31.4337 (78)
West				8.7300	19.6403		0.6300		0.7000		0.7700		52.4003 (80)
West				0.5400	25.9287		0.6300		0.7000		1.0000		5.5572 (82)
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274	(83)
Total gains	663.1711	784.9835	887.4519	1018.1213	1096.1766	1092.9436	1045.5008	965.0388	875.2733	746.6614	661.3005	630.5596	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538
util living area	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436
	0.9621	0.9426	0.9114	0.8452	0.7455	0.6072	0.4808	0.5272	0.7189	0.8811	0.9450	0.9662 (86)
MIT	18.0092	18.3602	18.8991	19.6263	20.2457	20.6885	20.8749	20.8391	20.4933	19.6678	18.7234	17.9570 (87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605 (88)
util rest of house	0.9567	0.9346	0.8986	0.8218	0.7047	0.5399	0.3876	0.4344	0.6602	0.8581	0.9360	0.9614 (89)
MIT 2	17.2178	17.5649	18.0954	18.8051	19.3855	19.7784	19.9188	19.8989	19.6235	18.8602	17.9349	17.1718 (90)
Living area fraction	17.3929	17.7409	18.2733	18.9868	19.5759	19.9798	20.1304	20.1070	19.8160	19.0390	18.1094	17.3456 (91)
MIT	17.3929	17.7409	18.2733	18.9868	19.5759	19.9798	20.1304	20.1070	19.8160	19.0390	18.1094	17.3456 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3929	17.7409	18.2733	18.9868	19.5759	19.9798	20.1304	20.1070	19.8160	19.0390	18.1094	17.3456 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9383	0.9117	0.8720	0.7952	0.6871	0.5401	0.4024	0.4469	0.6500	0.8320	0.9139	0.9442 (94)
Ext temp.	622.2222	715.7074	773.8709	809.6424	753.1692	590.2905	420.7135	431.2384	568.8904	621.2122	604.3824	595.4040 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
	1738.2825	1700.6914	1555.5830	1317.8235	1026.7900	694.4341	455.7106	477.6194	740.6733	1100.1995	1441.4735	1728.8658 (97)
Space heating kWh												

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830.3489	661.9093	581.5939	365.8904	203.5738	0.0000	0.0000	0.0000	0.0000	356.3665	602.7056	843.2956 (98a)
Space heating requirement - total per year (kWh/year)											4445.6840
Solar heating kWh											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)	
Solar heating contribution - total per year (kWh/year)											0.0000
Space heating kWh											
830.3489	661.9093	581.5939	365.8904	203.5738	0.0000	0.0000	0.0000	0.0000	356.3665	602.7056	843.2956 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											4445.6840
Space heating per m2											(98c) / (4) = 38.8609 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1213.3698	955.2060	979.2080	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7097	0.7756	0.7410	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	861.1693	740.8508	725.5704	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1206.0734	1153.9537	1063.8177	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	248.3310	307.3486	251.6560	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	62.0827	76.8371	62.9140	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												201.8339 (107)
Energy for space heating												38.8609 (99)
Energy for space cooling												1.7643 (108)
Total												40.6252 (109)
Fabric Energy Efficiency (DFEE)												40.6 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	268.0460 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1492 (8)
Pressure Test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3992 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.0200	1.0000	2.0200		(26)
TER Opening Type (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Rooflight W			0.5400	1.4151	0.7642		(27a)
Ground Floor			81.8300	0.1300	10.6379		(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442		(29a)

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Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	(30)
Rafters	17.9400	0.5400	17.4000	0.1100	1.9140	(30)
D Flat	1.7800		1.7800	0.1100	0.1958	(30)
Total net area of external elements Aum(A, m2)			311.1600			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	64.7925		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	14.4000	0.0900	1.2960
E16 Corner (normal)	38.6100	0.0600	2.3166
E10 Eaves (insulation at ceiling level)	4.8000	-0.0900	-0.4320
E17 Corner (inverted - internal area greater than external area)	22.5600	0.0600	1.3536
R8 Roof to wall (rafter)	30.0000	0.0600	1.8000
R6 Flat ceiling	2.6000	0.0800	0.2080
E13 Gable (insulation at rafter level)	3.3000	0.0600	0.1980
E12 Gable (insulation at ceiling level)	13.3100	0.0500	0.6655
E2 Other lintels (including other steel lintels)	12.3500	0.0500	0.6175
E3 Sill	32.9600	0.0500	1.6480
E4 Jamb	43.7400	0.1600	6.9984
E5 Ground floor (normal)	27.3400	0.0000	0.0000
E6 Intermediate floor within a dwelling	0.5500	0.0800	0.0440
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	1.9600	0.0800	0.1568
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.9034 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 81.6959 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591
Average = Sum(39)m / 12 =	134.2028	133.8813	133.5662	132.0860	131.8091	130.5199	130.5199	130.2812	131.0165	131.8091	132.3693	132.9550

132.0847 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1731	1.1703	1.1675	1.1546	1.1522	1.1409	1.1409	1.1388	1.1452	1.1522	1.1571	1.1622
HLP (average)												1.1546
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8388 (42)
Hot water usage for mixer showers													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022		(42b)
Hot water usage for other uses													
43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023		(42c)
Average daily hot water use (litres/day)													68.4778 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.7093	72.6597	70.4220	67.6372	65.1527	62.5708	62.0345	64.2676	66.5579	69.2094	72.0189	74.6045	(44)
Energy conte	118.3213	103.4664	108.2360	92.5919	87.7080	76.9380	75.0254	79.5768	82.0726	93.9165	102.6041	116.8127	(45)
Energy content (annual)										Total = Sum(45)m =		1137.2698	
Distribution loss (46)m = 0.15 x (45)m													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908		(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908	(64)
12Total per year (kWh/year)													966.6793 (64)
Electric shower(s)	57.5138	51.2452	55.9578	53.3999	54.4019	51.8941	53.6239	54.4019	53.3999	55.9578	54.9056	57.5138	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												654.2157	(64a)
Heat gains from water heating, kWh/month	39.5217	34.7979	36.9896	33.0257	32.2384	29.3229	29.3489	30.5105	30.7904	33.9467	35.5298	39.2011	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	(71)
Water heating gains (Table 5)													
53.1206	51.7826	49.7172	45.8691	43.3312	40.7262	39.4474	41.0088	42.7644	45.6273	49.3469	52.6897		(72)
Total internal gains	543.2174	560.4880	535.4334	521.0170	494.0696	478.0143	459.5884	458.2678	472.1787	485.6099	513.7391	530.5322	(73)

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6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	2.7000		10.6334		0.6300		0.7000		0.7700		8.7742	(74)
East	3.6300		19.6403		0.6300		0.7000		0.7700		21.7884	(76)
South	2.2000		46.7521		0.6300		0.7000		0.7700		31.4337	(78)
West	8.7300		19.6403		0.6300		0.7000		0.7700		52.4003	(80)
West	0.5400		25.9287		0.6300		0.7000		1.0000		5.5572	(82)
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274 (83)
Total gains	663.1711	784.9835	887.4519	1018.1213	1096.1766	1092.9436	1045.5008	965.0388	875.2733	746.6614	661.3005	630.5596 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.2204	21.2714	21.3216	21.5605	21.6058	21.8192	21.8192	21.8592	21.7365	21.6058	21.5144	21.4196	
alpha	2.4147	2.4181	2.4214	2.4374	2.4404	2.4546	2.4546	2.4573	2.4491	2.4404	2.4343	2.4280	
util living area	0.9622	0.9429	0.9120	0.8465	0.7478	0.6103	0.4842	0.5306	0.7214	0.8820	0.9453	0.9663 (86)	
MIT	17.9779	18.3291	18.8704	19.6022	20.2285	20.6790	20.8701	20.8334	20.4809	19.6469	18.6963	17.9255 (87)	
Th 2	19.9416	19.9438	19.9461	19.9565	19.9584	19.9676	19.9676	19.9693	19.9641	19.9584	19.9545	19.9504 (88)	
util rest of house	0.9568	0.9349	0.8992	0.8231	0.7069	0.5426	0.3898	0.4367	0.6625	0.8590	0.9363	0.9615 (89)	
MIT 2	17.1805	17.5279	18.0609	18.7752	19.3625	19.7624	19.9066	19.8861	19.6052	18.8335	17.9019	17.1343 (90)	
Living area fraction	fLA = Living area / (4) =												0.2213 (91)
MIT	17.3570	17.7052	18.2401	18.9582	19.5542	19.9652	20.1198	20.0958	19.7990	19.0136	18.0778	17.3094 (92)	
Temperature adjustment													0.0000
adjusted MIT	17.3570	17.7052	18.2401	18.9582	19.5542	19.9652	20.1198	20.0958	19.7990	19.0136	18.0778	17.3094 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9383	0.9119	0.8724	0.7962	0.6888	0.5424	0.4047	0.4492	0.6518	0.8327	0.9141	0.9442 (94)
Useful gains	622.2291	715.8336	774.2453	810.6483	755.0344	592.8259	423.0718	433.4473	570.4914	621.7221	604.4764	595.3940 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1752.2856	1714.3813	1568.0762	1328.5512	1035.2512	700.2707	459.4101	481.4899	746.6623	1108.9829	1453.1186	1742.9591 (97)
Space heating kWh	840.7621	671.0240	590.6102	372.8901	208.4813	0.0000	0.0000	0.0000	0.0000	362.5220	611.0224	853.7885 (98a)
Space heating requirement - total per year (kWh/year)	4511.1006											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	840.7621	671.0240	590.6102	372.8901	208.4813	0.0000	0.0000	0.0000	0.0000	362.5220	611.0224	853.7885 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4511.1006											
Space heating per m2	(98c) / (4) = 39.4327 (99)											

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1226.8873	965.8475	990.1371	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7044	0.7706	0.7358	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	864.2544	744.3244	728.5349	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1206.0734	1153.9537	1063.8177	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	246.1097	304.7642	249.4504	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	61.5274	76.1911	62.3626	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	200.0811 (107)											
Energy for space heating	39.4327 (99)											
Energy for space cooling	1.7490 (108)											
Total	41.1817 (109)											
Fabric Energy Efficiency (TFEE)	41.2 (109)											

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)

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Dwelling volume

(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 268.0460 (5)

2. Ventilation rate

												m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												4 * 10 = 40.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) = 0.1492 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0000 (17)
Infiltration rate												0.3992 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3393 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

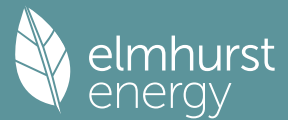
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)					
Solid Doors			2.0200	1.0000	2.0200			(26)					
Rooflight W			0.5400	1.1450	0.6183			(27a)					
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)					
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)					
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)					
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)					
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)					
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)					
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)					
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)					
Total net area of external elements Aum(A, m2)			311.1600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)					
GF			100.0000			9.0000	900.0000	(32c)					
FF			50.0000			9.0000	450.0000	(32c)					
Internal Floor 1			32.5700			18.0000	586.2600	(32d)					
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10252.2300	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.6174	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E16 Corner (normal)				14.4000	0.0900	1.2960							
E10 Eaves (insulation at ceiling level)				38.6100	0.0600	2.3166							
E17 Corner (inverted - internal area greater than external area)				4.8000	-0.0900	-0.4320							
R8 Roof to wall (rafter)				22.5600	0.0600	1.3536							
R6 Flat ceiling				30.0000	0.0600	1.8000							
E13 Gable (insulation at rafter level)				2.6000	0.0800	0.2080							
E12 Gable (insulation at ceiling level)				3.3000	0.0600	0.1980							
E2 Other lintels (including other steel lintels)				13.3100	0.0500	0.6655							
E3 Sill				12.3500	0.0500	0.6175							
E4 Jamb				32.9600	0.0500	1.6480							
E5 Ground floor (normal)				43.7400	0.1600	6.9984							
E6 Intermediate floor within a dwelling				27.3400	0.0000	0.0000							
R1 Head of roof window				0.5500	0.0600	0.0330							
R2 Sill of roof window				0.5500	0.0800	0.0440							
R3 Jamb of roof window				1.9600	0.0600	0.1176							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.8642	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	80.2579	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 52.5069	Feb 52.1854	Mar 51.8703	Apr 50.3901	May 50.1132	Jun 48.8240	Jul 48.8240	Aug 48.5853	Sep 49.3206	Oct 50.1132	Nov 50.6734	Dec 51.2591	(38)
Heat transfer coeff	132.7648	132.4433	132.1281	130.6480	130.3711	129.0819	129.0819	128.8432	129.5785	130.3711	130.9313	131.5170	(39)
Average = Sum(39)m / 12 =												130.6467	
HLP	Jan 1.1605	Feb 1.1577	Mar 1.1550	Apr 1.1420	May 1.1396	Jun 1.1283	Jul 1.1283	Aug 1.1263	Sep 1.1327	Oct 1.1396	Nov 1.1445	Dec 1.1496	(40)
HLP (average)												1.1420	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers												
	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278 (42a)
Hot water usage for baths												
	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses												

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	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												151.2443 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy conte	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Energy content (annual)	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2512.1698
Water storage loss:	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage												
Primary loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
WWHRS	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453 (72)
Total internal gains	742.5067	739.8983	717.4078	675.3570	633.5455	592.7733	570.4214	574.1857	595.7333	637.0802	683.3167	723.5706 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.7000	10.6334		0.6300		0.7000		0.7700		8.7742 (74)
East				3.6300	19.6403		0.6300		0.7000		0.7700		21.7884 (76)
South				2.2000	46.7521		0.6300		0.7000		0.7700		31.4337 (78)
West				8.7300	19.6403		0.6300		0.7000		0.7700		52.4003 (80)
West				0.5400	25.9287		0.6300		0.7000		1.0000		5.5572 (82)
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274	(83)
Total gains	862.4605	964.3937	1069.4263	1172.4613	1235.6526	1207.7026	1156.3338	1080.9567	998.8279	898.1317	830.8782	823.5981	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538
alpha	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436
util living area	0.9359	0.9150	0.8767	0.8072	0.7039	0.5686	0.4440	0.4843	0.6710	0.8383	0.9147	0.9418 (86)
MIT	18.3296	18.6303	19.1433	19.7902	20.3460	20.7327	20.8955	20.8674	20.5717	19.8492	18.9807	18.2735 (87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605 (88)
util rest of house	0.9274	0.9039	0.8602	0.7805	0.6608	0.5019	0.3552	0.3953	0.6099	0.8099	0.9017	0.9341 (89)
MIT 2	16.8455	17.2242	17.8666	18.6679	19.3281	19.7613	19.9157	19.8960	19.6011	18.7589	17.6785	16.7800 (90)
Living area fraction	17.1740	17.5354	18.1492	18.9163	19.5534	19.9763	20.1325	20.1110	19.8159	19.0002	17.9667	17.1105 (92)
MIT	17.1740	17.5354	18.1492	18.9163	19.5534	19.9763	20.1325	20.1110	19.8159	19.0002	17.9667	17.1105 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8961	0.8695	0.8240	0.7483	0.6413	0.5018	0.3694	0.4075	0.5994	0.7772	0.8680	0.9042 (94)
	772.8100	838.5641	881.1865	877.3598	792.4532	606.0310	427.1333	440.4660	598.6996	698.0558	721.1934	744.6743 (95)

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Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1709.2105	1673.4758	1539.1878	1308.6125	1023.8555	693.9816	455.9854	478.1349	740.6626	1095.1406	1422.7878	1697.9564 (97)
Space heating kWh	696.6820	561.0607	489.5530	310.5020	172.1633	0.0000	0.0000	0.0000	0.0000	295.4311	505.1480	709.2419 (98a)
Space heating requirement - total per year (kWh/year)												3739.7819
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	696.6820	561.0607	489.5530	310.5020	172.1633	0.0000	0.0000	0.0000	0.0000	295.4311	505.1480	709.2419 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3739.7819
Space heating per m2										(98c) / (4) =		32.6904 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	696.6820	561.0607	489.5530	310.5020	172.1633	0.0000	0.0000	0.0000	0.0000	295.4311	505.1480	709.2419 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	278.7843	224.5141	195.8995	124.2505	68.8929	0.0000	0.0000	0.0000	0.0000	118.2197	202.1400	283.8103 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1496.5114 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1817.8213 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												251.8419 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3566.1746 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1496.5114	16.4900	246.7747 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1817.8213	16.4900	299.7587 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	251.8419	16.4900	41.5287 (250)
Additional standing charges			0.0000 (251)
Total energy cost			588.0622 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] = 1.3281 (257)$

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SAP value
SAP rating (Section 12)
SAP band

78.4712
78 (258)
C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1496.5114	0.1544	231.0605 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1817.8213	0.1410	256.2660 (264)
Space and water heating			487.3265 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	251.8419	0.1443	36.3486 (268)
Total CO2, kg/year			523.6751 (272)
CO2 emissions per m2			4.5800 (273)
EI value			95.5977
EI rating			96 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1492 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3992	(18)
Number of sides sheltered	2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3054	0.2800	0.2715	0.2715	0.2800	0.2460	0.2630	0.2375	0.2375	0.2545	0.2375	0.2715 (22b)
Effective ac	0.5466	0.5392	0.5368	0.5368	0.5392	0.5303	0.5346	0.5282	0.5282	0.5324	0.5282	0.5368 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500 (28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100 (29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200 (29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700 (29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400 (30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300 (30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000 (30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200 (30)
Total net area of external elements Aum(A, m2)			311.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			50.0000			9.0000	450.0000 (32c)
Internal Floor 1			32.5700			18.0000	586.2600 (32d)
Internal Ceiling 1			32.5700			9.0000	293.1300 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10252.2300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		89.6174 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.8642 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss		(33) + (36) + (36a) =	80.2579 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.3529	47.6940	47.4871	47.4871	47.6940	46.9046	47.2866	46.7232	46.7232	47.0924	46.7232	47.4871	(38)
Heat transfer coeff	128.6108	127.9519	127.7450	127.7450	127.9519	127.1625	127.5445	126.9810	126.9810	127.3503	126.9810	127.7450	(39)
Average = Sum(39)m / 12 =												127.5625	
HLP	1.1242	1.1185	1.1167	1.1167	1.1185	1.1116	1.1149	1.1100	1.1100	1.1132	1.1100	1.1167	(40)
HLP (average)												1.1151	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8388 (42)
Hot water usage for mixer showers													
89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278	(42a)	
Hot water usage for baths													
31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022	(42b)	
Hot water usage for other uses													
43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023	(42c)	
Average daily hot water use (litres/day)												151.2443	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323	(44)	
Energy conte	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350	(45)
Energy content (annual)										Total =	Sum(45)m =	2512.1698	
Distribution loss (46)m = 0.15 x (45)m													
39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252	(46)	
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)	
If cylinder contains dedicated solar storage													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month													
317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h													
317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100	(64)	
Electric shower(s)									Total per year (kWh/year) =	Sum(64)m =	3183.0051	(64)	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
												0.0000	(64a)
Heat gains from water heating, kWh/month													
132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453 (72)
Total internal gains	742.5067	739.8983	717.4078	675.3570	633.5455	592.7733	570.4214	574.1857	595.7333	637.0802	683.3167	723.5706 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains

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	m2	Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	W
North	2.7000	13.0723	0.6300	0.7000	0.7700	10.7867 (74)
East	3.6300	24.4329	0.6300	0.7000	0.7700	27.1052 (76)
South	2.2000	54.9219	0.6300	0.7000	0.7700	36.9267 (78)
West	8.7300	24.4329	0.6300	0.7000	0.7700	65.1869 (80)
West	0.5400	32.4879	0.6300	0.7000	1.0000	6.9630 (82)

Solar gains	146.9685	241.5909	375.2790	546.8309	644.2318	712.2608	665.3036	581.6162	459.2161	299.4584	181.4444	119.4609 (83)
Total gains	889.4752	981.4892	1092.6868	1222.1879	1277.7773	1305.0342	1235.7250	1155.8019	1054.9495	936.5386	864.7611	843.0315 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.1431	22.2571	22.2932	22.2932	22.2571	22.3953	22.3282	22.4273	22.4273	22.3623	22.4273	22.2932
alpha	2.4762	2.4838	2.4862	2.4862	2.4838	2.4930	2.4885	2.4952	2.4952	2.4908	2.4952	2.4862
util living area	0.9229	0.9037	0.8556	0.7697	0.6399	0.4699	0.3510	0.3619	0.5975	0.7882	0.8911	0.9302 (86)
MIT	18.6752	18.8910	19.4307	20.0322	20.5545	20.8584	20.9511	20.9496	20.7217	20.1646	19.3504	18.6242 (87)
Th 2	19.9811	19.9858	19.9873	19.9873	19.9858	19.9914	19.9887	19.9927	19.9927	19.9901	19.9927	19.9873 (88)
util rest of house	0.9126	0.8911	0.8363	0.7385	0.5890	0.3968	0.2598	0.2659	0.5276	0.7508	0.8742	0.9207 (89)
MIT 2	17.2981	17.5695	18.2412	18.9707	19.5739	19.8910	19.9661	19.9700	19.7696	19.1496	18.1565	17.2385 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.6029	17.8620	18.5044	19.2057	19.7909	20.1051	20.1841	20.1868	19.9803	19.3742	18.4208	17.5452 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6029	17.8620	18.5044	19.2057	19.7909	20.1051	20.1841	20.1868	19.9803	19.3742	18.4208	17.5452 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8801	0.8569	0.8017	0.7108	0.5783	0.4055	0.2780	0.2851	0.5267	0.7240	0.8402	0.8895 (94)
Useful gains	782.8339	840.9981	876.0113	868.7848	738.9374	529.1416	343.5832	329.5571	555.6029	678.0357	726.5373	749.8428 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	1595.1460	1581.7405	1431.3111	1214.3022	894.5003	572.8773	355.0941	341.1713	645.1050	964.5800	1297.8415	1577.0404 (97)
Space heating kWh	604.3602	497.7789	413.1431	248.7725	115.7388	0.0000	0.0000	0.0000	0.0000	213.1889	411.3390	615.4350 (98a)
Space heating requirement - total per year (kWh/year)	3119.7564											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	604.3602	497.7789	413.1431	248.7725	115.7388	0.0000	0.0000	0.0000	0.0000	213.1889	411.3390	615.4350 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3119.7564											
Space heating per m2	(98c) / (4) = 27.2706 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	604.3602	497.7789	413.1431	248.7725	115.7388	0.0000	0.0000	0.0000	0.0000	213.1889	411.3390	615.4350 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	241.8408	199.1912	165.3234	99.5488	46.3140	0.0000	0.0000	0.0000	0.0000	85.3097	164.6014	246.2725 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	1248.4019 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	175.1000
Water heating fuel used	1817.8213 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	251.8419 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3318.0651 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1248.4019	26.0600	325.3335 (240)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1817.8213	26.0600	473.7242 (247)	
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)	
Energy for lighting	251.8419	26.0600	65.6300 (250)	
Additional standing charges			0.0000 (251)	
Total energy cost			864.6878 (255)	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1248.4019	0.1550	193.5334 (261)	
Total CO2 associated with community systems			0.0000 (373)	
Water heating (other fuel)	1817.8213	0.1410	256.2660 (264)	
Space and water heating			449.7994 (265)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)	
Energy for lighting	251.8419	0.1443	36.3486 (268)	
Total CO2, kg/year			486.1480 (272)	

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1248.4019	1.5740	1964.9223 (275)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1817.8213	1.5213	2765.4070 (278)	
Space and water heating			4730.3293 (279)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)	
Energy for lighting	251.8419	1.5338	386.2835 (282)	
Total Primary energy kWh/year			5116.6128 (286)	

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:	C 78
Current environmental impact rating:	A 96

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.9	-£ 102	-49 kg (10.1%)
U Solar photovoltaic panels	+ 5.6	-£ 256	-132 kg (30.3%)

Recommended measures	Typical annual savings	Energy efficiency impact	Environmental impact
Solar water heating	£102	0.43 kg/m²	C 80 A 96
Solar photovoltaic panels	£256	1.16 kg/m²	B 86 A 97
Total Savings	£358	1.58 kg/m²	

Potential energy efficiency rating:	B 86
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£865	£762	£102
Space heating	£325	£347	-£21
Water heating	£474	£350	£123
Lighting	£66	£66	£0
Generated (PV)	-£0	-£256	£256

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Total cost of fuels	£865	£506	£358
Total cost of uses	£865	£507	£358
Delivered energy	29 kWh/m²	17 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	3 kg/m²	2 kg/m²
Primary energy	45 kWh/m²	27 kWh/m²	18 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

2. Ventilation rate

												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1492 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000 (17)	
Infiltration rate												0.3992 (18)	
Number of sides sheltered												2 (19)	
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.3393 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)	
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)	

3. Heat losses and heat loss parameter

Element	Gross m²	Openings m²	NetArea m²	U-value W/m²K	A x U W/K	K-value kJ/m²K	A x K kJ/K
Windows (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500 (28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100 (29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200 (29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700 (29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400 (30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300 (30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000 (30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200 (30)
Total net area of external elements Aum(A, m²)			311.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			50.0000			9.0000	450.0000 (32c)
Internal Floor 1			32.5700			18.0000	586.2600 (32d)
Internal Ceiling 1			32.5700			9.0000	293.1300 (32e)

Heat capacity Cm = Sum (A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 10252.2300 (34)
89.6174 (35)

List of Thermal Bridges

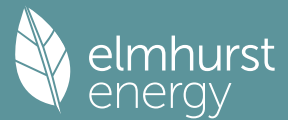
K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000

[illegible]

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	177.6822	174.7584	167.5199	148.7980	134.7852	126.4105	121.3577	126.4379	138.2364	151.7536	165.4389	176.0453 (72)
Total internal gains	742.5067	739.8983	715.9070	667.8530	619.7882	578.7659	556.4139	561.1787	589.7301	635.5794	683.3167	723.5706 (73)

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[Jan]	Area m2					Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d	Gains W
North	2.7000					10.6334		0.6300		0.7000		0.7700	8.7742 (74)
East	3.6300					19.6403		0.6300		0.7000		0.7700	21.7884 (76)
South	2.2000					46.7521		0.6300		0.7000		0.7700	31.4337 (78)
West	8.7300					19.6403		0.6300		0.7000		0.7700	52.4003 (80)
West	0.5400					25.9287		0.6300		0.7000		1.0000	5.5572 (82)
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274	(83)
Total gains	862.4605	964.3937	1067.9255	1164.9573	1221.8952	1193.6952	1142.3263	1067.9498	992.8247	896.6309	830.8782	823.5981	(84)
7. Mean internal temperature (heating season)													
Temperature during heating periods in the living area from Table 9, Th1 (C)													
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538	
alpha	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436	
util living area	0.9359	0.9150	0.8770	0.8091	0.7079	0.5731	0.4484	0.4889	0.6733	0.8387	0.9147	0.9418	(86)
MIT	18.3296	18.6303	19.1414	19.7828	20.3368	20.7277	20.8932	20.8646	20.5682	19.8475	18.9807	18.2735	(87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605	(88)
util rest of house	0.9274	0.9039	0.8605	0.7825	0.6649	0.5063	0.3590	0.3993	0.6123	0.8104	0.9017	0.9341	(89)
MIT 2	16.8455	17.2242	17.8643	18.6593	19.3184	19.7569	19.9141	19.8940	19.5978	18.7569	17.6785	16.7800	(90)
Living area fraction	17.1740	17.5354	18.1470	18.9079	19.5438	19.9718	20.1308	20.1088	19.8126	18.9983	17.9667	17.1105	(92)
MIT	17.1740	17.5354	18.1470	18.9079	19.5438	19.9718	20.1308	20.1088	19.8126	18.9983	17.9667	17.1105	(93)
Temperature adjustment	17.1740	17.5354	18.1470	18.9079	19.5438	19.9718	20.1308	20.1088	19.8126	18.9983	17.9667	17.1105	(93)
adjusted MIT	17.1740	17.5354	18.1470	18.9079	19.5438	19.9718	20.1308	20.1088	19.8126	18.9983	17.9667	17.1105	(93)
8. Space heating requirement													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8961	0.8695	0.8243	0.7502	0.6451	0.5059	0.3731	0.4114	0.6015	0.7777	0.8680	0.9042	(94)
Useful gains	772.8100	838.5641	880.3007	873.9117	788.2490	603.8823	426.2583	439.3798	597.1857	697.2966	721.1934	744.6743	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1709.2105	1673.4758	1538.8957	1307.5162	1022.6035	693.4022	455.7656	477.8576	740.2273	1094.8967	1422.7878	1697.9564	(97)
Space heating kWh	696.6820	561.0607	489.9946	312.1952	174.3597	0.0000	0.0000	0.0000	0.0000	295.8145	505.1480	709.2419	(98a)
Space heating requirement - total per year (kWh/year)												3744.4966	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	696.6820	561.0607	489.9946	312.1952	174.3597	0.0000	0.0000	0.0000	0.0000	295.8145	505.1480	709.2419	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3744.4966	
Space heating per m2										(98c) / (4) =		32.7316	(99)
9a. Energy requirements - Individual heating systems, including micro-CHP													
Fraction of space heat from secondary/supplementary system (Table 11)													
Fraction of space heat from main system(s)													
Efficiency of main space heating system 1 (in %)													
Efficiency of main space heating system 2 (in %)													
Efficiency of secondary/supplementary heating system, %													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	696.6820	561.0607	489.9946	312.1952	174.3597	0.0000	0.0000	0.0000	0.0000	295.8145	505.1480	709.2419	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	278.7843	224.5141	196.0763	124.9281	69.7718	0.0000	0.0000	0.0000	0.0000	118.3731	202.1400	283.8103	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	317.4729	264.6629	237.2840	171.5879	130.2929	113.0700	109.5240	132.8922	170.2335	232.5871	280.7200	313.8100	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	181.3095	151.1496	135.5134	97.9942	74.4105	64.5745	62.5494	75.8950	97.2207	132.8310	160.3198	179.2176	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-39.1866	-59.1644	-89.7769	-104.3842	-112.3678	-99.0713	-97.5974	-91.7305	-80.6820	-68.6342	-44.2225	-33.4542	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1498.3980	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1412.9853	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.8419	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-920.2721	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2322.9531	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1498.3980	16.4900	247.0858	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1412.9853	16.4900	233.0013	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	251.8419	16.4900	41.5287	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-920.2721	16.4900	-151.7529	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-151.7529	(252)
Total energy cost			383.0550	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8651	(257)
SAP value		85.9764	
SAP rating (Section 12)		86	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1498.3980	0.1544	231.3213	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1412.9853	0.1450	204.8452	(264)
Space and water heating			436.1665	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-920.2721	0.1344	-123.6529	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-123.6529	(269)
Total CO2, kg/year			359.9592	(272)
CO2 emissions per m2			3.1500	(273)
EI value			96.9740	
EI rating			97	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)	
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	268.0460 (5)	

2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000	Air changes per hour	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.3992	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500		(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393		(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Adj infilt rate	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Effective ac	0.3054	0.2800	0.2715	0.2715	0.2800	0.2460	0.2630	0.2375	0.2375	0.2545	0.2375	0.2715	(22b)
	0.5466	0.5392	0.5368	0.5368	0.5392	0.5303	0.5346	0.5282	0.5282	0.5324	0.5282	0.5368	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight W			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)
Total net area of external elements Aum (A, m2)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			50.0000			9.0000	450.0000	(32c)
Internal Floor 1			32.5700			18.0000	586.2600	(32d)
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)
Heat capacity Cm = Sum (A x k)						(28)...(30) + (32) + (32a)...(32e) =	10252.2300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.6174	(35)

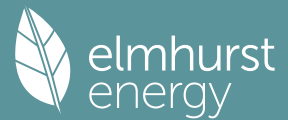
List of Thermal Bridges													
K1 Element													
E16 Corner (normal)						Length	Psi-value	Total					
E10 Eaves (insulation at ceiling level)						14.4000	0.0900	1.2960					
E17 Corner (inverted - internal area greater than external area)						38.6100	0.0600	2.3166					
R8 Roof to wall (rafter)						4.8000	-0.0900	-0.4320					
R6 Flat ceiling						22.5600	0.0600	1.3536					
E13 Gable (insulation at rafter level)						30.0000	0.0600	1.8000					
E12 Gable (insulation at ceiling level)						2.6000	0.0800	0.2080					
E2 Other lintels (including other steel lintels)						3.3000	0.0600	0.1980					
E3 Sill						13.3100	0.0500	0.6655					
E4 Jamb						12.3500	0.0500	0.6175					
E5 Ground floor (normal)						32.9600	0.0500	1.6480					
E6 Intermediate floor within a dwelling						43.7400	0.1600	6.9984					
R1 Head of roof window						27.3400	0.0000	0.0000					
R2 Sill of roof window						0.5500	0.0600	0.0330					
R3 Jamb of roof window						0.5500	0.0800	0.0440					
						1.9600	0.0600	0.1176					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												16.8642	(36)
Point Thermal bridges												0.0000	(36a)
Total fabric heat loss												80.2579	(37)
													(33) + (36) + (36a) =

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	48.3529	47.6940	47.4871	47.4871	47.6940	46.9046	47.2866	46.7232	46.7232	47.0924	46.7232	47.4871	(38)
Average = Sum(39)m / 12 =	128.6108	127.9519	127.7450	127.7450	127.9519	127.1625	127.5445	126.9810	126.9810	127.3503	126.9810	127.7450	(39)
												127.5625	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1242	1.1185	1.1167	1.1167	1.1185	1.1116	1.1149	1.1100	1.1100	1.1132	1.1100	1.1167	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388	(42)
Hot water usage for mixer showers	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278	(42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022	(42b)
Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023	(42c)
Average daily hot water use (litres/day)												151.2443	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323	(44)
Energy content	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350	(45)
Energy content (annual)	Total = Sum(45)m =											2512.1698	

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Distribution loss (46)m = 0.15 x (45)m	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
33.7127 30.4501 33.7127 32.6252 33.7127 32.6252 33.7127 33.7127 32.6252 33.7127 32.6252 33.7127 (56)												
If cylinder contains dedicated solar storage												
33.7127 30.4501 33.7127 32.6252 33.7127 32.6252 33.7127 33.7127 32.6252 33.7127 32.6252 33.7127 (57)												
Primary loss 23.2624 21.0112 21.8667 15.7584 10.4681 9.9053 10.2355 11.1660 17.1091 21.8667 22.5120 23.2624 (59)												
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)												
Total heat required for water heating calculated for each month												
317.4729 280.8404 296.6962 254.1813 239.4759 213.9326 209.7575 219.8167 229.4119 261.4175 280.7200 313.8100 (62)												
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)												
PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)												
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												763.9825 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												763.9825
Solar input -1.7760 -20.9090 -66.4092 -94.2840 -119.0285 -119.8568 -116.4267 -104.0535 -72.7611 -40.9082 -7.5696 -0.0000 (63c)												
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)												
Output from w/h												
315.6969 259.9314 230.2870 159.8973 120.4473 94.0757 93.3308 115.7632 156.6508 220.5093 273.1504 313.8100 (64)												
Electric shower(s)												
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)												
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
132.1956 117.4376 124.6348 107.1346 100.2802 91.0156 90.2901 94.0698 99.5302 112.9047 119.1160 130.9777 (65)												

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
35.6508 31.6647 25.7515 19.4955 14.5731 12.3033 13.2941 17.2802 23.1934 29.4494 34.3718 36.6417 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
414.5257 418.8272 407.9876 384.9114 355.7818 328.4041 310.1142 305.8127 316.6523 339.7285 368.8580 396.2357 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 54.8717 (69)													
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 -113.5526 (71)													
Water heating gains (Table 5)													
177.6822 174.7584 167.5199 148.7980 134.7852 126.4105 121.3577 126.4379 138.2364 151.7536 165.4389 176.0453 (72)													
Total internal gains													
742.5067 739.8983 715.9070 667.8530 619.7882 578.7659 556.4139 561.1787 589.7301 635.5794 683.3167 723.5706 (73)													

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					2.7000	13.0723		0.6300	0.7000	0.7700		10.7867 (74)
East					3.6300	24.4329		0.6300	0.7000	0.7700		27.1052 (76)
South					2.2000	54.9219		0.6300	0.7000	0.7700		36.9267 (78)
West					8.7300	24.4329		0.6300	0.7000	0.7700		65.1869 (80)
West					0.5400	32.4879		0.6300	0.7000	1.0000		6.9630 (82)
Solar gains	146.9685	241.5909	375.2790	546.8309	644.2318	712.2608	665.3036	581.6162	459.2161	299.4584	181.4444	119.4609 (83)
Total gains	889.4752	981.4892	1091.1860	1214.6839	1264.0199	1291.0267	1221.7176	1142.7950	1048.9463	935.0378	864.7611	843.0315 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	22.1431	22.2571	22.2932	22.2932	22.2571	22.3953	22.3282	22.4273	22.4273	22.3623	22.4273	22.2932	
alpha	2.4762	2.4838	2.4862	2.4862	2.4838	2.4930	2.4885	2.4952	2.4952	2.4908	2.4952	2.4862	
util living area	0.9229	0.9037	0.8559	0.7717	0.6440	0.4739	0.3546	0.3655	0.5997	0.7887	0.8911	0.9302 (86)	
MIT	18.6752	18.8910	19.4289	20.0257	20.5476	20.8556	20.9500	20.9484	20.7192	20.1632	19.3504	18.6242 (87)	
Th 2	19.9811	19.9858	19.9873	19.9873	19.9858	19.9914	19.9887	19.9927	19.9927	19.9901	19.9927	19.9873 (88)	
util rest of house	0.9126	0.8911	0.8367	0.7406	0.5932	0.4004	0.2626	0.2687	0.5298	0.7514	0.8742	0.9207 (89)	
MIT 2	17.2981	17.5695	18.2390	18.9634	19.5670	19.8889	19.9655	19.9694	19.7675	19.1480	18.1565	17.2385 (90)	
Living area fraction									fLA = Living area / (4) =			0.2213 (91)	
MIT	17.6029	17.8620	18.5024	19.1985	19.7840	20.1028	20.1834	20.1861	19.9781	19.3727	18.4208	17.5452 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.6029	17.8620	18.5024	19.1985	19.7840	20.1028	20.1834	20.1861	19.9781	19.3727	18.4208	17.5452 (93)	

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8801	0.8569	0.8021	0.7128	0.5821	0.4090	0.2809	0.2881	0.5287	0.7245	0.8402	0.8895	(94)
Useful gains	782.8339	840.9981	875.1919	865.7953	735.8049	528.0058	343.2216	329.1963	554.5641	677.4103	726.5373	749.8428	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1595.1460	1581.7405	1431.0487	1213.3854	893.6172	572.5899	355.0062	341.0834	644.8239	964.3876	1297.8415	1577.0404	(97)
Space heating kWh	604.3602	497.7789	413.5574	250.2648	117.4123	0.0000	0.0000	0.0000	0.0000	213.5111	411.3390	615.4350	(98a)
Space heating requirement - total per year (kWh/year)												3123.6588	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	604.3602	497.7789	413.5574	250.2648	117.4123	0.0000	0.0000	0.0000	0.0000	213.5111	411.3390	615.4350	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3123.6588	
Space heating per m2										(98c) / (4) =		27.3047	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	604.3602	497.7789	413.5574	250.2648	117.4123	0.0000	0.0000	0.0000	0.0000	213.5111	411.3390	615.4350	(98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating fuel (main heating system)	241.8408	199.1912	165.4892	100.1460	46.9837	0.0000	0.0000	0.0000	0.0000	85.4386	164.6014	246.2725	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	315.6969	259.9314	230.2870	159.8973	120.4473	94.0757	93.3308	115.7632	156.6508	220.5093	273.1504	313.8100	(64)	
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
Fuel for water heating, kWh/month	180.2952	148.4474	131.5174	91.3177	68.7877	53.7269	53.3014	66.1126	89.4636	125.9334	155.9968	179.2176	(219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)	
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-46.2673	-62.1388	-92.7382	-108.9578	-113.8911	-105.5870	-103.1224	-98.0354	-86.8985	-74.5950	-51.8699	-38.7378	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													1249.9635	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													175.1000	
Water heating fuel used													1344.1178	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													80.0000	(231)
Electricity for lighting (calculated in Appendix L)													251.8419	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-982.8393	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													1943.0839	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1249.9635	26.0600	325.7405	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1344.1178	26.0600	350.2771	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	251.8419	26.0600	65.6300	(250)
Additional standing charges			0.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-982.8393	26.0600	-256.1279
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-256.1279 (252)
Total energy cost			506.3677 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1249.9635	0.1550	193.7501 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1344.1178	0.1458	195.9781 (264)
Space and water heating			389.7282 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	251.8419	0.1443	36.3486 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-982.8393	0.1346	-132.2775
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-132.2775 (269)
Total CO2, kg/year			304.8963 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1249.9635	1.5739	1967.2856 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1344.1178	1.5394	2069.0696 (278)
Space and water heating			4036.3552 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	251.8419	1.5338	386.2835 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-982.8393	1.4974	-1471.7154
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1471.7154 (283)
Total Primary energy kWh/year			3071.9473 (286)

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Property Reference	FURNERS LANE 11				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 11, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	79 C	DER	5.85	TER	13.78	
Environmental	96 A	% DER < TER				57.55
CO ₂ Emissions (t/year)	0.3	DFEE	38.06	TFEE	39.04	
Compliance Check	See BREL	% DFEE < TFEE				2.51
% DPER < TPER	14.39	DPER	61.91	TPER	72.31	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.4100 (1b)	2.4000 (2b)	135.3840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	135.3840 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1477 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3977 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3381 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4310	0.4226	0.4141	0.3719	0.3634	0.3212	0.3212	0.3127	0.3381	0.3634	0.3803	0.3972 (22b)
Effective ac	0.5929	0.5893	0.5858	0.5691	0.5660	0.5516	0.5516	0.5489	0.5571	0.5660	0.5723	0.5789 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			11.4000	1.1450	13.0534		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			56.4100	0.1100	6.2051	75.0000	4230.7500 (28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	9.0000	317.7900 (29a)
Cladding	6.9500		6.9500	0.1800	1.2510	9.0000	62.5500 (29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400 (30)
Total net area of external elements A _{um} (A, m ²)			118.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.5369		(33)
Party Wall 1			26.8300	0.0000	0.0000	20.0000	536.6000 (32)
Party Ceiling 1			50.0000			20.0000	1000.0000 (32b)
GF			80.0000			9.0000	720.0000 (32c)
Heat capacity C _m = Sum (A x k)						(28)...(30) + (32) + (32a)...(32e) =	6926.7300 (34)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							122.7926 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				2.0000	0.0600	0.1200	
E10 Eaves (insulation at ceiling level)				8.0000	0.0600	0.4800	
E16 Corner (normal)				12.0000	0.0900	1.0800	
E17 Corner (inverted - internal area greater than external area)				2.4000	-0.0900	-0.2160	

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E2 Other lintels (including other steel lintels)	8.5500	0.0500	0.4275	
E3 Sill	7.6200	0.0500	0.3810	
E4 Jamb	17.9000	0.0500	0.8950	
E5 Ground floor (normal)	23.1700	0.1600	3.7072	
P1 Party wall - Ground floor	11.1800	0.0800	0.8944	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.1800	0.0000	0.0000	
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880	
E7 Party floor between dwellings (in blocks of flats)	18.0000	0.0700	1.2600	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.3171 (36)
Point Thermal bridges				0.0000
Total fabric heat loss		(33) + (36) + (36a) =		38.8540 (37)

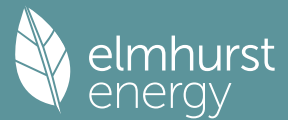
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	26.4887	26.3275	26.1695	25.4276	25.2887	24.6425	24.6425	24.5228	24.8914	25.2887	25.5696	25.8632 (38)
Average = Sum(39)m / 12 =	65.3427	65.1816	65.0236	64.2816	64.1428	63.4965	63.4965	63.3769	63.7455	64.1428	64.4236	64.7172 (39)
												64.2809
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1584	1.1555	1.1527	1.1395	1.1371	1.1256	1.1256	1.1235	1.1300	1.1371	1.1421	1.1473 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.8785 (42)
Hot water usage for mixer showers												
	69.6455	68.5989	67.0737	64.1556	62.0021	59.6006	58.2355	59.7492	61.4084	63.9869	66.9677	69.3787 (42a)
Hot water usage for baths												
	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017 (42b)
Hot water usage for other uses												
	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681 (42c)
Average daily hot water use (litres/day)												117.3289 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	127.5967	124.9609	121.7005	116.6221	112.5417	108.1375	106.3559	109.6013	113.0366	117.6718	122.8319	127.2485 (44)
Energy content (annual)	202.0820	177.9426	187.0491	159.6498	151.5027	132.9677	128.6283	135.7093	139.3854	159.6795	174.9966	199.2404 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1948.8335
	30.3123	26.6914	28.0574	23.9475	22.7254	19.9451	19.2942	20.3564	20.9078	23.9519	26.2495	29.8861 (46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.8736 (55)
Total storage loss												
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)
If cylinder contains dedicated solar storage												
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
12Total per year (kWh/year)												2541.5986 (64)
Electric shower(s)												2542 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	107.4678	95.5438	102.4694	92.0599	90.6502	83.1881	83.0445	85.3989	85.3220	93.3690	97.1627	106.5230 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	83.1186	92.0241	83.1186	85.8892	83.1186	85.8892	83.1186	83.1186	85.8892	83.1186	85.8892	83.1186 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	163.8111	165.5109	161.2274	152.1082	140.5969	129.7778	122.5500	120.8502	125.1338	134.2529	145.7643	156.5833 (68)
Pumps, fans	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415 (71)
Total internal gains	144.4460	142.1783	137.7277	127.8610	121.8417	115.5390	111.6189	114.7834	118.5028	125.4959	134.9482	143.1760 (72)
	445.5537	453.8914	436.2516	420.0364	399.7351	382.3841	368.4655	369.9302	380.7038	397.0455	420.7797	437.0560 (73)

6. Solar gains						
[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.4800	10.6334	0.6300	0.7000	0.7700	21.0581 (74)
East	2.5800	19.6403	0.6300	0.7000	0.7700	15.4860 (76)
South	2.3400	46.7521	0.6300	0.7000	0.7700	33.4340 (78)

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Solar gains	69.9781	125.2932	188.0223	261.4339	319.2847	328.7403	312.0355	266.9937	213.1040	142.9101	84.9178	59.1800 (83)
Total gains	515.5318	579.1847	624.2739	681.4703	719.0199	711.1243	680.5011	636.9239	593.8077	539.9556	505.6975	496.2360 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	29.4462	29.5190	29.5907	29.9322	29.9970	30.3023	30.3023	30.3595	30.1840	29.9970	29.8662	29.7308	
alpha	2.9631	2.9679	2.9727	2.9955	2.9998	3.0202	3.0202	3.0240	3.0123	2.9998	2.9911	2.9821	
util living area	0.9397	0.9152	0.8769	0.7969	0.6763	0.5209	0.3936	0.4333	0.6296	0.8229	0.9122	0.9452 (86)	
MIT	19.0759	19.3517	19.7439	20.2513	20.6480	20.8849	20.9631	20.9502	20.7890	20.2891	19.6164	19.0330 (87)	
Th 2	19.9535	19.9558	19.9580	19.9687	19.9707	19.9800	19.9800	19.9817	19.9764	19.9707	19.9666	19.9624 (88)	
util rest of house	0.9303	0.9023	0.8578	0.7656	0.6274	0.4516	0.3087	0.3461	0.5618	0.7886	0.8967	0.9365 (89)	
MIT 2	17.7429	18.0873	18.5739	19.1922	19.6455	19.8959	19.9613	19.9547	19.8082	19.2530	18.4313	17.6950 (90)	
Living area fraction									fLA = Living area / (4) =				0.4042 (91)
MIT	18.2817	18.5984	19.0468	19.6203	20.0507	20.2956	20.3662	20.3571	20.2046	19.6718	18.9103	18.2358 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.2817	18.5984	19.0468	19.6203	20.0507	20.2956	20.3662	20.3571	20.2046	19.6718	18.9103	18.2358 (93)	

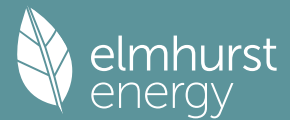
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9108	0.8815	0.8381	0.7539	0.6314	0.4738	0.3416	0.3792	0.5779	0.7773	0.8771	0.9178 (94)
Useful gains	469.5478	510.5464	523.2183	513.7493	454.0171	336.9625	232.4501	241.4917	343.1511	419.7061	443.5525	455.4562 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.1000	14.0000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	913.6007	892.8801	815.8376	689.1155	535.6363	361.6529	239.1408	250.7864	389.1431	581.8886	760.8604	908.3551 (97)
Space heating kWh	330.3753	256.9282	217.7088	126.2636	60.7247	0.0000	0.0000	0.0000	0.0000	120.6637	228.4617	336.9567 (98a)
Space heating requirement - total per year (kWh/year)												1678.0829
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	330.3753	256.9282	217.7088	126.2636	60.7247	0.0000	0.0000	0.0000	0.0000	120.6637	228.4617	336.9567 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1678.0829
Space heating per m2										(98c) / (4) =		29.7480 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	330.3753	256.9282	217.7088	126.2636	60.7247	0.0000	0.0000	0.0000	0.0000	120.6637	228.4617	336.9567 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	132.2030	102.8124	87.1184	50.5257	24.2996	0.0000	0.0000	0.0000	0.0000	48.2848	91.4213	134.8366 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	144.1613	127.5928	135.5760	119.0007	115.2754	103.7625	102.2117	106.2557	107.4277	119.9451	127.7653	142.5384 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	18.3728	14.7394	13.2712	9.7230	7.5103	6.1360	6.8512	8.9054	11.5673	15.1769	17.1423	18.8835 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												671.5018 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1451.5126 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												148.2792 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2271.2936 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	671.5018	0.1550	104.1106 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1451.5126	0.1409	204.5324 (264)
Space and water heating			308.6430 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	148.2792	0.1443	21.4013 (268)
Total CO2, kg/year			330.0443 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.8500 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	671.5018	1.5740	1056.9414 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1451.5126	1.5210	2207.8002 (278)
Space and water heating			3264.7416 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	148.2792	1.5338	227.4356 (282)
Total Primary energy kWh/year			3492.1773 (286)
Dwelling Primary energy Rate (DPER)			61.9100 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4100 (1b)	x 2.4000 (2b)	= 135.3840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 135.3840 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

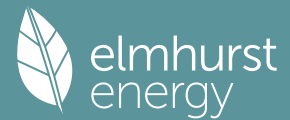
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1477 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3977	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3381 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4310	0.4226	0.4141	0.3719	0.3634	0.3212	0.3212	0.3127	0.3381	0.3634	0.3803	0.3972 (22b)
Effective ac	0.5929	0.5893	0.5858	0.5691	0.5660	0.5516	0.5516	0.5489	0.5571	0.5660	0.5723	0.5789 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)

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TER Opening Type (Uw = 1.20)			11.4000	1.1450	13.0534	(27)
Ground Floor			56.4100	0.1300	7.3333	(28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	(29a)
Cladding	6.9500		6.9500	0.1800	1.2510	(29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	(30)
Total net area of external elements Aum(A, m2)			118.5800			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	30.6651		(33)
Party Wall 1			26.8300	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 131.6563 (35)

List of Thermal Bridges						
K1 Element			Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)			2.0000	0.0600	0.1200	
E10 Eaves (insulation at ceiling level)			8.0000	0.0600	0.4800	
E16 Corner (normal)			12.0000	0.0900	1.0800	
E17 Corner (inverted - internal area greater than external area)			2.4000	-0.0900	-0.2160	
E2 Other lintels (including other steel lintels)			8.5500	0.0500	0.4275	
E3 Sill			7.6200	0.0500	0.3810	
E4 Jamb			17.9000	0.0500	0.8950	
E5 Ground floor (normal)			23.1700	0.1600	3.7072	
P1 Party wall - Ground floor			11.1800	0.0800	0.8944	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)			11.1800	0.0000	0.0000	
E25 Staggered party wall between dwellings			4.8000	0.0600	0.2880	
E7 Party floor between dwellings (in blocks of flats)			18.0000	0.0700	1.2600	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.3171 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 39.9822 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	26.4887	26.3275	26.1695	25.4276	25.2887	24.6425	24.6425	24.5228	24.8914	25.2887	25.5696	25.8632
Average = Sum(39)m / 12 =	66.4709	66.3098	66.1518	65.4098	65.2710	64.6247	64.6247	64.5051	64.8737	65.2710	65.5518	65.8454
												65.4091

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1784	1.1755	1.1727	1.1595	1.1571	1.1456	1.1456	1.1435	1.1500	1.1571	1.1621	1.1673
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.8785 (42)
Hot water usage for mixer showers													
Hot water usage for baths	55.7164	54.8791	53.6590	51.3245	49.6017	47.6805	46.5884	47.7993	49.1267	51.1895	53.5741	55.5030	(42a)
Hot water usage for other uses	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017	(42b)
Average daily hot water use (litres/day)	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681	(42c)
													104.4867 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	113.6676	111.2411	108.2857	103.7910	100.1412	96.2174	94.7088	97.6514	100.7549	104.8744	109.4384	113.3727	(44)
Energy content (annual)	180.0217	158.4058	166.4311	142.0847	134.8094	118.3105	114.5421	120.9129	124.2409	142.3136	155.9151	177.5143	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 1735.5021
Water storage loss:	27.0033	23.7609	24.9647	21.3127	20.2214	17.7466	17.1813	18.1369	18.6361	21.3470	23.3873	26.6271	(46)
Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5520 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8381 (55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	229.2644	202.8831	215.6738	189.7389	184.0520	165.9647	163.7848	170.1556	171.8951	191.5563	203.5693	226.7570	(62)
WWHRS	-25.4712	-22.5270	-23.5889	-19.5326	-18.2037	-15.5770	-14.6009	-15.5266	-16.1166	-18.9996	-21.5243	-24.9995	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	203.7932	180.3561	192.0849	170.2063	165.8484	150.3877	149.1839	154.6289	155.7786	172.5566	182.0450	201.7575	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2078.6269 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	99.2514	88.2517	94.7325	85.3665	84.2183	77.4616	77.4794	79.5977	79.4335	86.7134	89.9651	98.4176	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	83.1186	92.0241	83.1186	85.8892	83.1186	85.8892	83.1186	83.1186	85.8892	83.1186	85.8892	83.1186	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	163.8111	165.5109	161.2274	152.1082	140.5969	129.7778	122.5500	120.8502	125.1338	134.2529	145.7643	156.5833	(68)
Pumps, fans	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	(71)
Total internal gains	133.4024	131.3270	127.3286	118.5646	113.1966	107.5855	104.1390	106.9861	110.3243	116.5503	124.9516	132.2818	(72)
	434.5101	443.0401	425.8526	410.7400	391.0900	374.4306	360.9856	362.1329	372.5252	388.0998	410.7831	426.1617	(73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				6.4800	10.6334	0.6300	0.7000		0.7700		21.0581 (74)	
East				2.5800	19.6403	0.6300	0.7000		0.7700		15.4860 (76)	
South				2.3400	46.7521	0.6300	0.7000		0.7700		33.4340 (78)	
Solar gains	69.9781	125.2932	188.0223	261.4339	319.2847	328.7403	312.0355	266.9937	213.1040	142.9101	84.9178	59.1800 (83)
Total gains	504.4882	568.3333	613.8749	672.1739	710.3748	703.1709	673.0211	629.1266	585.6292	531.0100	495.7008	485.3417 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.0358	31.1113	31.1856	31.5393	31.6064	31.9225	31.9225	31.9817	31.8000	31.6064	31.4710	31.3307
alpha	3.0691	3.0741	3.0790	3.1026	3.1071	3.1282	3.1282	3.1321	3.1200	3.1071	3.0981	3.0887
util living area	0.9495	0.9271	0.8913	0.8141	0.6942	0.5363	0.4055	0.4469	0.6480	0.8402	0.9246	0.9544 (86)
MIT	19.0993	19.3701	19.7569	20.2604	20.6548	20.8891	20.9653	20.9526	20.7931	20.2949	19.6297	19.0571 (87)
Th 2	19.9374	19.9397	19.9419	19.9525	19.9545	19.9637	19.9637	19.9655	19.9602	19.9545	19.9505	19.9463 (88)
util rest of house	0.9409	0.9150	0.8731	0.7830	0.6441	0.4640	0.3166	0.3555	0.5780	0.8065	0.9102	0.9466 (89)
MIT 2	17.7547	18.0938	18.5744	19.1885	19.6387	19.8844	19.9468	19.9407	19.7978	19.2455	18.4314	17.7076 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	18.2982	18.6097	19.0524	19.6218	20.0494	20.2905	20.3585	20.3497	20.2001	19.6697	18.9157	18.2530 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2982	18.6097	19.0524	19.6218	20.0494	20.2905	20.3585	20.3497	20.2001	19.6697	18.9157	18.2530 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9237	0.8962	0.8548	0.7721	0.6490	0.4877	0.3512	0.3904	0.5952	0.7959	0.8924	0.9302 (94)
Useful gains	466.0130	509.3619	524.7346	518.9529	461.0190	342.9488	236.3911	245.6212	348.5787	422.6570	442.3589	451.4737 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	930.4707	909.0836	830.3607	701.3081	544.9731	367.7488	242.8911	254.7746	395.7354	591.9855	774.5420	925.3289 (97)
Space heating kWh	345.5566	268.6130	227.3858	131.2957	62.4618	0.0000	0.0000	0.0000	0.0000	125.9804	239.1718	352.5483 (98a)
Space heating requirement - total per year (kWh/year)												1753.0135
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	345.5566	268.6130	227.3858	131.2957	62.4618	0.0000	0.0000	0.0000	0.0000	125.9804	239.1718	352.5483 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1753.0135
Space heating per m2										(98c) / (4) =		31.0763 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	345.5566	268.6130	227.3858	131.2957	62.4618	0.0000	0.0000	0.0000	0.0000	125.9804	239.1718	352.5483 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	374.3842	291.0217	246.3552	142.2489	67.6726	0.0000	0.0000	0.0000	0.0000	136.4901	259.1244	381.9591 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	203.7932	180.3561	192.0849	170.2063	165.8484	150.3877	149.1839	154.6289	155.7786	172.5566	182.0450	201.7575 (64)
Efficiency of water heater	85.2339	84.9512	84.4391	83.4847	82.0758	79.8000	79.8000	79.8000	79.8000	83.3655	84.6728	79.8000 (216)
Fuel for water heating, kWh/month	239.0987	212.3055	227.4833	203.8774	202.0673	188.4557	186.9472	193.7706	195.2112	206.9880	214.9982	85.2984 (217)
Space cooling fuel requirement												236.5312 (219)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	17.2704	13.8550	12.4748	9.1396	7.0597	5.7678	6.4401	8.3711	10.8732	14.2662	16.1137	17.7504 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-26.7507	-37.9038	-54.7755	-61.9604	-67.1705	-62.8701	-62.1308	-58.4951	-52.1075	-43.5448	-29.4908	-23.1084 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-14.5470	-30.6638	-61.0452	-91.8141	-121.5025	-122.0794	-120.6062	-102.0415	-74.7187	-43.8534	-19.4267	-11.4958 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												

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(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1899.2562	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2507.7344	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												139.3820	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1394.1028	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3238.2698	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1899.2562	0.2100	398.8438	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2507.7344	0.2100	526.6242	(264)
Space and water heating			925.4680	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	139.3820	0.1443	20.1171	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-580.3085	0.1345	-78.0238	
PV Unit electricity exported	-813.7943	0.1259	-102.4263	
Total			-180.4501	(269)
Total CO2, kg/year			777.0643	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.7800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1899.2562	1.1300	2146.1595	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2507.7344	1.1300	2833.7399	(278)
Space and water heating			4979.8994	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	139.3820	1.5338	213.7887	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-580.3085	1.4969	-868.6669	
PV Unit electricity exported	-813.7943	0.4620	-375.9743	
Total			-1244.6412	(283)
Total Primary energy kWh/year			4079.1477	(286)
Target Primary Energy Rate (TPER)			72.3100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	56.4100	(1b) x 2.4000 (2b)	= 135.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 135.3840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	= 20.0000 / (5) = 0.1477 (8)
Pressure test		Yes
Pressure Test Method		Blower Door

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Measured/design AP50												5.0000 (17)
Infiltration rate												0.3977 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3381 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.4310	0.4226	0.4141	0.3719	0.3634	0.3212	0.3212	0.3127	0.3381	0.3634	0.3803	0.3972 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5929	0.5893	0.5858	0.5691	0.5660	0.5516	0.5516	0.5489	0.5571	0.5660	0.5723	0.5789 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.4000	1.1450	13.0534			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			56.4100	0.1100	6.2051	75.0000	4230.7500	(28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	9.0000	317.7900	(29a)
Cladding	6.9500		6.9500	0.1800	1.2510	9.0000	62.5500	(29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
Total net area of external elements Aum(A, m2)			118.5800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 29.5369			(33)
Party Wall 1			26.8300	0.0000	0.0000	20.0000	536.6000	(32)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)
GF			80.0000			9.0000	720.0000	(32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 7426.7300 (34)
List of Thermal Bridges
131.6563 (35)

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	2.0000	0.0600	0.1200
E10 Eaves (insulation at ceiling level)	8.0000	0.0600	0.4800
E16 Corner (normal)	12.0000	0.0900	1.0800
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E2 Other lintels (including other steel lintels)	8.5500	0.0500	0.4275
E3 Sill	7.6200	0.0500	0.3810
E4 Jamb	17.9000	0.0500	0.8950
E5 Ground floor (normal)	23.1700	0.1600	3.7072
P1 Party wall - Ground floor	11.1800	0.0800	0.8944
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.1800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	18.0000	0.0700	1.2600

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 38.8540 (37)

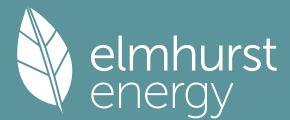
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	26.4887	26.3275	26.1695	25.4276	25.2887	24.6425	24.6425	24.5228	24.8914	25.2887	25.5696	25.8632 (38)
Average = Sum(39)m / 12 =	65.3427	65.1816	65.0236	64.2816	64.1428	63.4965	63.4965	63.3769	63.7455	64.1428	64.4236	64.7172 (39)
												64.2809

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1584	1.1555	1.1527	1.1395	1.1371	1.1256	1.1256	1.1235	1.1300	1.1371	1.1421	1.1473 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.8785 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017 (42c)
Average daily hot water use (litres/day)	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681 (43)
												53.1180 (44)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	57.9512	56.3620	54.6267	52.4665	50.5395	48.5369	48.1204	49.8521	51.6283	53.6849	55.8643	57.8698 (44)
Energy content (annual)	91.7805	80.2587	83.9593	71.8240	68.0359	59.6818	58.1975	61.7273	63.6628	72.8499	79.5889	90.6101 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	78.0135	68.2199	71.3654	61.0504	57.8305	50.7295	49.4678	52.4682	54.1134	61.9224	67.6506	77.0186 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	78.0135	68.2199	71.3654	61.0504	57.8305	50.7295	49.4678	52.4682	54.1134	61.9224	67.6506	77.0186 (64)
12Total per year (kWh/year)												749.8502 (64)
Electric shower(s)	44.6196	39.7564	43.4125	41.4280	42.2054	40.2598	41.6018	42.2054	41.4280	43.4125	42.5961	44.6196 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												507.5450 (64a)
Heat gains from water heating, kWh/month												

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30.6583 26.9941 28.6945 25.6196 25.0090 22.7473 22.7674 23.6684 23.8853 26.3337 27.5617 30.4095 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	83.1186	92.0241	83.1186	85.8892	83.1186	85.8892	83.1186	83.1186	85.8892	83.1186	85.8892	83.1186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.8111	165.5109	161.2274	152.1082	140.5969	129.7778	122.5500	120.8502	125.1338	134.2529	145.7643	156.5833	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	(71)
Water heating gains (Table 5)	41.2073	40.1698	38.5678	35.5828	33.6142	31.5935	30.6014	31.8124	33.1741	35.3948	38.2801	40.8730	(72)
Total internal gains	339.3150	348.8829	334.0918	324.7582	308.5077	298.4386	287.4480	286.9592	295.3751	303.9443	321.1116	331.7530	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					6.4800	10.6334	0.6300	0.7000	0.7700		21.0581 (74)	
East					2.5800	19.6403	0.6300	0.7000	0.7700		15.4860 (76)	
South					2.3400	46.7521	0.6300	0.7000	0.7700		33.4340 (78)	
Solar gains	69.9781	125.2932	188.0223	261.4339	319.2847	328.7403	312.0355	266.9937	213.1040	142.9101	84.9178	59.1800 (83)
Total gains	409.2931	474.1761	522.1141	586.1921	627.7924	627.1789	599.4835	553.9528	508.4790	446.8545	406.0294	390.9330 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.5717	31.6498	31.7267	32.0929	32.1623	32.4897	32.4897	32.5510	32.3628	32.1623	32.0221	31.8768	
alpha	3.1048	3.1100	3.1151	3.1395	3.1442	3.1660	3.1660	3.1701	3.1575	3.1442	3.1348	3.1251	
util living area	0.9697	0.9518	0.9224	0.8531	0.7390	0.5789	0.4429	0.4913	0.7019	0.8844	0.9524	0.9734	(86)
MIT	18.8966	19.1867	19.6004	20.1540	20.5958	20.8675	20.9575	20.9407	20.7466	20.1712	19.4514	18.8522	(87)
Th 2	19.9535	19.9558	19.9580	19.9687	19.9707	19.9800	19.9800	19.9817	19.9764	19.9707	19.9666	19.9624	(88)
util rest of house	0.9642	0.9433	0.9083	0.8262	0.6915	0.5053	0.3490	0.3951	0.6339	0.8572	0.9425	0.9686	(89)
MIT 2	18.0505	18.3366	18.7417	19.2766	19.6769	19.9045	19.9634	19.9568	19.8168	19.3061	18.6085	18.0130	(90)
Living area fraction	18.3925	18.6802	19.0888	19.6312	20.0483	20.2937	20.3652	20.3545	20.1926	19.6557	18.9491	18.3522	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3925	18.6802	19.0888	19.6312	20.0483	20.2937	20.3652	20.3545	20.1926	19.6557	18.9491	18.3522	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9535	0.9302	0.8941	0.8162	0.6954	0.5290	0.3855	0.4316	0.6494	0.8474	0.9302	0.9587	(94)
Ext temp.	390.2717	441.0805	466.8329	478.4445	436.5471	331.7634	231.0788	239.0962	330.2316	378.6624	377.6779	374.7875	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	920.8407	898.2129	818.5690	689.8200	535.4816	361.5307	239.0794	250.6235	388.3759	580.8608	763.3647	915.8904	(97)
Space heating kWh	394.7433	307.1929	261.6917	152.1904	73.6073	0.0000	0.0000	0.0000	0.0000	150.4356	277.6945	402.5805	(98a)
Space heating requirement - total per year (kWh/year)												2020.1363	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	394.7433	307.1929	261.6917	152.1904	73.6073	0.0000	0.0000	0.0000	0.0000	150.4356	277.6945	402.5805	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2020.1363	
Space heating per m ²												35.8117	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	596.8674	469.8743	481.6641	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8179	0.8749	0.8462	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	488.1551	411.0750	407.5628	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	702.5267	671.8075	620.1912	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	154.3475	193.9850	158.1955	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.5869	48.4962	39.5489	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												126.6320	(107)
Energy for space heating												35.8117	(99)
Energy for space cooling												2.2449	(108)
Total												38.0565	(109)

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Fabric Energy Efficiency (DFEE)

38.1 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.4100 (1b)	x 2.4000 (2b)	= 135.3840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 135.3840 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000	Air changes per hour (5) =	0.1477 (8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.3977	(18)
Number of sides sheltered			2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3381	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4310	0.4226	0.4141	0.3719	0.3634	0.3212	0.3212	0.3127	0.3381	0.3634	0.3803	0.3972 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5929	0.5893	0.5858	0.5691	0.5660	0.5516	0.5516	0.5489	0.5571	0.5660	0.5723	0.5789 (25)

3. Heat losses and heat loss parameter

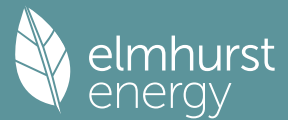
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			11.4000	1.1450	13.0534		(27)
Ground Floor			56.4100	0.1300	7.3333		(28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558		(29a)
Cladding	6.9500		6.9500	0.1800	1.2510		(29a)
GF Joists	6.5600		6.5600	0.1100	0.7216		(30)
Total net area of external elements Aum(A, m ²)			118.5800				(31)
Fabric heat loss, W/K = Sum (A x U)							(32)
Party Wall 1			26.8300	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 131.6563 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E12 Gable (insulation at ceiling level)	2.0000	0.0600	0.1200
E10 Eaves (insulation at ceiling level)	8.0000	0.0600	0.4800
E16 Corner (normal)	12.0000	0.0900	1.0800
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E2 Other lintels (including other steel lintels)	8.5500	0.0500	0.4275
E3 Sill	7.6200	0.0500	0.3810
E4 Jamb	17.9000	0.0500	0.8950
E5 Ground floor (normal)	23.1700	0.1600	3.7072
P1 Party wall - Ground floor	11.1800	0.0800	0.8944
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.1800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	18.0000	0.0700	1.2600
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.3171 (36)
Point Thermal bridges			0.0000
Total fabric heat loss			(33) + (36) + (36a) = 39.9822 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	26.4887	26.3275	26.1695	25.4276	25.2887	24.6425	24.6425	24.5228	24.8914	25.2887	25.5696	25.8632 (38)
Heat transfer coeff	66.4709	66.3098	66.1518	65.4098	65.2710	64.6247	64.6247	64.5051	64.8737	65.2710	65.5518	65.8454 (39)
Average = Sum(39)m / 12 =												65.4091
HLP	1.1784	1.1755	1.1727	1.1595	1.1571	1.1456	1.1456	1.1435	1.1500	1.1571	1.1621	1.1673 (40)
HLP (average)												1.1595
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.8785 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017 (42b)
Hot water usage for other uses	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681 (42c)
Average daily hot water use (litres/day)												53.1180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	57.9512	56.3620	54.6267	52.4665	50.5395	48.5369	48.1204	49.8521	51.6283	53.6849	55.8643	57.8698 (44)
Energy content (annual)	91.7805	80.2587	83.9593	71.8240	68.0359	59.6818	58.1975	61.7273	63.6628	72.8499	79.5889	90.6101 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											882.1767
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	78.0135	68.2199	71.3654	61.0504	57.8305	50.7295	49.4678	52.4682	54.1134	61.9224	67.6506	77.0186 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	78.0135	68.2199	71.3654	61.0504	57.8305	50.7295	49.4678	52.4682	54.1134	61.9224	67.6506	77.0186 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											749.8502 (64)
Electric shower(s)	44.6196	39.7564	43.4125	41.4280	42.2054	40.2598	41.6018	42.2054	41.4280	43.4125	42.5961	44.6196 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											507.5450 (64a)
Heat gains from water heating, kWh/month	30.6583	26.9941	28.6945	25.6196	25.0090	22.7473	22.7674	23.6684	23.8853	26.3337	27.5617	30.4095 (65)

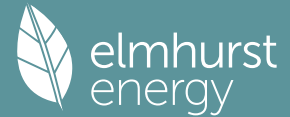
5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	83.1186	92.0241	83.1186	85.8892	83.1186	85.8892	83.1186	83.1186	85.8892	83.1186	85.8892	83.1186 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.8111	165.5109	161.2274	152.1082	140.5969	129.7778	122.5500	120.8502	125.1338	134.2529	145.7643	156.5833 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415 (71)
Water heating gains (Table 5)	41.2073	40.1698	38.5678	35.5828	33.6142	31.5935	30.6014	31.8124	33.1741	35.3948	38.2801	40.8730 (72)
Total internal gains	339.3150	348.8829	334.0918	324.7582	308.5077	298.4386	287.4480	286.9592	295.3751	303.9443	321.1116	331.7530 (73)

6. Solar gains												
[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
North				6.4800	10.6334		0.6300		0.7000		0.7700	21.0581 (74)
East				2.5800	19.6403		0.6300		0.7000		0.7700	15.4860 (76)
South				2.3400	46.7521		0.6300		0.7000		0.7700	33.4340 (78)
Solar gains	69.9781	125.2932	188.0223	261.4339	319.2847	328.7403	312.0355	266.9937	213.1040	142.9101	84.9178	59.1800 (83)
Total gains	409.2931	474.1761	522.1141	586.1921	627.7924	627.1789	599.4835	553.9528	508.4790	446.8545	406.0294	390.9330 (84)

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.0358	31.1113	31.1856	31.5393	31.6064	31.9225	31.9225	31.9817	31.8000	31.6064	31.4710	31.3307
alpha	3.0691	3.0741	3.0790	3.1026	3.1071	3.1282	3.1282	3.1321	3.1200	3.1071	3.0981	3.0887
util living area	0.9699	0.9524	0.9236	0.8557	0.7436	0.5851	0.4490	0.4976	0.7071	0.8864	0.9530	0.9736 (86)
MIT	18.8523	19.1432	19.5610	20.1223	20.5752	20.8581	20.9538	20.9358	20.7325	20.1432	19.4136	18.8076 (87)
Th 2	19.9374	19.9397	19.9419	19.9525	19.9545	19.9637	19.9637	19.9655	19.9602	19.9545	19.9505	19.9463 (88)
util rest of house	0.9645	0.9439	0.9096	0.8289	0.6960	0.5103	0.3528	0.3993	0.6386	0.8593	0.9431	0.9688 (89)
MIT 2	17.9957	18.2827	18.6920	19.2347	19.6458	19.8830	19.9458	19.9387	19.7918	19.2678	18.5602	17.9578 (90)
Living area fraction									fLA = Living area / (4) =			0.4042 (91)
MIT	18.3419	18.6305	19.0432	19.5935	20.0215	20.2771	20.3532	20.3417	20.1720	19.6216	18.9051	18.3013 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3419	18.6305	19.0432	19.5935	20.0215	20.2771	20.3532	20.3417	20.1720	19.6216	18.9051	18.3013 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9537	0.9306	0.8951	0.8184	0.6993	0.5340	0.3900	0.4364	0.6537	0.8491	0.9306	0.9588	(94)
Useful gains	390.3250	441.2870	467.3416	479.7627	438.9974	334.9347	233.8258	241.7581	332.4115	379.4272	377.8569	374.8188	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
Space heating kWh	933.3798	910.4659	829.7582	699.4566	543.1495	366.8828	242.5519	254.2597	393.9123	588.8504	773.8475	928.5059	(97)
Space heating requirement - total per year (kWh/year)	404.0328	315.2883	269.6379	158.1796	77.4892	0.0000	0.0000	0.0000	0.0000	155.8108	285.1133	411.9432	(98a)
Solar heating kWh													
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating kWh	404.0328	315.2883	269.6379	158.1796	77.4892	0.0000	0.0000	0.0000	0.0000	155.8108	285.1133	411.9432	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2077.4950	
Space heating per m2										(98c) / (4) =		36.8285	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	607.4725	478.2230	490.2384	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8097	0.8681	0.8386	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	491.8869	415.1242	411.1046	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	702.5267	671.8075	620.1912	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	151.6607	190.9724	155.5604	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	37.9152	47.7431	38.8901	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												124.5484	(107)
Energy for space heating												36.8285	(99)
Energy for space cooling												2.2079	(108)
Total												39.0364	(109)
Fabric Energy Efficiency (TFEE)												39.0	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

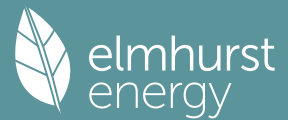
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4100	(1b) x 2.4000 (2b)	135.3840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	135.3840 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1477 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3977 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3381 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infilt rate	0.4310 0.4226 0.4141 0.3719 0.3634 0.3212 0.3212 0.3127 0.3381 0.3634 0.3803 0.3972 (22b)
Effective ac	0.5929 0.5893 0.5858 0.5691 0.5660 0.5516 0.5516 0.5489 0.5571 0.5660 0.5723 0.5789 (25)

3. Heat losses and heat loss parameter

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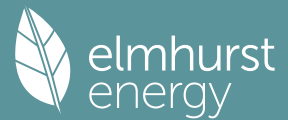
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.4000	1.1450	13.0534			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			56.4100	0.1100	6.2051	75.0000	4230.7500	(28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	9.0000	317.7900	(29a)
Cladding	6.9500		6.9500	0.1800	1.2510	9.0000	62.5500	(29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
Total net area of external elements Aum(A, m2)			118.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.5369			(33)
Party Wall 1			26.8300	0.0000	0.0000	20.0000	536.6000	(32)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)
GF			80.0000			9.0000	720.0000	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7426.7300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							131.6563	(35)

List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E12 Gable (insulation at ceiling level)				2.0000	0.0600	0.1200							
E10 Eaves (insulation at ceiling level)				8.0000	0.0600	0.4800							
E16 Corner (normal)				12.0000	0.0900	1.0800							
E17 Corner (inverted - internal area greater than external area)				2.4000	-0.0900	-0.2160							
E2 Other lintels (including other steel lintels)				8.5500	0.0500	0.4275							
E3 Sill				7.6200	0.0500	0.3810							
E4 Jamb				17.9000	0.0500	0.8950							
E5 Ground floor (normal)				23.1700	0.1600	3.7072							
P1 Party wall - Ground floor				11.1800	0.0800	0.8944							
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				11.1800	0.0000	0.0000							
E25 Staggered party wall between dwellings				4.8000	0.0600	0.2880							
E7 Party floor between dwellings (in blocks of flats)				18.0000	0.0700	1.2600							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												9.3171	(36)
Point Thermal Bridges												0.0000	(36a)
Total fabric heat loss												38.8540	(33) + (36) + (36a) = (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	26.4887	26.3275	26.1695	25.4276	25.2887	24.6425	24.6425	24.5228	24.8914	25.2887	25.5696	25.8632	(38)
Average = Sum(39)m / 12 =	65.3427	65.1816	65.0236	64.2816	64.1428	63.4965	63.4965	63.3769	63.7455	64.1428	64.4236	64.7172	(39)
												64.2809	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1584	1.1555	1.1527	1.1395	1.1371	1.1256	1.1256	1.1235	1.1300	1.1371	1.1421	1.1473	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												1.1395	
												31	

4. Water heating energy requirements (kWh/year)													
Assumed occupancy													1.8785 (42)
Hot water usage for mixer showers													
Hot water usage for baths	69.6455	68.5989	67.0737	64.1556	62.0021	59.6006	58.2355	59.7492	61.4084	63.9869	66.9677	69.3787	(42a)
Hot water usage for other uses	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017	(42b)
Average daily hot water use (litres/day)	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681	(42c)
												117.3289	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	127.5967	124.9609	121.7005	116.6221	112.5417	108.1375	106.3559	109.6013	113.0366	117.6718	122.8319	127.2485	(44)
Energy content (annual)	202.0820	177.9426	187.0491	159.6498	151.5027	132.9677	128.6283	135.7093	139.3854	159.6795	174.9966	199.2404	(45)
Distribution loss (46)m = 0.15 x (45)m	30.3123	26.6914	28.0574	23.9475	22.7254	19.9451	19.2942	20.3564	20.9078	23.9519	26.2495	29.8861	(46)
Water storage loss:													
Store volume													180.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.8736 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													0.8736 (55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848	(64)
												2541.5986	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month	107.4678	95.5438	102.4694	92.0599	90.6502	83.1881	83.0445	85.3989	85.3220	93.3690	97.1627	106.5230	(65)

5. Internal gains (see Table 5 and 5a)													
Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	20.9905	18.6435	15.1619	11.4786	8.5804	7.2439	7.8273	10.1742	13.6558	17.3392	20.2374	21.5738	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	244.4942	247.0313	240.6379	227.0272	209.8461	193.6982	182.9105	180.3734	186.7668	200.3775	217.5586	233.7065	(68)
Pumps, fans	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

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	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	(71)
Water heating gains (Table 5)	144.4460	142.1783	137.7277	127.8610	121.8417	115.5390	111.6189	114.7834	118.5028	125.4959	134.9482	(72)
Total internal gains	498.6511	496.5736	482.2480	455.0872	428.9886	402.2016	388.0772	391.0516	404.6459	431.9332	461.4647	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				6.4800	10.6334		0.6300		0.7000		0.7700		21.0581 (74)
East				2.5800	19.6403		0.6300		0.7000		0.7700		15.4860 (76)
South				2.3400	46.7521		0.6300		0.7000		0.7700		33.4340 (78)
Solar gains	69.9781	125.2932	188.0223	261.4339	319.2847	328.7403	312.0355	266.9937	213.1040	142.9101	84.9178		59.1800 (83)
Total gains	568.6292	621.8668	670.2703	716.5211	748.2733	730.9419	700.1127	658.0452	617.7498	574.8433	546.3825		546.3569 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	31.5717	31.6498	31.7267	32.0929	32.1623	32.4897	32.4897	32.5510	32.3628	32.1623	32.0221	31.8768
alpha	3.1048	3.1100	3.1151	3.1395	3.1442	3.1660	3.1660	3.1701	3.1575	3.1442	3.1348	3.1251
util living area	0.9320	0.9094	0.8676	0.7886	0.6670	0.5138	0.3857	0.4237	0.6193	0.8119	0.9048	0.9385 (86)
MIT	19.2998	19.5329	19.9037	20.3519	20.7031	20.9058	20.9714	20.9611	20.8250	20.3892	19.7791	19.2540 (87)
Th 2	19.9535	19.9558	19.9580	19.9687	19.9707	19.9800	19.9800	19.9817	19.9764	19.9707	19.9666	19.9624 (88)
util rest of house	0.9212	0.8953	0.8469	0.7558	0.6169	0.4440	0.3015	0.3371	0.5502	0.7753	0.8877	0.9286 (89)
MIT 2	18.0136	18.3039	18.7610	19.3042	19.7011	19.9129	19.9660	19.9614	19.8403	19.3630	18.6234	17.9627 (90)
Living area fraction									fLA = Living area / (4) =			0.4042 (91)
MIT	18.5335	18.8006	19.2229	19.7277	20.1061	20.3142	20.3724	20.3655	20.2383	19.7777	19.0905	18.4846 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5335	18.8006	19.2229	19.7277	20.1061	20.3142	20.3724	20.3655	20.2383	19.7777	19.0905	18.4846 (93)

8. Space heating requirement

Utilisation	0.9027	0.8764	0.8300	0.7473	0.6238	0.4676	0.3345	0.3705	0.5688	0.7676	0.8701	0.9108 (94)
Useful gains	513.3263	544.9953	556.2951	535.4613	466.8063	341.7988	234.1894	243.8377	351.3880	441.2755	475.4232	497.5973 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	930.0527	906.0642	827.2856	696.0209	539.1889	362.8325	239.5324	251.3195	391.2874	588.6857	772.4734	924.4624 (97)
Space heating kWh	310.0445	242.6383	201.6170	115.6030	53.8527	0.0000	0.0000	0.0000	0.0000	109.6732	213.8762	317.5876 (98a)
Space heating requirement - total per year (kWh/year)												1564.8924
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	310.0445	242.6383	201.6170	115.6030	53.8527	0.0000	0.0000	0.0000	0.0000	109.6732	213.8762	317.5876 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1564.8924
Space heating per m2										(98c) / (4) =		27.7414 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	310.0445	242.6383	201.6170	115.6030	53.8527	0.0000	0.0000	0.0000	0.0000	109.6732	213.8762	317.5876 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	124.0674	97.0942	80.6791	46.2597	21.5497	0.0000	0.0000	0.0000	0.0000	43.8869	85.5847	127.0859 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	144.1613	127.5928	135.5760	119.0007	115.2754	103.7625	102.2117	106.2557	107.4277	119.9451	127.7653	142.5384 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	18.3728	14.7394	13.2712	9.7230	7.5103	6.1360	6.8512	8.9054	11.5673	15.1769	17.1423	18.8835 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												626.2074	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1451.5126	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												148.2792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2225.9993	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	626.2074	16.4900	103.2616	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1451.5126	16.4900	239.3544	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	148.2792	16.4900	24.4512	(250)
Additional standing charges			0.0000	(251)
Total energy cost			367.0673	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		1.3031	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	78.8773	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	626.2074	0.1552	97.1685	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1451.5126	0.1409	204.5324	(264)
Space and water heating			301.7009	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	148.2792	0.1443	21.4013	(268)
Total CO2, kg/year			323.1022	(272)
CO2 emissions per m2			5.7300	(273)
EI value			95.7306	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	56.4100	2.4000	135.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100			(4)
Dwelling volume				(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)

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Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000	Air changes per hour	0.1477 (8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.3977	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500		(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3381		(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Adj infilt rate	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Effective ac	0.3043	0.2789	0.2705	0.2705	0.2789	0.2451	0.2620	0.2366	0.2366	0.2536	0.2366	0.2705	(22b)
	0.5463	0.5389	0.5366	0.5366	0.5389	0.5300	0.5343	0.5280	0.5280	0.5321	0.5280	0.5366	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.4000	1.1450	13.0534			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			56.4100	0.1100	6.2051	75.0000	4230.7500	(28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	9.0000	317.7900	(29a)
Cladding	6.9500		6.9500	0.1800	1.2510	9.0000	62.5500	(29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
Total net area of external elements Aum(A, m2)			118.5800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.5369			(33)
Party Wall 1			26.8300	0.0000	0.0000	20.0000	536.6000	(32)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)
GF			80.0000			9.0000	720.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7426.7300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		131.6563	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	2.0000	0.0600	0.1200	
E10 Eaves (insulation at ceiling level)	8.0000	0.0600	0.4800	
E16 Corner (normal)	12.0000	0.0900	1.0800	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160	
E2 Other lintels (including other steel lintels)	8.5500	0.0500	0.4275	
E3 Sill	7.6200	0.0500	0.3810	
E4 Jamb	17.9000	0.0500	0.8950	
E5 Ground floor (normal)	23.1700	0.1600	3.7072	
P1 Party wall - Ground floor	11.1800	0.0800	0.8944	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.1800	0.0000	0.0000	
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880	
E7 Party floor between dwellings (in blocks of flats)	18.0000	0.0700	1.2600	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.3171	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =		38.8540	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	24.4063	24.0760	23.9723	23.9723	24.0760	23.6803	23.8718	23.5894	23.5894	23.7745	23.5894	23.9723	(38)
Average = Sum(39)m / 12 =	63.2604	62.9301	62.8264	62.8264	62.9301	62.5343	62.7258	62.4434	62.4434	62.6285	62.4434	62.8264	(39)
												62.7349	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1214	1.1156	1.1137	1.1137	1.1156	1.1086	1.1120	1.1070	1.1070	1.1102	1.1070	1.1137	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.8785	(42)
Hot water usage for mixer showers														
Hot water usage for baths	69.6455	68.5989	67.0737	64.1556	62.0021	59.6006	58.2355	59.7492	61.4084	63.9869	66.9677	69.3787	(42a)	
Hot water usage for other uses	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017	(42b)	
Average daily hot water use (litres/day)	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681	(42c)	
												117.3289	(43)	

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	127.5967	124.9609	121.7005	116.6221	112.5417	108.1375	106.3559	109.6013	113.0366	117.6718	122.8319	127.2485	(44)
Energy content (annual)	202.0820	177.9426	187.0491	159.6498	151.5027	132.9677	128.6283	135.7093	139.3854	159.6795	174.9966	199.2404	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1948.8335	
Water storage loss:	30.3123	26.6914	28.0574	23.9475	22.7254	19.9451	19.2942	20.3564	20.9078	23.9519	26.2495	29.8861	(46)
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)

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Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
								Total per year (kWh/year) = Sum(64)m =				2541.5986 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000 (64a)
Heat gains from water heating, kWh/month												
	107.4678	95.5438	102.4694	92.0599	90.6502	83.1881	83.0445	85.3989	85.3220	93.3690	97.1627	106.5230 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	20.9905	18.6435	15.1619	11.4786	8.5804	7.2439	7.8273	10.1742	13.6558	17.3392	20.2374	21.5738 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	244.4942	247.0313	240.6379	227.0272	209.8461	193.6982	182.9105	180.3734	186.7668	200.3775	217.5586	233.7065 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415 (71)
Water heating gains (Table 5)												
	144.4460	142.1783	137.7277	127.8610	121.8417	115.5390	111.6189	114.7834	118.5028	125.4959	134.9482	143.1760 (72)
Total internal gains												
	498.6511	496.5736	482.2480	455.0872	428.9886	402.2016	388.0772	391.0516	404.6459	431.9332	461.4647	487.1768 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				6.4800	13.0723	0.6300	0.7000	0.7700	25.8880 (74)			
East				2.5800	24.4329	0.6300	0.7000	0.7700	19.2649 (76)			
South				2.3400	54.9219	0.6300	0.7000	0.7700	39.2766 (78)			
Solar gains	84.4294	133.1461	199.1755	287.8297	343.2268	382.9266	356.1963	307.2826	241.9701	162.2183	102.8883	69.5648 (83)
Total gains	583.0805	629.7197	681.4235	742.9169	772.2154	785.1282	744.2735	698.3342	646.6160	594.1514	564.3530	556.7416 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	32.6109	32.7821	32.8362	32.8362	32.7821	32.9896	32.8889	33.0376	33.0376	32.9400	33.0376	32.8362
alpha	3.1741	3.1855	3.1891	3.1891	3.1855	3.1993	3.1926	3.2025	3.2025	3.1960	3.2025	3.1891
util living area	0.9158	0.8953	0.8415	0.7437	0.5929	0.4131	0.2987	0.3077	0.5392	0.7499	0.8745	0.9238 (86)
MIT	19.5745	19.7374	20.1183	20.5169	20.8216	20.9590	20.9892	20.9887	20.9009	20.5986	20.0598	19.5319 (87)
Th 2	19.9834	19.9881	19.9896	19.9896	19.9881	19.9938	19.9911	19.9952	19.9952	19.9925	19.9952	19.9896 (88)
util rest of house	0.9024	0.8792	0.8173	0.7060	0.5363	0.3420	0.2170	0.2217	0.4649	0.7032	0.8520	0.9114 (89)
MIT 2	18.3760	18.5786	19.0431	19.5092	19.8379	19.9690	19.9872	19.9912	19.9258	19.6168	18.9862	18.3285 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.8604	19.0469	19.4777	19.9165	20.2355	20.3692	20.3922	20.3944	20.3199	20.0136	19.4201	18.8149 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8604	19.0469	19.4777	19.9165	20.2355	20.3692	20.3922	20.3944	20.3199	20.0136	19.4201	18.8149 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8843	0.8614	0.8034	0.7030	0.5507	0.3690	0.2498	0.2563	0.4898	0.7042	0.8370	0.8936 (94)
Useful gains	515.6210	542.4572	547.4243	522.2740	425.2969	289.7331	185.9555	178.9642	316.7234	418.4154	472.3866	497.5282 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	864.1647	852.5098	765.0798	641.8640	467.9140	298.2378	187.6871	180.7365	338.4389	514.4059	700.6217	855.3759 (97)
Space heating kWh	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388 (98a)
Space heating requirement - total per year (kWh/year)												1249.4044
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1249.4044
Space heating per m ²												22.1486 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	249.9000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)

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Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	103.7681	83.3755	64.8002	34.4557	12.6879	0.0000	0.0000	0.0000	0.0000	28.5782	65.7580	106.5381 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	144.1613	127.5928	135.5760	119.0007	115.2754	103.7625	102.2117	106.2557	107.4277	119.9451	127.7653	142.5384 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	18.3728	14.7394	13.2712	9.7230	7.5103	6.1360	6.8512	8.9054	11.5673	15.1769	17.1423	18.8835 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												499.9618 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1451.5126 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												148.2792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												2099.7536 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	499.9618	26.0600	130.2900 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1451.5126	26.0600	378.2642 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	148.2792	26.0600	38.6416 (250)
Additional standing charges			0.0000 (251)
Total energy cost			547.1958 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	499.9618	0.1559	77.9525 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1451.5126	0.1409	204.5324 (264)
Space and water heating			282.4849 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	148.2792	0.1443	21.4013 (268)
Total CO2, kg/year			303.8862 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	499.9618	1.5772	788.5643 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1451.5126	1.5210	2207.8002 (278)
Space and water heating			2996.3645 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	148.2792	1.5338	227.4356 (282)
Total Primary energy kWh/year			3223.8001 (286)

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SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: (none)	SAP change	Cost change	CO2 change

Recommended measures (none)	Total Savings	£0	Typical annual savings	0.00 kg/m²	Energy efficiency	Environmental impact

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£547	£547	£0
Space heating	£130	£130	£0
Water heating	£378	£378	£0
Lighting	£39	£39	£0
Total cost of fuels	£547	£547	£0
Total cost of uses	£547	£547	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4100 (1b)	x 2.4000 (2b)	= 135.3840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 135.3840 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1477 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3977 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3381 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4310	0.4226	0.4141	0.3719	0.3634	0.3212	0.3212	0.3127	0.3381	0.3634	0.3803	0.3972 (22b)
Effective ac	0.5929	0.5893	0.5858	0.5691	0.5660	0.5516	0.5516	0.5489	0.5571	0.5660	0.5723	0.5789 (25)

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3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Windows (Uw = 1.20)			11.4000	1.1450	13.0534			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			56.4100	0.1100	6.2051	75.0000	4230.7500	(28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	9.0000	317.7900	(29a)
Cladding	6.9500		6.9500	0.1800	1.2510	9.0000	62.5500	(29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
Total net area of external elements Aum(A, m ²)			118.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.5369			(33)
Party Wall 1			26.8300	0.0000	0.0000	20.0000	536.6000	(32)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)
GF			80.0000			9.0000	720.0000	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7426.7300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							131.6563	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	2.0000	0.0600	0.1200	
E10 Eaves (insulation at ceiling level)	8.0000	0.0600	0.4800	
E16 Corner (normal)	12.0000	0.0900	1.0800	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160	
E2 Other lintels (including other steel lintels)	8.5500	0.0500	0.4275	
E3 Sill	7.6200	0.0500	0.3810	
E4 Jamb	17.9000	0.0500	0.8950	
E5 Ground floor (normal)	23.1700	0.1600	3.7072	
P1 Party wall - Ground floor	11.1800	0.0800	0.8944	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.1800	0.0000	0.0000	
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880	
E7 Party floor between dwellings (in blocks of flats)	18.0000	0.0700	1.2600	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.3171 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	38.8540 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.4887	26.3275	26.1695	25.4276	25.2887	24.6425	24.6425	24.5228	24.8914	25.2887	25.5696	25.8632	(38)
Heat transfer coeff	65.3427	65.1816	65.0236	64.2816	64.1428	63.4965	63.4965	63.3769	63.7455	64.1428	64.4236	64.7172	(39)
Average = Sum(39)m / 12 =												64.2809	
HLP	1.1584	1.1555	1.1527	1.1395	1.1371	1.1256	1.1256	1.1235	1.1300	1.1371	1.1421	1.1473	(40)
HLP (average)												1.1395	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

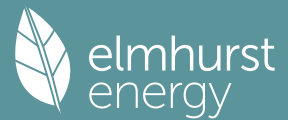
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.8785	(42)
Hot water usage for mixer showers	69.6455	68.5989	67.0737	64.1556	62.0021	59.6006	58.2355	59.7492	61.4084	63.9869	66.9677	69.3787	69.3787	(42a)
Hot water usage for baths	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017	24.0017	(42b)
Hot water usage for other uses	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681	33.8681	(42c)
Average daily hot water use (litres/day)													117.3289	(43)
Daily hot water use	127.5967	124.9609	121.7005	116.6221	112.5417	108.1375	106.3559	109.6013	113.0366	117.6718	122.8319	127.2485	127.2485	(44)
Energy conte	202.0820	177.9426	187.0491	159.6498	151.5027	132.9677	128.6283	135.7093	139.3854	159.6795	174.9966	199.2404	199.2404	(45)
Energy content (annual)										Total = Sum(45)m =			1948.8335	
Distribution loss (46)m = 0.15 x (45)m	30.3123	26.6914	28.0574	23.9475	22.7254	19.9451	19.2942	20.3564	20.9078	23.9519	26.2495	29.8861	29.8861	(46)
Water storage loss:														
Store volume													180.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.8736	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848	249.5848	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848	249.5848	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000	(64a)
Heat gains from water heating, kWh/month	107.4678	95.5438	102.4694	92.0599	90.6502	83.1881	83.0445	85.3989	85.3220	93.3690	97.1627	106.5230	106.5230	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts														
(66)m	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9905	18.6435	15.1619	11.4786	8.5804	7.2439	7.8273	10.1742	13.6558	17.3392	20.2374	21.5738	21.5738	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4942	247.0313	240.6379	227.0272	209.8461	193.6982	182.9105	180.3734	186.7668	200.3775	217.5586	233.7065	233.7065	(68)

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415 (71)
Water heating gains (Table 5)	144.4460	142.1783	137.7277	127.8610	121.8417	115.5390	111.6189	114.7834	118.5028	125.4959	134.9482 (72)
Total internal gains	498.6511	496.5736	482.2480	455.0872	428.9886	402.2016	388.0772	391.0516	404.6459	431.9332	461.4647 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					6.4800	10.6334	0.6300	0.7000			0.7700	21.0581 (74)
East					2.5800	19.6403	0.6300	0.7000			0.7700	15.4860 (76)
South					2.3400	46.7521	0.6300	0.7000			0.7700	33.4340 (78)
Solar gains	69.9781	125.2932	188.0223	261.4339	319.2847	328.7403	312.0355	266.9937	213.1040	142.9101	84.9178	59.1800 (83)
Total gains	568.6292	621.8668	670.2703	716.5211	748.2733	730.9419	700.1127	658.0452	617.7498	574.8433	546.3825	546.3569 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.5717	31.6498	31.7267	32.0929	32.1623	32.4897	32.4897	32.5510	32.3628	32.1623	32.0221	31.8768
alpha	3.1048	3.1100	3.1151	3.1395	3.1442	3.1660	3.1660	3.1701	3.1575	3.1442	3.1348	3.1251
util living area	0.9320	0.9094	0.8676	0.7886	0.6670	0.5138	0.3857	0.4237	0.6193	0.8119	0.9048	0.9385 (86)
MIT	19.2998	19.5329	19.9037	20.3519	20.7031	20.9058	20.9714	20.9611	20.8250	20.3892	19.7791	19.2540 (87)
Th 2	19.9535	19.9558	19.9580	19.9687	19.9707	19.9800	19.9800	19.9817	19.9764	19.9707	19.9666	19.9624 (88)
util rest of house	0.9212	0.8953	0.8469	0.7558	0.6169	0.4440	0.3015	0.3371	0.5502	0.7753	0.8877	0.9286 (89)
MIT 2	18.0136	18.3039	18.7610	19.3042	19.7011	19.9129	19.9660	19.9614	19.8403	19.3630	18.6234	17.9627 (90)
Living area fraction	18.5335	18.8006	19.2229	19.7277	20.1061	20.3142	20.3724	20.3655	20.2383	19.7777	19.0905	18.4846 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5335	18.8006	19.2229	19.7277	20.1061	20.3142	20.3724	20.3655	20.2383	19.7777	19.0905	18.4846 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9027	0.8764	0.8300	0.7473	0.6238	0.4676	0.3345	0.3705	0.5688	0.7676	0.8701	0.9108 (94)
Useful gains	513.3263	544.9953	556.2951	535.4613	466.8063	341.7988	234.1894	243.8377	351.3880	441.2755	475.4232	497.5973 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	930.0527	906.0642	827.2856	696.0209	539.1889	362.8325	239.5324	251.3195	391.2874	588.6857	772.4734	924.4624 (97)
Space heating kWh	310.0445	242.6383	201.6170	115.6030	53.8527	0.0000	0.0000	0.0000	0.0000	109.6732	213.8762	317.5876 (98a)
Space heating requirement - total per year (kWh/year)												1564.8924
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	310.0445	242.6383	201.6170	115.6030	53.8527	0.0000	0.0000	0.0000	0.0000	109.6732	213.8762	317.5876 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1564.8924
Space heating per m2										(98c) / (4) =		27.7414 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	310.0445	242.6383	201.6170	115.6030	53.8527	0.0000	0.0000	0.0000	0.0000	109.6732	213.8762	317.5876 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	124.0674	97.0942	80.6791	46.2597	21.5497	0.0000	0.0000	0.0000	0.0000	43.8869	85.5847	127.0859 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	144.1613	127.5928	135.5760	119.0007	115.2754	103.7625	102.2117	106.2557	107.4277	119.9451	127.7653	142.5384 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	18.3728	14.7394	13.2712	9.7230	7.5103	6.1360	6.8512	8.9054	11.5673	15.1769	17.1423	18.8835 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)

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Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													626.2074	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													175.1000	
Water heating fuel used													1451.5126	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													148.2792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													2225.9993	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	626.2074	16.4900	103.2616	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1451.5126	16.4900	239.3544	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	148.2792	16.4900	24.4512	(250)
Additional standing charges			0.0000	(251)
Total energy cost			367.0673	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3031	(257)
SAP value		78.8773	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	626.2074	0.1552	97.1685	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1451.5126	0.1409	204.5324	(264)
Space and water heating			301.7009	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	148.2792	0.1443	21.4013	(268)
Total CO2, kg/year			323.1022	(272)
CO2 emissions per m2			5.7300	(273)
EI value			95.7306	
EI rating			96	(274)
EI band			A	

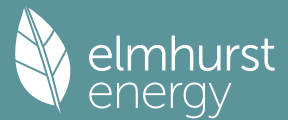
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	56.4100	2.4000	135.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100	x	135.3840	(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	135.3840	(5)

2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1477 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3977 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3381 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate													
Effective ac	0.3043	0.2789	0.2705	0.2705	0.2789	0.2451	0.2620	0.2366	0.2366	0.2536	0.2366	0.2705	(22b)
	0.5463	0.5389	0.5366	0.5366	0.5389	0.5300	0.5343	0.5280	0.5280	0.5321	0.5280	0.5366	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.4000	1.1450	13.0534			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			56.4100	0.1100	6.2051	75.0000	4230.7500	(28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	9.0000	317.9900	(29a)
Cladding	6.9500		6.9500	0.1800	1.2510	9.0000	62.5500	(29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
Total net area of external elements Aum(A, m2)			118.5800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.5369			(33)
Party Wall 1			26.8300	0.0000	0.0000	20.0000	536.6000	(32)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)
GF			80.0000			9.0000	720.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7426.7300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		131.6563	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	2.0000	0.0600	0.1200	
E10 Eaves (insulation at ceiling level)	8.0000	0.0600	0.4800	
E16 Corner (normal)	12.0000	0.0900	1.0800	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160	
E2 Other lintels (including other steel lintels)	8.5500	0.0500	0.4275	
E3 Sill	7.6200	0.0500	0.3810	
E4 Jamb	17.9000	0.0500	0.8950	
E5 Ground floor (normal)	23.1700	0.1600	3.7072	
P1 Party wall - Ground floor	11.1800	0.0800	0.8944	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.1800	0.0000	0.0000	
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880	
E7 Party floor between dwellings (in blocks of flats)	18.0000	0.0700	1.2600	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.3171	(36)
Point Thermal bridges		0.0000	(36a)
Total fabric heat loss	(33) + (36) + (36a) =	38.8540	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

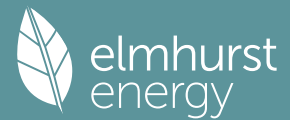
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	24.4063	24.0760	23.9723	23.9723	24.0760	23.6803	23.8718	23.5894	23.5894	23.7745	23.5894	23.9723	(38)
Heat transfer coeff	63.2604	62.9301	62.8264	62.8264	62.9301	62.5343	62.7258	62.4434	62.4434	62.6285	62.4434	62.8264	(39)
Average = Sum(39)m / 12 =												62.7349	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.1214	1.1156	1.1137	1.1137	1.1156	1.1086	1.1120	1.1070	1.1070	1.1102	1.1070	1.1137	(40)
HLP (average)												1.1121	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.8785 (42)
Hot water usage for mixer showers													
	69.6455	68.5989	67.0737	64.1556	62.0021	59.6006	58.2355	59.7492	61.4084	63.9869	66.9677	69.3787	(42a)
Hot water usage for baths													
	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017	(42b)
Hot water usage for other uses													
	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681	(42c)
Average daily hot water use (litres/day)													117.3289 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.5967	124.9609	121.7005	116.6221	112.5417	108.1375	106.3559	109.6013	113.0366	117.6718	122.8319	127.2485	(44)
Energy conte	202.0820	177.9426	187.0491	159.6498	151.5027	132.9677	128.6283	135.7093	139.3854	159.6795	174.9966	199.2404	(45)
Energy content (annual)										Total = Sum(45)m =		1948.8335	
Distribution loss (46)m = 0.15 x (45)m													
	30.3123	26.6914	28.0574	23.9475	22.7254	19.9451	19.2942	20.3564	20.9078	23.9519	26.2495	29.8861	(46)
Water storage loss:													
Store volume													180.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.8736 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													0.8736 (55)

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Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
	Total per year (kWh/year) = Sum(64)m =											2541.5986 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	107.4678	95.5438	102.4694	92.0599	90.6502	83.1881	83.0445	85.3989	85.3220	93.3690	97.1627	106.5230 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9905	18.6435	15.1619	11.4786	8.5804	7.2439	7.8273	10.1742	13.6558	17.3392	20.2374	21.5738	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4942	247.0313	240.6379	227.0272	209.8461	193.6982	182.9105	180.3734	186.7668	200.3775	217.5586	233.7065	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	(71)
Water heating gains (Table 5)	144.4460	142.1783	137.7277	127.8610	121.8417	115.5390	111.6189	114.7834	118.5028	125.4959	134.9482	143.1760	(72)
Total internal gains	498.6511	496.5736	482.2480	455.0872	428.9886	402.2016	388.0772	391.0516	404.6459	431.9332	461.4647	487.1768	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				6.4800	13.0723	0.6300	0.7000	0.7700		25.8880 (74)		
East				2.5800	24.4329	0.6300	0.7000	0.7700		19.2649 (76)		
South				2.3400	54.9219	0.6300	0.7000	0.7700		39.2766 (78)		
Solar gains	84.4294	133.1461	199.1755	287.8297	343.2268	382.9266	356.1963	307.2826	241.9701	162.2183	102.8883	69.5648 (83)
Total gains	583.0805	629.7197	681.4235	742.9169	772.2154	785.1282	744.2735	698.3342	646.6160	594.1514	564.3530	556.7416 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.6109	32.7821	32.8362	32.8362	32.7821	32.9896	32.8889	33.0376	33.0376	32.9400	33.0376	32.8362	
alpha	3.1741	3.1855	3.1891	3.1891	3.1855	3.1993	3.1926	3.2025	3.2025	3.1960	3.2025	3.1891	
util living area	0.9158	0.8953	0.8415	0.7437	0.5929	0.4131	0.2987	0.3077	0.5392	0.7499	0.8745	0.9238	(86)
MIT	19.5745	19.7374	20.1183	20.5169	20.8216	20.9590	20.9892	20.9887	20.9009	20.5986	20.0598	19.5319	(87)
Th 2	19.9834	19.9881	19.9896	19.9896	19.9881	19.9938	19.9911	19.9952	19.9952	19.9925	19.9952	19.9896	(88)
util rest of house	0.9024	0.8792	0.8173	0.7060	0.5363	0.3420	0.2170	0.2217	0.4649	0.7032	0.8520	0.9114	(89)
MIT 2	18.3760	18.5786	19.0431	19.5092	19.8379	19.9690	19.9872	19.9912	19.9258	19.6168	18.9862	18.3285	(90)
Living area fraction	18.8604	19.0469	19.4777	19.9165	20.2355	20.3692	20.3922	20.3944	20.3199	20.0136	19.4201	18.8149	(91)
MIT	18.8604	19.0469	19.4777	19.9165	20.2355	20.3692	20.3922	20.3944	20.3199	20.0136	19.4201	18.8149	(92)
Temperature adjustment	18.8604	19.0469	19.4777	19.9165	20.2355	20.3692	20.3922	20.3944	20.3199	20.0136	19.4201	18.8149	(93)
adjusted MIT	18.8604	19.0469	19.4777	19.9165	20.2355	20.3692	20.3922	20.3944	20.3199	20.0136	19.4201	18.8149	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8843	0.8614	0.8034	0.7030	0.5507	0.3690	0.2498	0.2563	0.4898	0.7042	0.8370	0.8936	(94)
Ext temp.	515.6210	542.4572	547.4243	522.2740	425.2969	289.7331	185.9555	178.9642	316.7234	418.4154	472.3866	497.5282	(95)
Heat loss rate W	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Space heating kWh	864.1647	852.5098	765.0798	641.8640	467.9140	298.2378	187.6871	180.7365	338.4389	514.4059	700.6217	855.3759	(97)
Space heating requirement - total per year (kWh/year)	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388	(98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388	(98c)
Space heating per m ²	(98c) / (4) =											22.1486	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

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Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												249.9000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	103.7681	83.3755	64.8002	34.4557	12.6879	0.0000	0.0000	0.0000	0.0000	28.5782	65.7580	106.5381	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	144.1613	127.5928	135.5760	119.0007	115.2754	103.7625	102.2117	106.2557	107.4277	119.9451	127.7653	142.5384	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	18.3728	14.7394	13.2712	9.7230	7.5103	6.1360	6.8512	8.9054	11.5673	15.1769	17.1423	18.8835	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												499.9618	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1451.5126	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												148.2792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2099.7536	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	499.9618	26.0600	130.2900	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1451.5126	26.0600	378.2642	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	148.2792	26.0600	38.6416	(250)
Additional standing charges			0.0000	(251)
Total energy cost			547.1958	(255)

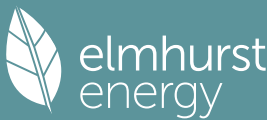
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	499.9618	0.1559	77.9525	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1451.5126	0.1409	204.5324	(264)
Space and water heating			282.4849	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	148.2792	0.1443	21.4013	(268)
Total CO2, kg/year			303.8862	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	499.9618	1.5772	788.5643	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1451.5126	1.5210	2207.8002	(278)
Space and water heating			2996.3645	(279)

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Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	148.2792	1.5338	227.4356 (282)
Total Primary energy kWh/year			3223.8001 (286)

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Property Reference	FURNERS LANE 12				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 12, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	5.14	TER	11.27	
Environmental	96 A	% DER < TER				54.39
CO ₂ Emissions (t/year)	0.33	DFEE	31.33	TFEE	31.65	
Compliance Check	See BREL	% DFEE < TFEE				1.01
% DPER < TPER	7.54	DPER	54.43	TPER	58.87	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.0560 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1204 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3704 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3149 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4015	0.3936	0.3857	0.3464	0.3385	0.2991	0.2991	0.2913	0.3149	0.3385	0.3542	0.3700 (22b)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			8.6400	1.1450	9.8931		(27)
Solid Doors			2.1200	1.0000	2.1200		(26)
Rooflight East			0.7600	1.1450	0.8702		(27a)
Ground Floor			4.1700	0.0900	0.3753	75.0000	312.7500 (28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632	9.0000	308.1600 (29a)
Ashlar	3.0100		3.0100	0.1800	0.5418	9.0000	27.0900 (29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036	9.0000	45.1800 (29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404	9.0000	7.0200 (29a)
Joists	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000 (30)
Rafters	14.0000	0.7600	13.2400	0.1300	1.7212	9.0000	119.1600 (30)
D Flat	4.8200		4.8200	0.1300	0.6266	9.0000	43.3800 (30)
Total net area of external elements Aum(A, m ²)			126.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.8555		(33)
Party Wall 1			44.7000	0.0000	0.0000	20.0000	894.0000 (32)
Party Floor 1			56.4100			30.0000	1692.3000 (32d)
GF			80.0000			9.0000	720.0000 (32c)
Heat capacity Cm = Sum (A x k)				(28)...(30) + (32) + (32a)...(32e) =			4619.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							66.7588 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E12 Gable (insulation at ceiling level)	9.9600	0.0600	0.5976
E10 Eaves (insulation at ceiling level)	3.8400	0.0600	0.2304
E16 Corner (normal)	9.6000	0.0900	0.8640
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
P1 Party wall - Ground floor	7.9600	0.0800	0.6368
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	23.1700	0.0700	1.6219
E14 Flat roof	12.4000	0.0400	0.4960
E11 Eaves (insulation at rafter level)	3.4100	0.0400	0.1364
R6 Flat ceiling	3.4100	0.0600	0.2046
E13 Gable (insulation at rafter level)	3.4000	0.0800	0.2720
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105
E3 Sill	7.2000	0.0500	0.3600
E4 Jamb	13.8000	0.0500	0.6900
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.9600	0.0800	0.1568
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.9958 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	36.8513 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	31.8153	31.6438	31.4757	30.6862	30.5385	29.8509	29.8509	29.7236	30.1158	30.5385	30.8374	31.1498	(38)
Average = Sum(39)m / 12 =	68.6666	68.4951	68.3270	67.5375	67.3898	66.7022	66.7022	66.5748	66.9670	67.3898	67.6886	68.0010	(39)
												67.5368	
HLP	0.9924	0.9900	0.9875	0.9761	0.9740	0.9640	0.9640	0.9622	0.9679	0.9740	0.9783	0.9828	(40)
HLP (average)												0.9761	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2263 (42)
Hot water usage for mixer showers													
76.9342	75.7780	74.0933	70.8698	68.4909	65.8380	64.3301	66.0021	67.8350	70.6834	73.9761	76.6394	(42a)	
Hot water usage for baths													
26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007	(42b)	
Hot water usage for other uses													
37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295	(42c)	
Average daily hot water use (litres/day)													129.6113 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.9544	138.0422	134.4403	128.8303	124.3226	119.4573	117.4895	121.0748	124.8700	129.9905	135.6908	140.5697	(44)
Energy content (annual)	223.2373	196.5703	206.6297	176.3623	167.3621	146.8867	142.0934	149.9159	153.9772	176.3958	193.3164	220.0982	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2152.8451	
33.4856	29.4855	30.9944	26.4543	25.1043	22.0330	21.3140	22.4874	23.0966	26.4594	28.9975	33.0147	(46)	
Water storage loss:													
Store volume													180.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.8736 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													0.8736 (55)
Total storage loss													
27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =	2745.6102	(64)	
Electric shower(s)											2746	(64)	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000	(64a)	
Heat gains from water heating, kWh/month													
114.5019	101.7375	108.9799	97.6168	95.9234	87.8161	87.5216	90.1226	90.1738	98.9272	103.2540	113.4582	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.0472	117.4095	106.0472	109.5822	106.0472	109.5822	106.0472	106.0472	109.5822	106.0472	109.5822	106.0472	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	195.3992	197.4269	192.3173	181.4396	167.7085	154.8032	146.1817	144.1541	149.2636	160.1413	173.8724	186.7777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	(71)
Water heating gains (Table 5)	153.9005	151.3951	146.4784	135.5789	128.9294	121.9669	117.6366	121.1325	125.2413	132.9666	143.4084	152.4976	(72)
Total internal gains	514.7414	525.6260	504.2374	485.9952	462.0796	442.7468	426.2600	427.7283	440.4816	458.5497	486.2574	504.7170	(73)

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6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	2.1600		10.6334		0.6300		0.7000		0.7700		7.0194 (74)	
East	4.3200		19.6403		0.6300		0.7000		0.7700		25.9300 (76)	
South	2.1600		46.7521		0.6300		0.7000		0.7700		30.8622 (78)	
East	0.7600		25.9287		0.6300		0.7000		1.0000		7.8212 (82)	
Solar gains	71.6328	130.3314	197.3747	271.5296	325.1671	331.1084	315.8434	275.1934	223.2888	149.4734	87.3872	60.2356 (83)
Total gains	586.3742	655.9574	701.6122	757.5247	787.2467	773.8552	742.1034	702.9217	663.7704	608.0230	573.6447	564.9526 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.6855	18.7322	18.7783	18.9978	19.0395	19.2358	19.2358	19.2725	19.1597	19.0395	18.9554	18.8683
alpha	2.2457	2.2488	2.2519	2.2665	2.2693	2.2824	2.2824	2.2848	2.2773	2.2693	2.2637	2.2579
util living area	0.8778	0.8454	0.8011	0.7197	0.6120	0.4775	0.3653	0.3963	0.5627	0.7418	0.8410	0.8853 (86)
MIT	18.5012	18.8301	19.3011	19.9164	20.4220	20.7701	20.9102	20.8889	20.6458	20.0037	19.1756	18.4494 (87)
Th 2	20.0896	20.0917	20.0937	20.1033	20.1051	20.1134	20.1134	20.1149	20.1102	20.1051	20.1015	20.0977 (88)
util rest of house	0.8663	0.8314	0.7827	0.6935	0.5744	0.4252	0.2999	0.3302	0.5116	0.7120	0.8244	0.8746 (89)
MIT 2	17.1685	17.5782	18.1642	18.9212	19.5209	19.9145	20.0527	20.0366	19.7874	19.0430	18.0233	17.1081 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.6384	18.0197	18.5652	19.2722	19.8387	20.2162	20.3551	20.3372	20.0901	19.3818	18.4296	17.5811 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6384	18.0197	18.5652	19.2722	19.8387	20.2162	20.3551	20.3372	20.0901	19.3818	18.4296	17.5811 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8272	0.7922	0.7462	0.6663	0.5625	0.4315	0.3182	0.3473	0.5103	0.6847	0.7867	0.8361 (94)
Useful gains	485.0483	519.6676	523.5302	504.7397	442.7877	333.9566	236.1564	244.1558	338.7551	416.3054	451.2910	472.3322 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	915.9050	898.6357	824.3762	700.5102	548.4652	374.6159	250.4711	262.1166	401.1413	591.8021	766.8875	909.9271 (97)
Space heating kWh	320.5574	254.6666	223.8294	140.9547	78.6241	0.0000	0.0000	0.0000	0.0000	130.5695	227.2295	325.5706 (98a)
Space heating requirement - total per year (kWh/year)	1702.0019											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	320.5574	254.6666	223.8294	140.9547	78.6241	0.0000	0.0000	0.0000	0.0000	130.5695	227.2295	325.5706 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1702.0019											
Space heating per m2	(98c) / (4) = 24.5990 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	320.5574	254.6666	223.8294	140.9547	78.6241	0.0000	0.0000	0.0000	0.0000	130.5695	227.2295	325.5706 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	128.2743	101.9074	89.5676	56.4045	31.4622	0.0000	0.0000	0.0000	0.0000	52.2487	90.9282	130.2804 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	156.2431	138.2311	146.7585	128.5452	124.3327	111.7116	109.9017	114.3691	115.7611	129.4919	138.2277	154.4504 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	25.0461	20.0929	18.0914	13.2545	10.2382	8.3647	9.3396	12.1400	15.7686	20.6893	23.3685	25.7422 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												

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(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												681.0732	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1568.0241	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												202.1361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2451.2333	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	681.0732	0.1545	105.2083	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1568.0241	0.1410	221.0279	(264)
Space and water heating			326.2362	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	202.1361	0.1443	29.1745	(268)
Total CO2, kg/year			355.4106	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.1400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	681.0732	1.5719	1070.5768	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1568.0241	1.5212	2385.3100	(278)
Space and water heating			3455.8868	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	202.1361	1.5338	310.0430	(282)
Total Primary energy kWh/year			3765.9299	(286)
Dwelling Primary energy Rate (DPER)			54.4300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080	(1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.0560	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1204 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3704	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3149 (21)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

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Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4015	0.3936	0.3857	0.3464	0.3385	0.2991	0.2991	0.2913	0.3149	0.3385	0.3542	0.3700 (22b)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.20)			8.6400	1.1450	9.8931		(27)
Rooflight East			0.7600	1.4151	1.0755		(27a)
Ground floor			4.1700	0.1300	0.5421		(28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632		(29a)
Ashlar	3.0100		3.0100	0.1800	0.5418		(29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036		(29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404		(29a)
Joists	50.0000		50.0000	0.1100	5.5000		(30)
Rafters	14.0000	0.7600	13.2400	0.1100	1.4564		(30)
D Flat	4.8200		4.8200	0.1100	0.5302		(30)
Total net area of external elements Aum(A, m2)			126.8000				(31)
Fabric heat loss, W/K = Sum (A x U)					28.8663		(33)
Party Wall 1			44.7000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

66.7588 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	9.9600	0.0600	0.5976
E10 Eaves (insulation at ceiling level)	3.8400	0.0600	0.2304
E16 Corner (normal)	9.6000	0.0900	0.8640
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
P1 Party wall - Ground floor	7.9600	0.0800	0.6368
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	23.1700	0.0700	1.6219
E14 Flat roof	12.4000	0.0800	0.9920
E11 Eaves (insulation at rafter level)	3.4100	0.0400	0.1364
R6 Flat ceiling	3.4100	0.0600	0.2046
E13 Gable (insulation at rafter level)	3.4000	0.0800	0.2720
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105
E3 Sill	7.2000	0.0500	0.3600
E4 Jamb	13.8000	0.0500	0.6900
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.9600	0.0800	0.1568

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	37.3581 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	31.8153	31.6438	31.4757	30.6862	30.5385	29.8509	29.8509	29.7236	30.1158	30.5385	30.8374	31.1498 (38)
Heat transfer coeff	69.1734	69.0019	68.8338	68.0443	67.8966	67.2090	67.2090	67.0817	67.4739	67.8966	68.1955	68.5079 (39)
Average = Sum(39)m / 12 =												68.0436

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9998	0.9973	0.9949	0.9834	0.9813	0.9714	0.9714	0.9695	0.9752	0.9813	0.9856	0.9901 (40)
HLP (average)												0.9834
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2263 (42)
Hot water usage for mixer showers	61.5474	60.6224	59.2746	56.6958	54.7927	52.6704	51.4641	52.8017	54.2680	56.5467	59.1809	61.3116 (42a)
Hot water usage for baths	26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007 (42b)
Hot water usage for other uses	37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295 (42c)
Average daily hot water use (litres/day)												115.4252 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	125.5675	122.8866	119.6216	114.6564	110.6244	106.2897	104.6235	107.8744	111.3030	115.8538	120.8955	125.2418 (44)
Energy conte	198.8683	174.9889	183.8539	156.9588	148.9217	130.6955	126.5330	133.5710	137.2477	157.2125	172.2379	196.0984 (45)
Energy content (annual)										Total = Sum(45)m =		1917.1877
Distribution loss (46)m = 0.15 x (45)m	29.8302	26.2483	27.5781	23.5438	22.3383	19.6043	18.9800	20.0357	20.5872	23.5819	25.8357	29.4148 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	248.1109	219.4661	233.0966	204.6130	198.1644	178.3497	175.7757	182.8137	184.9019	206.4552	219.8921	245.3411 (62)
WWHRS	-28.1369	-24.8845	-26.0576	-21.5767	-20.1087	-17.2072	-16.1290	-17.1516	-17.8032	-20.9880	-23.7769	-27.6158 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	219.9740	194.5816	207.0390	183.0363	178.0556	161.1426	159.6467	165.6621	167.0987	185.4671	196.1152	217.7252 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2235.5443 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

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Heat gains from water heating, kWh/month
 105.5178 93.7656 100.5256 90.3122 88.9106 81.5796 81.4664 83.8065 83.7582 91.6673 95.3924 104.5969 (65)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.0472	117.4095	106.0472	109.5822	106.0472	109.5822	106.0472	106.0472	109.5822	106.0472	109.5822	106.0472	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	195.3992	197.4269	192.3173	181.4396	167.7085	154.8032	146.1817	144.1541	149.2636	160.1413	173.8724	186.7777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	(71)
Water heating gains (Table 5)	141.8250	139.5321	135.1150	125.4336	119.5035	113.3050	109.4978	112.6432	116.3309	123.2087	132.4895	140.5872	(72)
Total internal gains	502.6660	513.7630	492.8741	475.8498	452.6538	434.0849	418.1213	419.2390	431.5712	448.7918	475.3386	492.8066	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.1600	10.6334		0.6300		0.7000		0.7700		7.0194 (74)
East				4.3200	19.6403		0.6300		0.7000		0.7700		25.9300 (76)
South				2.1600	46.7521		0.6300		0.7000		0.7700		30.8622 (78)
East				0.7600	25.9287		0.6300		0.7000		1.0000		7.8212 (82)
Solar gains	71.6328	130.3314	197.3747	271.5296	325.1671	331.1084	315.8434	275.1934	223.2888	149.4734	87.3872	60.2356	(83)
Total gains	574.2988	644.0944	690.2488	747.3794	777.8208	765.1934	733.9647	694.4324	654.8600	598.2652	562.7258	553.0422	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.5486	18.5947	18.6401	18.8563	18.8974	19.0907	19.0907	19.1269	19.0158	18.8974	18.8145	18.7288	
alpha	2.2366	2.2396	2.2427	2.2571	2.2598	2.2727	2.2727	2.2751	2.2677	2.2598	2.2543	2.2486	
util living area	0.8824	0.8505	0.8066	0.7258	0.6184	0.4838	0.3708	0.4024	0.5699	0.7484	0.8464	0.8898	(86)
MIT	18.4450	18.7785	19.2571	19.8847	20.4022	20.7606	20.9059	20.8836	20.6318	19.9731	19.1295	18.3925	(87)
Th 2	20.0835	20.0856	20.0876	20.0972	20.0989	20.1073	20.1073	20.1088	20.1041	20.0989	20.0953	20.0916	(88)
util rest of house	0.8712	0.8367	0.7885	0.6996	0.5807	0.4309	0.3043	0.3352	0.5184	0.7188	0.8301	0.8793	(89)
MIT 2	17.0958	17.5116	18.1075	18.8801	19.4946	19.9002	20.0437	20.0268	19.7684	19.0036	17.9637	17.0343	(90)
Living area fraction	17.5716	17.9584	18.5129	19.2344	19.8147	20.2036	20.3477	20.3289	20.0729	19.3455	18.3748	17.5133	(91)
MIT	17.5716	17.9584	18.5129	19.2344	19.8147	20.2036	20.3477	20.3289	20.0729	19.3455	18.3748	17.5133	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5716	17.9584	18.5129	19.2344	19.8147	20.2036	20.3477	20.3289	20.0729	19.3455	18.3748	17.5133	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	477.8570	513.4710	518.6396	501.9468	441.7585	334.2662	236.8741	244.7260	338.1992	413.1797	445.7010	465.0333	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	918.0432	901.0529	826.8944	703.1966	550.9612	376.6120	251.8825	263.5586	403.0118	593.7925	768.8924	912.0649	(97)
Space heating kWh	327.4986	260.4550	229.3415	144.8999	81.2468	0.0000	0.0000	0.0000	0.0000	134.3759	232.6978	332.5915	(98a)
Space heating requirement - total per year (kWh/year)												1743.1071	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	327.4986	260.4550	229.3415	144.8999	81.2468	0.0000	0.0000	0.0000	0.0000	134.3759	232.6978	332.5915	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1743.1071	
Space heating per m ²										(98c) / (4) =		25.1930	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
327.4986	260.4550	229.3415	144.8999	81.2468	0.0000	0.0000	0.0000	0.0000	0.0000	134.3759	232.6978	332.5915	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	354.8197	282.1831	248.4740	156.9880	88.0247	0.0000	0.0000	0.0000	0.0000	145.5860	252.1103	360.3375	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	219.9740	194.5816	207.0390	183.0363	178.0556	161.1426	159.6467	165.6621	167.0987	185.4671	196.1152	217.7252 (64)
Efficiency of water heater	84.9504	84.7144	84.2897	83.5412	82.4173	79.8000	79.8000	79.8000	79.8000	83.3491	84.4443	79.8000 (216)
Fuel for water heating, kWh/month	258.9441	229.6913	245.6278	219.0971	216.0417	201.9330	200.0585	207.5967	209.3969	222.5185	232.2419	85.0069 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685 (231)
Lighting	22.0345	17.6769	15.9161	11.6608	9.0072	7.3589	8.2166	10.6803	13.8726	18.2016	20.5587	22.6469 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-32.5444	-45.9671	-66.1974	-74.5820	-80.5640	-75.2661	-74.3600	-70.1495	-62.7104	-52.6617	-35.8191	-28.1284 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-18.1095	-38.1349	-75.8632	-114.0310	-150.8539	-151.5848	-149.7772	-126.7576	-92.8489	-54.5371	-24.1809	-14.3155 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1888.5234 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												2699.2738 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												177.8312 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1709.9446 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3141.6839 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1888.5234	0.2100	396.5899 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2699.2738	0.2100	566.8475 (264)
Space and water heating			963.4374 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	177.8312	0.1443	25.6665 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-698.9500	0.1345	-94.0362
PV Unit electricity exported	-1010.9945	0.1259	-127.2602
Total			-221.2965 (269)
Total CO2, kg/year			779.7367 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.2700 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1888.5234	1.1300	2134.0314 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2699.2738	1.1300	3050.1794 (278)
Space and water heating			5184.2108 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	177.8312	1.5338	272.7635 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-698.9500	1.4972	-1046.4902
PV Unit electricity exported	-1010.9945	0.4621	-467.1319
Total			-1513.6221 (283)
Total Primary energy kWh/year			4073.4530 (286)
Target Primary Energy Rate (TPER)			58.8700 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

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	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.0560 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1204 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3704 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3149 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4015	0.3936	0.3857	0.3464	0.3385	0.2991	0.2991	0.2913	0.3149	0.3385	0.3542	0.3700 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			8.6400	1.1450	9.8931		(27)
Solid Doors			2.1200	1.0000	2.1200		(26)
Rooflight East			0.7600	1.1450	0.8702		(27a)
Ground Floor			4.1700	0.0900	0.3753	75.0000	312.7500 (28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632	9.0000	308.1600 (29a)
Ashlar	3.0100		3.0100	0.1800	0.5418	9.0000	27.0900 (29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036	9.0000	45.1800 (29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404	9.0000	7.0200 (29a)
Joists	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000 (30)
Rafters	14.0000	0.7600	13.2400	0.1300	1.7212	9.0000	119.1600 (30)
D Flat	4.8200		4.8200	0.1300	0.6266	9.0000	43.3800 (30)
Total net area of external elements Aum (A, m ²)			126.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.8555		(33)
Party Wall 1			44.7000	0.0000	0.0000	20.0000	894.0000 (32)
Party Floor 1			56.4100			30.0000	1692.3000 (32d)
GF			80.0000			9.0000	720.0000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4619.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		66.7588 (35)

List of Thermal Bridges

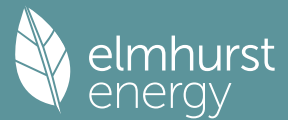
K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	9.9600	0.0600	0.5976
E10 Eaves (insulation at ceiling level)	3.8400	0.0600	0.2304
E16 Corner (normal)	9.6000	0.0900	0.8640
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
P1 Party wall - Ground floor	7.9600	0.0800	0.6368
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	23.1700	0.0700	1.6219
E14 Flat roof	12.4000	0.0400	0.4960
E11 Eaves (insulation at rafter level)	3.4100	0.0400	0.1364
R6 Flat ceiling	3.4100	0.0600	0.2046
E13 Gable (insulation at rafter level)	3.4000	0.0800	0.2720
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105
E3 Sill	7.2000	0.0500	0.3600
E4 Jamb	13.8000	0.0500	0.6900
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.9600	0.0800	0.1568

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.9958 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	36.8513 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	31.8153	31.6438	31.4757	30.6862	30.5385	29.8509	29.8509	29.7236	30.1158	30.5385	30.8374	31.1498 (38)
Heat transfer coeff	68.6666	68.4951	68.3270	67.5375	67.3898	66.7022	66.7022	66.5748	66.9670	67.3898	67.6886	68.0010 (39)
Average = Sum(39)m / 12 =												67.5368

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9924	0.9900	0.9875	0.9761	0.9740	0.9640	0.9640	0.9622	0.9679	0.9740	0.9783	0.9828 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

Full SAP Calculation Printout



4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2263 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007 (42b)
Hot water usage for other uses	37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295 (42c)
Average daily hot water use (litres/day)												58.6805 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	64.0201	62.2642	60.3470	57.9605	55.8317	53.6192	53.1594	55.0727	57.0350	59.3071	61.7146	63.9303 (44)
Energy content (annual)	101.3923	88.6633	92.7511	79.3451	75.1602	65.9311	64.2917	68.1915	70.3299	80.4791	87.9238	100.0993 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											974.5584
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	86.1834	75.3638	78.8384	67.4433	63.8861	56.0414	54.6479	57.9628	59.7804	68.4073	74.7352	85.0844 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	86.1834	75.3638	78.8384	67.4433	63.8861	56.0414	54.6479	57.9628	59.7804	68.4073	74.7352	85.0844 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											828.3746 (64)
Electric shower(s)	49.2892	43.9171	47.9558	45.7636	46.6223	44.4732	45.9556	46.6223	45.7636	47.9558	47.0540	49.2892 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											560.6616 (64a)
Heat gains from water heating, kWh/month	33.8682	29.8202	31.6985	28.3017	27.6271	25.1287	25.1509	26.1463	26.3860	29.0908	30.4473	33.5934 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	195.3992	197.4269	192.3173	181.4396	167.7085	154.8032	146.1817	144.1541	149.2636	160.1413	173.8724	186.7777 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520 (71)
Water heating gains (Table 5)	45.5217	44.3753	42.6056	39.3080	37.1332	34.9009	33.8050	35.1428	36.6472	39.1005	42.2879	45.1524 (72)
Total internal gains	403.3627	415.6062	397.3646	386.7242	367.2835	355.6808	342.4284	341.7387	351.8875	361.6835	382.1370	394.3719 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	g Specific data or Table 6b	FF Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North				2.1600	10.6334	0.6300		0.7000		0.7700	7.0194 (74)	
East				4.3200	19.6403	0.6300		0.7000		0.7700	25.9300 (76)	
South				2.1600	46.7521	0.6300		0.7000		0.7700	30.8622 (78)	
East				0.7600	25.9287	0.6300		0.7000		1.0000	7.8212 (82)	
Solar gains	71.6328	130.3314	197.3747	271.5296	325.1671	331.1084	315.8434	275.1934	223.2888	149.4734	87.3872	60.2356 (83)
Total gains	474.9955	545.9376	594.7393	658.2538	692.4506	686.7892	658.2718	616.9320	575.1763	511.1569	469.5242	454.6075 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.6855	18.7322	18.7783	18.9978	19.0395	19.2358	19.2358	19.2725	19.1597	19.0395	18.9554	18.8683
alpha	2.2457	2.2488	2.2519	2.2665	2.2693	2.2824	2.2824	2.2848	2.2773	2.2693	2.2637	2.2579
util living area	0.9141	0.8843	0.8436	0.7649	0.6588	0.5210	0.4038	0.4403	0.6160	0.7945	0.8842	0.9209 (86)
MIT	18.1829	18.5459	19.0621	19.7501	20.3200	20.7232	20.8891	20.8613	20.5690	19.8247	18.9076	18.1256 (87)
Th 2	20.0896	20.0917	20.0937	20.1033	20.1051	20.1134	20.1134	20.1149	20.1102	20.1051	20.1015	20.0977 (88)
util rest of house	0.9055	0.8729	0.8278	0.7406	0.6220	0.4669	0.3335	0.3696	0.5646	0.7680	0.8709	0.9129 (89)
MIT 2	17.5034	17.8593	18.3640	19.0311	19.5638	19.9246	20.0542	20.0375	19.7994	19.1162	18.2263	17.4524 (90)
Living area fraction	17.7430	18.1014	18.6102	19.2846	19.8305	20.2062	20.3486	20.3280	20.0708	19.3660	18.4666	17.6898 (91)
MIT	17.7430	18.1014	18.6102	19.2846	19.8305	20.2062	20.3486	20.3280	20.0708	19.3660	18.4666	17.6898 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7430	18.1014	18.6102	19.2846	19.8305	20.2062	20.3486	20.3280	20.0708	19.3660	18.4666	17.6898 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8765	0.8419	0.7969	0.7156	0.6097	0.4728	0.3529	0.3873	0.5622	0.7426	0.8408	0.8849	(94)
Useful gains	416.3513	459.6333	473.9542	471.0174	422.2150	324.7211	232.2767	238.9630	323.3633	379.5947	394.7849	402.3026	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	923.0870	904.2326	827.4518	701.3530	547.9142	373.9476	250.0389	261.5062	399.8461	590.7416	769.3890	917.3208	(97)
Space heating kWh	377.0114	298.7707	263.0022	165.8417	93.5202	0.0000	0.0000	0.0000	0.0000	157.0933	269.7149	383.1735	(98a)
Space heating requirement - total per year (kWh/year)												2008.1280	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	377.0114	298.7707	263.0022	165.8417	93.5202	0.0000	0.0000	0.0000	0.0000	157.0933	269.7149	383.1735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2008.1280	
Space heating per m2												29.0234	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	627.0004	493.5961	505.9687	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7542	0.8122	0.7874	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	472.9117	400.9051	398.3857	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	748.4877	717.8942	673.0304	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	198.4147	235.8399	204.3357	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	49.6037	58.9600	51.0839	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												159.6476	(107)
Energy for space heating												29.0234	(99)
Energy for space cooling												2.3074	(108)
Total												31.3308	(109)
Fabric Energy Efficiency (DFEE)												31.3	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	166.0560 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1204 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3704 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3149 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4015	0.3936	0.3857	0.3464	0.3385	0.2991	0.2991	0.2913	0.3149	0.3385	0.3542	0.3700	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684	(25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.20)			8.6400	1.1450	9.8931			(27)
Rooflight East			0.7600	1.4151	1.0755			(27a)
Ground Floor			4.1700	0.1300	0.5421			(28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632			(29a)
Ashlar	3.0100		3.0100	0.1800	0.5418			(29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036			(29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404			(29a)
Joists	50.0000		50.0000	0.1100	5.5000			(30)
Rafters	14.0000	0.7600	13.2400	0.1100	1.4564			(30)
D Flat	4.8200		4.8200	0.1100	0.5302			(30)
Total net area of external elements Aum(A, m2)			126.8000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.8663			(33)
Party Wall 1			44.7000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 66.7588 (35)

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element				
E12 Gable (insulation at ceiling level)	9.9600	0.0600	0.5976	
E10 Eaves (insulation at ceiling level)	3.8400	0.0600	0.2304	
E16 Corner (normal)	9.6000	0.0900	0.8640	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160	
P1 Party wall - Ground floor	7.9600	0.0800	0.6368	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000	
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880	
E7 Party floor between dwellings (in blocks of flats)	23.1700	0.0700	1.6219	
E14 Flat roof	12.4000	0.0800	0.9920	
E11 Eaves (insulation at rafter level)	3.4100	0.0400	0.1364	
R6 Flat ceiling	3.4100	0.0600	0.2046	
E13 Gable (insulation at rafter level)	3.4000	0.0800	0.2720	
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376	
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105	
E3 Sill	7.2000	0.0500	0.3600	
E4 Jamb	13.8000	0.0500	0.6900	
R1 Head of roof window	0.7800	0.0800	0.0624	
R2 Sill of roof window	0.7800	0.0600	0.0468	
R3 Jamb of roof window	1.9600	0.0800	0.1568	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.4918 (36)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 37.3581 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	31.8153	31.6438	31.4757	30.6862	30.5385	29.8509	29.8509	29.7236	30.1158	30.5385	30.8374	31.1498	(38)
Average = Sum(39)m / 12 =	69.1734	69.0019	68.8338	68.0443	67.8966	67.2090	67.2090	67.0817	67.4739	67.8966	68.1955	68.5079	(39)
												68.0436	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9998	0.9973	0.9949	0.9834	0.9813	0.9714	0.9714	0.9695	0.9752	0.9813	0.9856	0.9901	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2263 (42)
Hot water usage for mixer showers													
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for other uses	26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007	(42b)
Average daily hot water use (litres/day)	37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295	(42c)
												58.6805	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	64.0201	62.2642	60.3470	57.9605	55.8317	53.6192	53.1594	55.0727	57.0350	59.3071	61.7146	63.9303	(44)
Energy content (annual)	101.3923	88.6633	92.7511	79.3451	75.1602	65.9311	64.2917	68.1915	70.3299	80.4791	87.9238	100.0993	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	86.1834	75.3638	78.8384	67.4433	63.8861	56.0414	54.6479	57.9628	59.7804	68.4073	74.7352	85.0844	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	86.1834	75.3638	78.8384	67.4433	63.8861	56.0414	54.6479	57.9628	59.7804	68.4073	74.7352	85.0844	(64)
12Total per year (kWh/year)													
Electric shower(s)	49.2892	43.9171	47.9558	45.7636	46.6223	44.4732	45.9556	46.6223	45.7636	47.9558	47.0540	49.2892	(64a)
Heat gains from water heating, kWh/month	33.8682	29.8202	31.6985	28.3017	27.6271	25.1287	25.1509	26.1463	26.3860	29.0908	30.4473	33.5934	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	106.0472	117.4095	106.0472	109.5822	106.0472	109.5822	106.0472	106.0472	109.5822	106.0472	109.5822	106.0472	(67)

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Cooking gains	195.3992	197.4269	192.3173	181.4396	167.7085	154.8032	146.1817	144.1541	149.2636	160.1413	173.8724	186.7777 (68)
Pumps, fans	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315 (69)
Losses e.g. evaporation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520 (71)
Total internal gains	45.5217	44.3753	42.6056	39.3080	37.1332	34.9009	33.8050	35.1428	36.6472	39.1005	42.2879	45.1524 (72)
	403.3627	415.6062	397.3646	386.7242	367.2835	355.6808	342.4284	341.7387	351.8875	361.6835	382.1370	394.3719 (73)

6. Solar gains

[Jan]												
				Area	Solar flux		g	FF		Access		Gains
				m2	Table 6a		Specific data	Specific data		factor		W
					W/m2		or Table 6b	or Table 6c		Table 6d		
North				2.1600	10.6334		0.6300	0.7000		0.7700		7.0194 (74)
East				4.3200	19.6403		0.6300	0.7000		0.7700		25.9300 (76)
South				2.1600	46.7521		0.6300	0.7000		0.7700		30.8622 (78)
East				0.7600	25.9287		0.6300	0.7000		1.0000		7.8212 (82)
Solar gains	71.6328	130.3314	197.3747	271.5296	325.1671	331.1084	315.8434	275.1934	223.2888	149.4734	87.3872	60.2356 (83)
Total gains	474.9955	545.9376	594.7393	658.2538	692.4506	686.7892	658.2718	616.9320	575.1763	511.1569	469.5242	454.6075 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.5486	18.5947	18.6401	18.8563	18.8974	19.0907	19.0907	19.1269	19.0158	18.8974	18.8145	18.7288
alpha	2.2366	2.2396	2.2427	2.2571	2.2598	2.2727	2.2727	2.2751	2.2677	2.2598	2.2543	2.2486
util living area	0.9145	0.8849	0.8444	0.7662	0.6607	0.5232	0.4059	0.4425	0.6180	0.7957	0.8847	0.9212 (86)
MIT	18.1598	18.5233	19.0416	19.7336	20.3087	20.7173	20.8862	20.8579	20.5611	19.8101	18.8879	18.1022 (87)
Th 2	20.0835	20.0856	20.0876	20.0972	20.0989	20.1073	20.1073	20.1088	20.1041	20.0989	20.0953	20.0916 (88)
util rest of house	0.9058	0.8735	0.8286	0.7419	0.6237	0.4687	0.3350	0.3711	0.5664	0.7691	0.8714	0.9132 (89)
MIT 2	17.4769	17.8332	18.3401	19.0111	19.5490	19.9146	20.0466	20.0296	19.7878	19.0982	18.2032	17.4257 (90)
Living area fraction	17.7177	18.0766	18.5875	19.2659	19.8169	20.1976	20.3427	20.3217	20.0605	19.3493	18.4447	17.6643 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7177	18.0766	18.5875	19.2659	19.8169	20.1976	20.3427	20.3217	20.0605	19.3493	18.4447	17.6643 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8768	0.8423	0.7975	0.7165	0.6111	0.4745	0.3544	0.3889	0.5637	0.7435	0.8412	0.8851 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	928.1480	909.2091	832.0302	705.3393	551.1110	376.2119	251.5426	263.0736	402.1811	594.0474	773.6536	922.4072 (97)
Space heating kWh	380.6934	301.9701	266.1406	168.2415	95.1817	0.0000	0.0000	0.0000	0.0000	159.2283	272.6496	386.8886 (98a)
Space heating requirement - total per year (kWh/year)												2030.9937
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	380.6934	301.9701	266.1406	168.2415	95.1817	0.0000	0.0000	0.0000	0.0000	159.2283	272.6496	386.8886 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2030.9937
Space heating per m2										(98c) / (4) =		29.3539 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	631.7647	497.3467	509.8207	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7509	0.8092	0.7842	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	474.3876	402.4509	399.7925	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	748.4877	717.8942	673.0304	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	197.3521	234.6898	203.2890	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	49.3380	58.6724	50.8222	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												158.8327 (107)
Energy for space heating												29.3539 (99)
Energy for space cooling												2.2956 (108)
Total												31.6495 (109)
Fabric Energy Efficiency (TFEE)												31.6 (109)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.0560 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1204 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3704 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3149 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infilt rate	0.4015 0.3936 0.3857 0.3464 0.3385 0.2991 0.2991 0.2913 0.3149 0.3385 0.3542 0.3700 (22b)
Effective ac	0.5806 0.5775 0.5744 0.5600 0.5573 0.5447 0.5447 0.5424 0.5496 0.5573 0.5627 0.5684 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			8.6400	1.1450	9.8931		(27)
Solid Doors			2.1200	1.0000	2.1200		(26)
Rooflight East			0.7600	1.1450	0.8702		(27a)
Ground Floor			4.1700	0.0900	0.3753	75.0000	312.7500 (28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632	9.0000	308.1600 (29a)
Ashlar	3.0100		3.0100	0.1800	0.5418	9.0000	27.0900 (29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036	9.0000	45.1800 (29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404	9.0000	7.0200 (29a)
Joists	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000 (30)
Rafters	14.0000	0.7600	13.2400	0.1300	1.7212	9.0000	119.1600 (30)
D Flat	4.8200		4.8200	0.1300	0.6266	9.0000	43.3800 (30)
Total net area of external elements Aum(A, m ²)			126.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.8555		(33)
Party Wall 1			44.7000	0.0000	0.0000	20.0000	894.0000 (32)
Party Floor 1			56.4100			30.0000	1692.3000 (32d)
GF			80.0000			9.0000	720.0000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 4619.0400 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 66.7588 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	9.9600	0.0600	0.5976
E10 Eaves (insulation at ceiling level)	3.8400	0.0600	0.2304
E16 Corner (normal)	9.6000	0.0900	0.8640
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
P1 Party wall - Ground floor	7.9600	0.0800	0.6368
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	23.1700	0.0700	1.6219
E14 Flat roof	12.4000	0.0400	0.4960
E11 Eaves (insulation at rafter level)	3.4100	0.0400	0.1364
R6 Flat ceiling	3.4100	0.0600	0.2046
E13 Gable (insulation at rafter level)	3.4000	0.0800	0.2720
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105
E3 Sill	7.2000	0.0500	0.3600
E4 Jamb	13.8000	0.0500	0.6900
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.9600	0.0800	0.1568

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9958 (36)

Point Thermal bridges (36a) = 0.0000

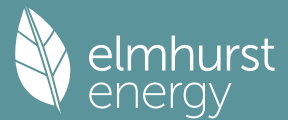
Total fabric heat loss (33) + (36) + (36a) = 36.8513 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 31.8153	Feb 31.6438	Mar 31.4757	Apr 30.6862	May 30.5385	Jun 29.8509	Jul 29.8509	Aug 29.7236	Sep 30.1158	Oct 30.5385	Nov 30.8374	Dec 31.1498 (38)
Heat transfer coeff	68.6666	68.4951	68.3270	67.5375	67.3898	66.7022	66.7022	66.5748	66.9670	67.3898	67.6886	68.0010 (39)
Average = Sum(39)m / 12 =												67.5368

HLP	Jan 0.9924	Feb 0.9900	Mar 0.9875	Apr 0.9761	May 0.9740	Jun 0.9640	Jul 0.9640	Aug 0.9622	Sep 0.9679	Oct 0.9740	Nov 0.9783	Dec 0.9828 (40)

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HLP (average)	31	28	31	30	31	30	31	31	30	31	30	0.9761
Days in mont												31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.2263 (42)
Hot water usage for mixer showers												
76.9342	75.7780	74.0933	70.8698	68.4909	65.8380	64.3301	66.0021	67.8350	70.6834	73.9761	76.6394	(42a)
Hot water usage for baths												
26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007	(42b)
Hot water usage for other uses												
37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295	(42c)
Average daily hot water use (litres/day)												129.6113 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	140.9544	138.0422	134.4403	128.8303	124.3226	119.4573	117.4895	121.0748	124.8700	129.9905	135.6908	140.5697 (44)
Energy conte	223.2373	196.5703	206.6297	176.3623	167.3621	146.8867	142.0934	149.9159	153.9772	176.3958	193.3164	220.0982 (45)
Energy content (annual)												
Distribution loss	(46)m = 0.15 x (45)m											2152.8451
33.4856	29.4855	30.9944	26.4543	25.1043	22.0330	21.3140	22.4874	23.0966	26.4594	28.9975	33.0147	(46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.8736 (55)
Total storage loss												
27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage												
27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426 (64)
												2745.6102 (64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												
Heat gains from water heating, kWh/month												
114.5019	101.7375	108.9799	97.6168	95.9234	87.8161	87.5216	90.1226	90.1738	98.9272	103.2540	113.4582	(65)

5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts												
(66)m	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
28.6145	25.4151	20.6690	15.6477	11.6969	9.8750	10.6703	13.8696	18.6158	23.6370	27.5879	29.4097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
291.6406	294.6670	287.0407	270.8054	250.3112	231.0496	218.1816	215.1553	222.7815	239.0169	259.5110	278.7727	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	(71)
Water heating gains (Table 5)												
153.9005	151.3951	146.4784	135.5789	128.9294	121.9669	117.6366	121.1325	125.2413	132.9666	143.4084	152.4976	(72)
Total internal gains												
572.2657	569.5873	552.2982	520.1421	489.0476	458.0016	441.5986	445.2676	461.7487	493.7306	528.6174	558.7901	(73)

6. Solar gains												

[Jan]												
			Area	Solar flux	g	FF	Access	Gains				
			m2	Table 6a	Specific data	Specific data	factor	W				
				W/m2	or Table 6b	or Table 6c	Table 6d					
North			2.1600	10.6334	0.6300	0.7000	0.7700	7.0194 (74)				
East			4.3200	19.6403	0.6300	0.7000	0.7700	25.9300 (76)				
South			2.1600	46.7521	0.6300	0.7000	0.7700	30.8622 (78)				
East			0.7600	25.9287	0.6300	0.7000	1.0000	7.8212 (82)				

Solar gains	71.6328	130.3314	197.3747	271.5296	325.1671	331.1084	315.8434	275.1934	223.2888	149.4734	87.3872	60.2356 (83)
Total gains	643.8984	699.9187	749.6729	791.6717	814.2146	789.1100	757.4420	720.4609	685.0376	643.2040	616.0046	619.0257 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.6855	18.7322	18.7783	18.9978	19.0395	19.2358	19.2358	19.2725	19.1597	19.0395	18.9554	18.8683
alpha	2.2457	2.2488	2.2519	2.2665	2.2693	2.2824	2.2824	2.2848	2.2773	2.2693	2.2637	2.2579
util living area	0.8582	0.8297	0.7822	0.7048	0.5995	0.4705	0.3589	0.3882	0.5510	0.7233	0.8233	0.8671 (86)
MIT	18.6511	18.9336	19.3975	19.9672	20.4473	20.7772	20.9134	20.8936	20.6615	20.0604	19.2738	18.5946 (87)
Th 2	20.0896	20.0917	20.0937	20.1033	20.1051	20.1134	20.1134	20.1149	20.1102	20.1051	20.1015	20.0977 (88)
util rest of house	0.8455	0.8147	0.7628	0.6780	0.5619	0.4186	0.2944	0.3231	0.5000	0.6927	0.8055	0.8551 (89)
MIT 2	17.3531	17.7045	18.2796	18.9798	19.5480	19.9210	20.0550	20.0401	19.8027	19.1076	18.1420	17.2874 (90)

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Living area fraction									fLA = Living area / (4) =		0.3527 (91)	
MIT	17.8108	18.1379	18.6739	19.3280	19.8651	20.2229	20.3577	20.3411	20.1056	19.4436	18.5411	17.7484 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8108	18.1379	18.6739	19.3280	19.8651	20.2229	20.3577	20.3411	20.1056	19.4436	18.5411	17.7484 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8060	0.7760	0.7276	0.6524	0.5511	0.4253	0.3127	0.3403	0.4998	0.6673	0.7684	0.8159	(94)
Useful gains	518.9616	543.1033	545.4849	516.4786	448.7439	335.5915	236.8430	245.1605	342.3535	429.1810	473.3566	505.0768	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	927.7420	906.7337	831.8037	704.2805	550.2471	375.0619	250.6474	262.3778	402.1741	595.9685	774.4333	921.3067	(97)
Space heating kWh	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	309.6751	(98a)
Space heating requirement - total per year (kWh/year)												1622.7893	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	309.6751	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1622.7893	
Space heating per m2										(98c) / (4) =		23.4541	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	309.6751	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	121.7017	97.7830	85.2426	54.1086	30.2194	0.0000	0.0000	0.0000	0.0000	49.6558	86.7448	123.9196	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	156.2431	138.2311	146.7585	128.5452	124.3327	111.7116	109.9017	114.3691	115.7611	129.4919	138.2277	154.4504	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	25.0461	20.0929	18.0914	13.2545	10.2382	8.3647	9.3396	12.1400	15.7686	20.6893	23.3685	25.7422	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												649.3755	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1568.0241	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												202.1361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2419.5356	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	649.3755	16.4900	107.0820	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1568.0241	16.4900	258.5672	(247)

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Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	202.1361	16.4900	33.3322 (250)
Additional standing charges			0.0000 (251)
Total energy cost			398.9814 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2578 (257)
SAP value		79.6103
SAP rating (Section 12)		80 (258)
SAP band		C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	649.3755	0.1545	100.3018 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1568.0241	0.1410	221.0279 (264)
Space and water heating			321.3297 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	202.1361	0.1443	29.1745 (268)
Total CO2, kg/year			350.5042 (272)
CO2 emissions per m2			5.0700 (273)
EI value			95.8869
EI rating			96 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	166.0560 (5)

2. Ventilation rate

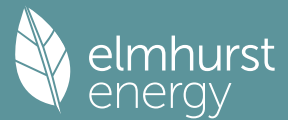
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1204 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3704 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3149 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.2834	0.2598	0.2519	0.2519	0.2598	0.2283	0.2440	0.2204	0.2204	0.2362	0.2204	0.2519 (22b)
Effective ac	0.5402	0.5337	0.5317	0.5317	0.5337	0.5261	0.5298	0.5243	0.5243	0.5279	0.5243	0.5317 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			8.6400	1.1450	9.8931		(27)
Solid Doors			2.1200	1.0000	2.1200		(26)
Rooflight East			0.7600	1.1450	0.8702		(27a)
Ground Floor			4.1700	0.0900	0.3753	75.0000	312.7500 (28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632	9.0000	308.1600 (29a)
Ashlar	3.0100		3.0100	0.1800	0.5418	9.0000	27.0900 (29a)

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Dormers	9.3400	4.3200	5.0200	0.1800	0.9036	9.0000	45.1800 (29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404	9.0000	7.0200 (29a)
Joists	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000 (30)
Rafters	14.0000	0.7600	13.2400	0.1300	1.7212	9.0000	119.1600 (30)
D Flat	4.8200		4.8200	0.1300	0.6266	9.0000	43.3800 (30)
Total net area of external elements Aum(A, m2)			126.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	28.8555			(33)
Party Wall 1			44.7000	0.0000	0.0000	20.0000	894.0000 (32)
Party Floor 1			56.4100			30.0000	1692.3000 (32d)
GF			80.0000			9.0000	720.0000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 4619.0400 (34)
66.7588 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	9.9600	0.0600	0.5976
E12 Gable (insulation at ceiling level)	3.8400	0.0600	0.2304
E10 Eaves (insulation at ceiling level)	9.6000	0.0900	0.8640
E16 Corner (normal)	2.4000	-0.0900	-0.2160
E17 Corner (inverted - internal area greater than external area)	7.9600	0.0800	0.6368
P1 Party wall - Ground floor	9.4800	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8000	0.0600	0.2880
E25 Staggered party wall between dwellings	23.1700	0.0700	1.6219
E7 Party floor between dwellings (in blocks of flats)	12.4000	0.0400	0.4960
E14 Flat roof	3.4100	0.0400	0.1364
E11 Eaves (insulation at rafter level)	3.4100	0.0600	0.2046
R6 Flat ceiling	3.4000	0.0800	0.2720
E13 Gable (insulation at rafter level)	9.4800	0.1200	1.1376
P4 Party wall - Roof (insulation at ceiling level)	8.2100	0.0500	0.4105
E2 Other lintels (including other steel lintels)	7.2000	0.0500	0.3600
E3 Sill	13.8000	0.0500	0.6900
E4 Jamb	0.7800	0.0800	0.0624
R1 Head of roof window	0.7800	0.0600	0.0468
R2 Sill of roof window	1.9600	0.0800	0.1568
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 36.8513 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.5996	29.2482	29.1378	29.1378	29.2482	28.8271	29.0309	28.7303	28.7303	28.9273	28.7303	29.1378	(38)
Heat transfer coeff	66.4509	66.0994	65.9891	65.9891	66.0994	65.6784	65.8821	65.5816	65.5816	65.7785	65.5816	65.9891	(39)
Average = Sum(39)m / 12 =												65.8917	
HLP	0.9604	0.9553	0.9537	0.9537	0.9553	0.9492	0.9522	0.9478	0.9478	0.9507	0.9478	0.9537	(40)
HLP (average)												0.9523	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2263 (42)
Hot water usage for mixer showers	76.9342	75.7780	74.0933	70.8698	68.4909	65.8380	64.3301	66.0021	67.8350	70.6834	73.9761	76.6394	(42a)
Hot water usage for baths	26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007	(42b)
Hot water usage for other uses	37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295	(42c)
Average daily hot water use (litres/day)												129.6113	(43)
Daily hot water use	140.9544	138.0422	134.4403	128.8303	124.3226	119.4573	117.4895	121.0748	124.8700	129.9905	135.6908	140.5697	(44)
Energy conte	223.2373	196.5703	206.6297	176.3623	167.3621	146.8867	142.0934	149.9159	153.9772	176.3958	193.3164	220.0982	(45)
Energy content (annual)										Total = Sum(45)m =		2152.8451	
Distribution loss (46)m = 0.15 x (45)m	33.4856	29.4855	30.9944	26.4543	25.1043	22.0330	21.3140	22.4874	23.0966	26.4594	28.9975	33.0147	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	114.5019	101.7375	108.9799	97.6168	95.9234	87.8161	87.5216	90.1226	90.1738	98.9272	103.2540	113.4582	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6145	25.4151	20.6690	15.6477	11.6969	9.8750	10.6703	13.8696	18.6158	23.6370	27.5879	29.4097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6406	294.6670	287.0407	270.8054	250.3112	231.0496	218.1816	215.1553	222.7815	239.0169	259.5110	278.7727	(68)

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	(71)
Water heating gains (Table 5)	153.9005	151.3951	146.4784	135.5789	128.9294	121.9669	117.6366	121.1325	125.2413	132.9666	143.4084	(72)
Total internal gains	572.2657	569.5873	552.2982	520.1421	489.0476	458.0016	441.5986	445.2676	461.7487	493.7306	528.6174	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
North				2.1600	13.0723	0.6300	0.7000			0.7700	8.6293 (74)	
East				4.3200	24.4329	0.6300	0.7000			0.7700	32.2574 (76)	
South				2.1600	54.9219	0.6300	0.7000			0.7700	36.2553 (78)	
East				0.7600	32.4879	0.6300	0.7000			1.0000	9.7998 (82)	
Solar gains	86.9418	139.0188	208.9593	297.4787	347.2353	383.0715	358.1052	314.8592	252.8976	170.0485	106.4548	71.2607 (83)
Total gains	659.2075	708.6061	761.2575	817.6208	836.2829	841.0730	799.7037	760.1267	714.6463	663.7790	635.0722	630.0508 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	19.3085	19.4112	19.4436	19.4436	19.4112	19.5356	19.4752	19.5644	19.5644	19.5059	19.5644	19.4436
alpha	2.2872	2.2941	2.2962	2.2962	2.2941	2.3024	2.2983	2.3043	2.3043	2.3004	2.3043	2.2962
util living area	0.8362	0.8118	0.7540	0.6640	0.5372	0.3862	0.2836	0.2884	0.4839	0.6642	0.7875	0.8463 (86)
MIT	18.9985	19.1924	19.6710	20.1835	20.6269	20.8797	20.9581	20.9582	20.7811	20.3376	19.6299	18.9491 (87)
Th 2	20.1165	20.1207	20.1221	20.1221	20.1207	20.1258	20.1234	20.1270	20.1270	20.1246	20.1270	20.1221 (88)
util rest of house	0.8215	0.7955	0.7325	0.6345	0.4954	0.3319	0.2187	0.2209	0.4293	0.6276	0.7662	0.8323 (89)
MIT 2	17.8013	18.0420	18.6319	19.2492	19.7615	20.0321	20.1000	20.1043	19.9406	19.4471	18.5956	17.7445 (90)
Living area fraction	18.2235	18.4477	18.9983	19.5787	20.0666	20.3310	20.4026	20.4054	FLA = Living area / (4) =			0.3527 (91)
MIT	18.2235	18.4477	18.9983	19.5787	20.0666	20.3310	20.4026	20.4054	20.2370	19.7612	18.9604	18.1693 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2235	18.4477	18.9983	19.5787	20.0666	20.3310	20.4026	20.4054	20.2370	19.7612	18.9604	18.1693 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.7838	0.7591	0.7015	0.6147	0.4927	0.3450	0.2398	0.2428	0.4365	0.6111	0.7332	0.7946 (94)
Ext temp.	516.6600	537.8799	534.0019	502.5763	412.0345	290.1686	191.7529	184.5923	311.9339	405.6247	465.6386	500.6165 (95)
Heat loss rate W	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Space heating kWh	865.4209	855.8357	771.9630	651.8843	480.3212	310.7245	197.8187	190.5426	350.0067	523.6735	705.6817	855.8314 (97)
Space heating requirement - total per year (kWh/year)	259.4781	213.6663	177.0430	107.5017	50.8052	0.0000	0.0000	0.0000	0.0000	87.8283	172.8311	264.2799 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	259.4781	213.6663	177.0430	107.5017	50.8052	0.0000	0.0000	0.0000	0.0000	87.8283	172.8311	264.2799 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1333.4337 (99)
Space heating per m2										(98c) / (4) =		19.2721 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
259.4781	213.6663	177.0430	107.5017	50.8052	0.0000	0.0000	0.0000	0.0000	0.0000	87.8283	172.8311	264.2799 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	103.8328	85.5007	70.8456	43.0179	20.3302	0.0000	0.0000	0.0000	0.0000	35.1454	69.1601	105.7543 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426 (64)
Water heating requirement	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Efficiency of water heater (217)m	156.2431	138.2311	146.7585	128.5452	124.3327	111.7116	109.9017	114.3691	115.7611	129.4919	138.2277	154.4504 (219)
Fuel for water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	25.0461	20.0929	18.0914	13.2545	10.2382	8.3647	9.3396	12.1400	15.7686	20.6893	23.3685	25.7422 (232)
Lighting												
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												533.5869	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1568.0241	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												202.1361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2303.7471	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	533.5869	26.0600	139.0527	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1568.0241	26.0600	408.6271	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	202.1361	26.0600	52.6767	(250)
Additional standing charges			0.0000	(251)
Total energy cost			600.3565	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	533.5869	0.1551	82.7403	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1568.0241	0.1410	221.0279	(264)
Space and water heating			303.7682	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	202.1361	0.1443	29.1745	(268)
Total CO2, kg/year			332.9427	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	533.5869	1.5741	839.9169	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1568.0241	1.5212	2385.3100	(278)
Space and water heating			3225.2269	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	202.1361	1.5338	310.0430	(282)
Total Primary energy kWh/year			3535.2700	(286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures Typical annual savings Energy Environmental
(none) efficiency impact

Total Savings £0 0.00 kg/m²

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Potential energy efficiency rating:
Potential environmental impact rating:

C 80
A 96

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £600	Potential £600	£0
Electricity			
Space heating	£139	£139	£0
Water heating	£409	£409	£0
Lighting	£53	£53	£0
Total cost of fuels	£600	£600	£0
Total cost of uses	£601	£601	£0
Delivered energy	33 kWh/m ²	33 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m ²	5 kg/m ²	5 kg/m ²	0 kg/m ²
Primary energy	51 kWh/m ²	51 kWh/m ²	0 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.0560 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.1204 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3704 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3149 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4015	0.3936	0.3857	0.3464	0.3385	0.2991	0.2991	0.2913	0.3149	0.3385	0.3542	0.3700 (22b)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			8.6400	1.1450	9.8931		(27)
Solid Doors			2.1200	1.0000	2.1200		(26)
Rooflight East			0.7600	1.1450	0.8702		(27a)
Ground Floor			4.1700	0.0900	0.3753	75.0000	312.7500 (28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632	9.0000	308.1600 (29a)
Ashlar	3.0100		3.0100	0.1800	0.5418	9.0000	27.0900 (29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036	9.0000	45.1800 (29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404	9.0000	7.0200 (29a)
Joists	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000 (30)
Rafters	14.0000	0.7600	13.2400	0.1300	1.7212	9.0000	119.1600 (30)
D Flat	4.8200		4.8200	0.1300	0.6266	9.0000	43.3800 (30)
Total net area of external elements Aum(A, m ²)			126.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.8555		(33)
Party Wall 1			44.7000	0.0000	0.0000	20.0000	894.0000 (32)
Party Floor 1			56.4100			30.0000	1692.3000 (32d)
GF			80.0000			9.0000	720.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	4619.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							66.7588 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E12 Gable (insulation at ceiling level)	9.9600	0.0600	0.5976
E10 Eaves (insulation at ceiling level)	3.8400	0.0600	0.2304
E16 Corner (normal)	9.6000	0.0900	0.8640
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
P1 Party wall - Ground floor	7.9600	0.0800	0.6368
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	23.1700	0.0700	1.6219
E14 Flat roof	12.4000	0.0400	0.4960
E11 Eaves (insulation at rafter level)	3.4100	0.0400	0.1364
R6 Flat ceiling	3.4100	0.0600	0.2046
E13 Gable (insulation at rafter level)	3.4000	0.0800	0.2720
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105
E3 Sill	7.2000	0.0500	0.3600
E4 Jamb	13.8000	0.0500	0.6900
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.9600	0.0800	0.1568
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.9958 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	36.8513 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	31.8153	31.6438	31.4757	30.6862	30.5385	29.8509	29.8509	29.7236	30.1158	30.5385	30.8374	31.1498	(38)
Average = Sum(39)m / 12 =	68.6666	68.4951	68.3270	67.5375	67.3898	66.7022	66.7022	66.5748	66.9670	67.3898	67.6886	68.0010	(39)
												67.5368	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9924	0.9900	0.9875	0.9761	0.9740	0.9640	0.9640	0.9622	0.9679	0.9740	0.9783	0.9828	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

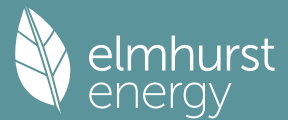
Assumed occupancy													2.2263 (42)
Hot water usage for mixer showers													
Hot water usage for baths	76.9342	75.7780	74.0933	70.8698	68.4909	65.8380	64.3301	66.0021	67.8350	70.6834	73.9761	76.6394	(42a)
Hot water usage for other uses	26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007	(42b)
Average daily hot water use (litres/day)	37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295	(42c)
												129.6113	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	140.9544	138.0422	134.4403	128.8303	124.3226	119.4573	117.4895	121.0748	124.8700	129.9905	135.6908	140.5697	(44)
Distribution loss (46)m = 0.15 x (45)m	223.2373	196.5703	206.6297	176.3623	167.3621	146.8867	142.0934	149.9159	153.9772	176.3958	193.3164	220.0982	(45)
Water storage loss:													
Store volume													180.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.8736 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													0.8736 (55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	114.5019	101.7375	108.9799	97.6168	95.9234	87.8161	87.5216	90.1226	90.1738	98.9272	103.2540	113.4582	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	28.6145	25.4151	20.6690	15.6477	11.6969	9.8750	10.6703	13.8696	18.6158	23.6370	27.5879	29.4097	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	291.6406	294.6670	287.0407	270.8054	250.3112	231.0496	218.1816	215.1553	222.7815	239.0169	259.5110	278.7727	(68)
Pumps, fans	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	(71)
Total internal gains	153.9005	151.3951	146.4784	135.5789	128.9294	121.9669	117.6366	121.1325	125.2413	132.9666	143.4084	152.4976	(72)
	572.2657	569.5873	552.2982	520.1421	489.0476	458.0016	441.5986	445.2676	461.7487	493.7306	528.6174	558.7901	(73)

6. Solar gains

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[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North				2.1600	10.6334	0.6300		0.7000		0.7700	7.0194 (74)
East				4.3200	19.6403	0.6300		0.7000		0.7700	25.9300 (76)
South				2.1600	46.7521	0.6300		0.7000		0.7700	30.8622 (78)
East				0.7600	25.9287	0.6300		0.7000		1.0000	7.8212 (82)

Solar gains	71.6328	130.3314	197.3747	271.5296	325.1671	331.1084	315.8434	275.1934	223.2888	149.4734	87.3872	60.2356 (83)
Total gains	643.8984	699.9187	749.6729	791.6717	814.2146	789.1100	757.4420	720.4609	685.0376	643.2040	616.0046	619.0257 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.6855	18.7322	18.7783	18.9978	19.0395	19.2358	19.2358	19.2725	19.1597	19.0395	18.9554	18.8683
alpha	2.2457	2.2488	2.2519	2.2665	2.2693	2.2824	2.2824	2.2848	2.2773	2.2693	2.2637	2.2579
util living area	0.8582	0.8297	0.7822	0.7048	0.5995	0.4705	0.3589	0.3882	0.5510	0.7233	0.8233	0.8671 (86)
MIT	18.6511	18.9336	19.3975	19.9672	20.4473	20.7772	20.9134	20.8936	20.6615	20.0604	19.2738	18.5946 (87)
Th 2	20.0896	20.0917	20.0937	20.1033	20.1051	20.1134	20.1134	20.1149	20.1102	20.1051	20.1015	20.0977 (88)
util rest of house	0.8455	0.8147	0.7628	0.6780	0.5619	0.4186	0.2944	0.3231	0.5000	0.6927	0.8055	0.8551 (89)
MIT 2	17.3531	17.7045	18.2796	18.9798	19.5480	19.9210	20.0550	20.0401	19.8027	19.1076	18.1420	17.2874 (90)
Living area fraction										fLA = Living area /	(4) =	0.3527 (91)
MIT	17.8108	18.1379	18.6739	19.3280	19.8651	20.2229	20.3577	20.3411	20.1056	19.4436	18.5411	17.7484 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8108	18.1379	18.6739	19.3280	19.8651	20.2229	20.3577	20.3411	20.1056	19.4436	18.5411	17.7484 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8060	0.7760	0.7276	0.6524	0.5511	0.4253	0.3127	0.3403	0.4998	0.6673	0.7684	0.8159 (94)
Useful gains	518.9616	543.1033	545.4849	516.4786	448.7439	335.5915	236.8430	245.1605	342.3535	429.1810	473.3566	505.0768 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	927.7420	906.7337	831.8037	704.2805	550.2471	375.0619	250.6474	262.3778	402.1741	595.9685	774.4333	921.3067 (97)
Space heating kWh	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	309.6751 (98a)
Space heating requirement - total per year (kWh/year)												1622.7893
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	309.6751 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1622.7893
Space heating per m2										(98c) / (4) =		23.4541 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	309.6751	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	121.7017	97.7830	85.2426	54.1086	30.2194	0.0000	0.0000	0.0000	0.0000	49.6558	86.7448	123.9196	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	156.2431	138.2311	146.7585	128.5452	124.3327	111.7116	109.9017	114.3691	115.7611	129.4919	138.2277	154.4504	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	25.0461	20.0929	18.0914	13.2545	10.2382	8.3647	9.3396	12.1400	15.7686	20.6893	23.3685	25.7422	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

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Annual totals kWh/year		
Space heating fuel - main system 1	649.3755	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	175.1000	
Water heating fuel used	1568.0241	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	202.1361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2419.5356	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	649.3755	16.4900	107.0820	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1568.0241	16.4900	258.5672	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	202.1361	16.4900	33.3322	(250)
Additional standing charges			0.0000	(251)
Total energy cost			398.9814	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2578	(257)
SAP value		79.6103	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	649.3755	0.1545	100.3018	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1568.0241	0.1410	221.0279	(264)
Space and water heating			321.3297	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	202.1361	0.1443	29.1745	(268)
Total CO2, kg/year			350.5042	(272)
CO2 emissions per m2			5.0700	(273)
EI value			95.8869	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

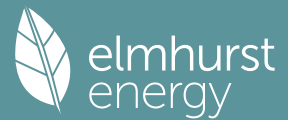
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)	
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	69.1900		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n) =	166.0560 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1204 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3704 (18)
Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3149 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate													
Effective ac	0.2834	0.2598	0.2519	0.2519	0.2598	0.2283	0.2440	0.2204	0.2204	0.2362	0.2204	0.2519	(22b)
	0.5402	0.5337	0.5317	0.5317	0.5337	0.5261	0.5298	0.5243	0.5243	0.5279	0.5243	0.5317	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			8.6400	1.1450	9.8931			(27)
Solid Doors			2.1200	1.0000	2.1200			(26)
Rooflight East			0.7600	1.1450	0.8702			(27a)
Ground Floor			4.1700	0.0900	0.3753	75.0000	312.7500	(28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632	9.0000	308.1600	(29a)
Ashlar	3.0100		3.0100	0.1800	0.5418	9.0000	27.0900	(29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036	9.0000	45.1800	(29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404	9.0000	7.0200	(29a)
Joists	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000	(30)
Rafters	14.0000	0.7600	13.2400	0.1300	1.7212	9.0000	119.1600	(30)
D Flat	4.8200		4.8200	0.1300	0.6266	9.0000	43.3800	(30)
Total net area of external elements Aum(A, m2)			126.8000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.8555			(33)
Party Wall 1			44.7000	0.0000	0.0000	20.0000	894.0000	(32)
Party Floor 1			56.4100			30.0000	1692.3000	(32d)
GF			80.0000			9.0000	720.0000	(32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 4619.0400 (34)
List of Thermal Bridges 66.7588 (35)

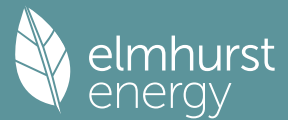
	Length	Psi-value	Total	
K1 Element	9.9600	0.0600	0.5976	
E12 Gable (insulation at ceiling level)	3.8400	0.0600	0.2304	
E10 Eaves (insulation at ceiling level)	9.6000	0.0900	0.8640	
E16 Corner (normal)	2.4000	-0.0900	-0.2160	
E17 Corner (inverted - internal area greater than external area)	7.9600	0.0800	0.6368	
P1 Party wall - Ground floor	9.4800	0.0000	0.0000	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8000	0.0600	0.2880	
E25 Staggered party wall between dwellings	23.1700	0.0700	1.6219	
E7 Party floor between dwellings (in blocks of flats)	12.4000	0.0400	0.4960	
E14 Flat roof	3.4100	0.0400	0.1364	
E11 Eaves (insulation at rafter level)	3.4100	0.0600	0.2046	
R6 Flat ceiling	3.4000	0.0800	0.2720	
E13 Gable (insulation at rafter level)	9.4800	0.1200	1.1376	
P4 Party wall - Roof (insulation at ceiling level)	8.2100	0.0500	0.4105	
E2 Other lintels (including other steel lintels)	7.2000	0.0500	0.3600	
E3 Sill	13.8000	0.0500	0.6900	
E4 Jamb	0.7800	0.0800	0.0624	
R1 Head of roof window	0.7800	0.0600	0.0468	
R2 Sill of roof window	1.9600	0.0800	0.1568	
R3 Jamb of roof window				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.9958	(36)
Point Thermal Bridges			0.0000	(36a) =
Total fabric heat loss			36.8513	(33) + (36) + (36a) =

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	29.5996	29.2482	29.1378	29.1378	29.2482	28.8271	29.0309	28.7303	28.7303	28.9273	28.7303	29.1378	(38)
Average = Sum(39)m / 12 =	66.4509	66.0994	65.9891	65.9891	66.0994	65.6784	65.8821	65.5816	65.5816	65.7785	65.5816	65.9891	(39)
												65.8917	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9604	0.9553	0.9537	0.9537	0.9553	0.9492	0.9522	0.9478	0.9478	0.9507	0.9478	0.9537	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												0.9523	
												31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2263 (42)
Hot water usage for mixer showers													
	76.9342	75.7780	74.0933	70.8698	68.4909	65.8380	64.3301	66.0021	67.8350	70.6834	73.9761	76.6394	(42a)
Hot water usage for baths													
	26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007	(42b)
Hot water usage for other uses													
	37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295	(42c)
Average daily hot water use (litres/day)													129.6113 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	140.9544	138.0422	134.4403	128.8303	124.3226	119.4573	117.4895	121.0748	124.8700	129.9905	135.6908	140.5697	(44)
Energy content (annual)	223.2373	196.5703	206.6297	176.3623	167.3621	146.8867	142.0934	149.9159	153.9772	176.3958	193.3164	220.0982	(45)
Distribution loss (46)m = 0.15 x (45)m													
	33.4856	29.4855	30.9944	26.4543	25.1043	22.0330	21.3140	22.4874	23.0966	26.4594	28.9975	33.0147	(46)
Water storage loss:													
Store volume													180.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.8736 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													0.8736 (55)
Total storage loss													

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	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426 (64)
	Total per year (kWh/year) = Sum(64)m =											2745.6102 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month												
	114.5019	101.7375	108.9799	97.6168	95.9234	87.8161	87.5216	90.1226	90.1738	98.9272	103.2540	113.4582 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6145	25.4151	20.6690	15.6477	11.6969	9.8750	10.6703	13.8696	18.6158	23.6370	27.5879	29.4097 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6406	294.6670	287.0407	270.8054	250.3112	231.0496	218.1816	215.1553	222.7815	239.0169	259.5110	278.7727 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520 (71)
Water heating gains (Table 5)	153.9005	151.3951	146.4784	135.5789	128.9294	121.9669	117.6366	121.1325	125.2413	132.9666	143.4084	152.4976 (72)
Total internal gains	572.2657	569.5873	552.2982	520.1421	489.0476	458.0016	441.5986	445.2676	461.7487	493.7306	528.6174	558.7901 (73)

6. Solar gains

[Jan]														
			Area	Solar flux		g		FF		Access		Gains		
			m2	Table 6a		Specific data		Specific data		factor		W		
				W/m2		or Table 6b		or Table 6c		Table 6d				
North			2.1600	13.0723		0.6300		0.7000		0.7700		8.6293 (74)		
East			4.3200	24.4329		0.6300		0.7000		0.7700		32.2574 (76)		
South			2.1600	54.9219		0.6300		0.7000		0.7700		36.2553 (78)		
East			0.7600	32.4879		0.6300		0.7000		1.0000		9.7998 (82)		
Solar gains	86.9418	139.0188	208.9593	297.4787	347.2353	383.0715	358.1052	314.8592	252.8976	170.0485	106.4548	71.2607	(83)	
Total gains	659.2075	708.6061	761.2575	817.6208	836.2829	841.0730	799.7037	760.1267	714.6463	663.7790	635.0722	630.0508	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.3085	19.4112	19.4436	19.4436	19.4112	19.5356	19.4752	19.5644	19.5644	19.5059	19.5644	19.4436
alpha	2.2872	2.2941	2.2962	2.2962	2.2941	2.3024	2.2983	2.3043	2.3043	2.3004	2.3043	2.2962
util living area	0.8362	0.8118	0.7540	0.6640	0.5372	0.3862	0.2836	0.2884	0.4839	0.6642	0.7875	0.8463 (86)
MIT	18.9985	19.1924	19.6710	20.1835	20.6269	20.8797	20.9581	20.9582	20.7811	20.3376	19.6299	18.9491 (87)
Th 2	20.1165	20.1207	20.1221	20.1221	20.1207	20.1258	20.1234	20.1270	20.1270	20.1246	20.1270	20.1221 (88)
util rest of house	0.8215	0.7955	0.7325	0.6345	0.4954	0.3319	0.2187	0.2209	0.4293	0.6276	0.7662	0.8323 (89)
MIT 2	17.8013	18.0420	18.6319	19.2492	19.7615	20.0321	20.1000	20.1043	19.9406	19.4471	18.5956	17.7445 (90)
Living area fraction									fLA = Living area / (4) =			0.3527 (91)
MIT	18.2235	18.4477	18.9983	19.5787	20.0666	20.3310	20.4026	20.4054	20.2370	19.7612	18.9604	18.1693 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2235	18.4477	18.9983	19.5787	20.0666	20.3310	20.4026	20.4054	20.2370	19.7612	18.9604	18.1693 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7838	0.7591	0.7015	0.6147	0.4927	0.3450	0.2398	0.2428	0.4365	0.6111	0.7332	0.7946 (94)
Useful gains	516.6600	537.8799	534.0019	502.5763	412.0345	290.1686	191.7529	184.5923	311.9339	405.6247	465.6386	500.6165 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W												
	865.4209	855.8357	771.9630	651.8843	480.3212	310.7245	197.8187	190.5426	350.0067	523.6735	705.6817	855.8314 (97)
Space heating kWh												
	259.4781	213.6663	177.0430	107.5017	50.8052	0.0000	0.0000	0.0000	0.0000	87.8283	172.8311	264.2799 (98a)
Space heating requirement - total per year (kWh/year)												1333.4337
Solar heating kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh												
	259.4781	213.6663	177.0430	107.5017	50.8052	0.0000	0.0000	0.0000	0.0000	87.8283	172.8311	264.2799 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1333.4337
Space heating per m2										(98c) / (4) =		19.2721 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

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Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												249.9000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	259.4781	213.6663	177.0430	107.5017	50.8052	0.0000	0.0000	0.0000	0.0000	87.8283	172.8311	264.2799	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	103.8328	85.5007	70.8456	43.0179	20.3302	0.0000	0.0000	0.0000	0.0000	35.1454	69.1601	105.7543	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	156.2431	138.2311	146.7585	128.5452	124.3327	111.7116	109.9017	114.3691	115.7611	129.4919	138.2277	154.4504	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	25.0461	20.0929	18.0914	13.2545	10.2382	8.3647	9.3396	12.1400	15.7686	20.6893	23.3685	25.7422	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												533.5869	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1568.0241	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												202.1361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2303.7471	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	533.5869	26.0600	139.0527	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1568.0241	26.0600	408.6271	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	202.1361	26.0600	52.6767	(250)
Additional standing charges			0.0000	(251)
Total energy cost			600.3565	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	533.5869	0.1551	82.7403	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1568.0241	0.1410	221.0279	(264)
Space and water heating			303.7682	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	202.1361	0.1443	29.1745	(268)
Total CO2, kg/year			332.9427	(272)

13a. Primary energy - Individual heating systems including micro-CHP

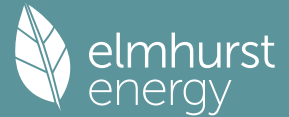
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	533.5869	1.5741	839.9169	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1568.0241	1.5212	2385.3100	(278)
Space and water heating			3225.2269	(279)

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Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	202.1361	1.5338	310.0430 (282)
Total Primary energy kWh/year			3535.2700 (286)

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Property Reference	FURNERS LANE 13				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 13, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	4.59	TER	10.00	
Environmental	96 A	% DER < TER				54.10
CO ₂ Emissions (t/year)	0.4	DFEE	30.89	TFEE	31.62	
Compliance Check	See BREL	% DFEE < TFEE				2.31
% DPER < TPER	6.77	DPER	48.58	TPER	52.11	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

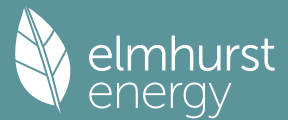
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			11.5300	1.1450	13.2023		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			46.6700	0.1000	4.6670	75.0000	3500.2500 (28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060	9.0000	330.3000 (29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300 (30)
Total net area of external elements Aum(A, m ²)			143.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5590		(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)
FF			110.0000			9.0000	990.0000 (32c)
Internal Floor 1			46.6700			18.0000	840.0600 (32d)
Internal Ceiling 1			46.6700			9.0000	420.0300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9154.6700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							98.0787 (35)
List of Thermal Bridges							
K1 Element					Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)					9.8400	0.0600	0.5904
E2 Other lintels (including other steel lintels)					8.8500	0.0500	0.4425

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E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	17.7000	0.0500	0.8850
E5 Ground floor (normal)	9.8400	0.1600	1.5744
E6 Intermediate floor within a dwelling	9.8400	0.0000	0.0000
E18 Party wall between dwellings	15.3000	0.0600	0.9180
E25 Staggered party wall between dwellings	5.1000	0.0600	0.3060
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752
P1 Party wall - Ground floor	18.9600	0.0800	1.5168
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.9043 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	40.4633 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124 (38)
Average = Sum(39)m / 12 =	86.2587	86.0054	85.7572	84.5911	84.3729	83.3573	83.3573	83.1692	83.7485	84.3729	84.8143	85.2757 (39)
												84.5900
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9241	0.9214	0.9188	0.9063	0.9039	0.8930	0.8930	0.8910	0.8972	0.9039	0.9087	0.9136 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.9063 (40)
												31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.6687 (42)
Hot water usage for mixer showers	86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768 (42a)
Hot water usage for baths	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800 (42b)
Hot water usage for other uses	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605 (42c)
Average daily hot water use (litres/day)	37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951 (43)
Daily hot water use	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173 (44)
Energy conte	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340 (45)
Energy content (annual)										Total = Sum(45)m =		2412.3938
Distribution loss (46)m = 0.15 x (45)m	37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951 (46)
Water storage loss:												
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7368 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
								Total per year (kWh/year) = Sum(64)m =				3134.5309 (64)
												3135 (64)
12Total per year (kWh/year)												
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000 (64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	126.0530	113.1930	111.4224	102.2107	102.0077	104.9224	104.8529	114.7886	119.5102	131.0716 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760 (68)
Pumps, fans	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	177.7434	174.9358	169.4261	157.2125	149.7613	141.9594	137.1072	141.0248	145.6291	154.2858	165.9864	176.1715 (72)
Total internal gains	625.1999	639.5429	613.0168	591.7039	562.4852	540.0406	519.8299	521.2042	536.7620	557.5181	590.9862	612.8139 (73)

6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
North	11.5300	10.6334	0.6300	0.7000	0.7700	37.4691 (74)						
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)

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Total gains 662.6690 711.1482 734.6918 787.1451 825.7623 821.8866 782.9691 729.9716 683.0547 642.7548 637.2091 644.0500 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.4807	29.5675	29.6531	30.0618	30.1396	30.5068	30.5068	30.5758	30.3643	30.1396	29.9827	29.8205
alpha	2.9654	2.9712	2.9769	3.0041	3.0093	3.0338	3.0338	3.0384	3.0243	3.0093	2.9988	2.9880
util living area	0.9434	0.9277	0.9026	0.8387	0.7311	0.5747	0.4423	0.4863	0.6856	0.8530	0.9206	0.9473 (86)
MIT	19.0429	19.2581	19.6041	20.1218	20.5623	20.8515	20.9502	20.9329	20.7343	20.2036	19.5699	19.0178 (87)
Th 2	20.1470	20.1493	20.1516	20.1622	20.1642	20.1734	20.1734	20.1751	20.1698	20.1642	20.1601	20.1560 (88)
util rest of house	0.9362	0.9186	0.8897	0.8167	0.6937	0.5169	0.3676	0.4106	0.6322	0.8285	0.9091	0.9406 (89)
MIT 2	17.8476	18.1197	18.5556	19.2014	19.7256	20.0495	20.1421	20.1307	19.9317	19.3124	18.5231	17.8217 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.0607	18.3226	18.7425	19.3655	19.8748	20.1924	20.2862	20.2737	20.0748	19.4712	18.7097	18.0349 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.0607	18.3226	18.7425	19.3655	19.8748	20.1924	20.2862	20.2737	20.0748	19.4712	18.7097	18.0349 (93)

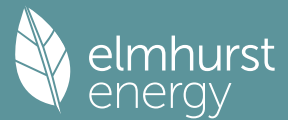
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9129	0.8934	0.8632	0.7925	0.6796	0.5183	0.3782	0.4200	0.6255	0.8045	0.8840	0.9183	(94)
Useful gains	604.9788	635.3457	634.1776	623.7841	561.1472	425.9717	296.0807	306.6036	427.2724	517.1087	563.2690	591.4161	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1186.9797	1154.4169	1049.8850	885.2889	689.7306	466.1704	307.2702	322.1704	500.3813	748.4922	984.6673	1179.7806	(97)
Space heating kWh	433.0087	348.8158	309.2863	188.2834	95.6661	0.0000	0.0000	0.0000	0.0000	172.1494	303.4068	437.7432	(98a)
Space heating requirement - total per year (kWh/year)	2288.3597												
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)	0.0000												
Space heating kWh	433.0087	348.8158	309.2863	188.2834	95.6661	0.0000	0.0000	0.0000	0.0000	172.1494	303.4068	437.7432	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2288.3597												
Space heating per m2	(98c) / (4) = 24.5164 (99)												

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	433.0087	348.8158	309.2863	188.2834	95.6661	0.0000	0.0000	0.0000	0.0000	172.1494	303.4068	437.7432 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	173.2728	139.5822	123.7640	75.3435	38.2817	0.0000	0.0000	0.0000	0.0000	68.8873	121.4113	175.1674 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	177.8890	157.4333	167.2603	146.7607	142.1308	127.8975	125.9601	130.9664	132.4357	147.9126	157.6110	175.8802 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												915.7102 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1790.1376 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												242.5617 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2948.4095 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	915.7102	0.1546	141.5939 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1790.1376	0.1409	252.2626 (264)
Space and water heating			393.8565 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	242.5617	0.1443	35.0092 (268)
Total CO2, kg/year			428.8656 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.5900 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	915.7102	1.5725	1439.9336 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1790.1376	1.5211	2722.9151 (278)
Space and water heating			4162.8488 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	242.5617	1.5338	372.0493 (282)
Total Primary energy kWh/year			4534.8980 (286)
Dwelling Primary energy Rate (DPER)			48.5800 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

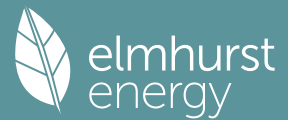
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)

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TER Opening Type (Uw = 1.20)			11.5300	1.1450	13.2023	(27)
Ground Floor			46.6700	0.1300	6.0671	(28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	(30)
Total net area of external elements Aum(A, m2)			143.5200			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.9591	(33)
Party Wall 1			96.7000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 98.0787 (35)

List of Thermal Bridges						
K1 Element				Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)				9.8400	0.0600	0.5904
E2 Other lintels (including other steel lintels)				8.8500	0.0500	0.4425
E3 Sill				7.9200	0.0500	0.3960
E4 Jamb				17.7000	0.0500	0.8850
E5 Ground floor (normal)				9.8400	0.1600	1.5744
E6 Intermediate floor within a dwelling				9.8400	0.0000	0.0000
E18 Party wall between dwellings				15.3000	0.0600	0.9180
E25 Staggered party wall between dwellings				5.1000	0.0600	0.3060
P4 Party wall - Roof (insulation at ceiling level)				18.9600	0.1200	2.2752
P1 Party wall - Ground floor				18.9600	0.0800	1.5168
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				18.9600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9043 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 41.8634 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124	(38)
Average = Sum(39)m / 12 =	87.6588	87.4055	87.1573	85.9912	85.7730	84.7574	84.7574	84.5693	85.1486	85.7730	86.2144	86.6758	(39)
												85.9901	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9391	0.9364	0.9338	0.9213	0.9189	0.9080	0.9080	0.9060	0.9122	0.9189	0.9237	0.9286	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687 (42)
Hot water usage for mixer showers													
Hot water usage for baths	68.9657	67.9292	66.4190	63.5293	61.3969	59.0188	57.6670	59.1659	60.8089	63.3623	66.3139	68.7014	(42a)
Hot water usage for other uses	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	(42b)
Average daily hot water use (litres/day)	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	(42c)
												129.3413	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	140.7069	137.7023	134.0434	128.4795	123.9613	119.1039	117.2372	120.8803	124.7225	129.8220	135.4716	140.3420	(44)
Energy content (annual)	222.8453	196.0863	206.0197	175.8821	166.8758	146.4521	141.7882	149.6751	153.7954	176.1673	193.0041	219.7416	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	33.4268	29.4129	30.9030	26.3823	25.0314	21.9678	21.2682	22.4513	23.0693	26.4251	28.9506	32.9612	(46)
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1127 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1409 (55)
Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage													
Primary loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
WWHRS	281.4741	249.0413	264.6485	232.6196	225.5046	203.1897	200.4170	208.3039	210.5329	234.7961	249.7417	278.3704	(62)
PV diverter	-31.5282	-27.8838	-29.1983	-24.1774	-22.5324	-19.2812	-18.0730	-19.2188	-19.9490	-23.5177	-26.6427	-30.9444	(63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
12Total per year (kWh/year)	249.9459	221.1575	235.4502	208.4423	202.9722	183.9085	182.3440	189.0850	190.5839	211.2784	223.0989	247.4260	(64)
Electric shower(s)													
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
	120.9991	107.5627	115.4046	103.8708	102.3893	94.0854	94.0476	96.6700	96.5270	105.4787	109.5639	119.9671	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760	(68)
Pumps, fans	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	(71)
Total internal gains	162.6332	160.0636	155.1137	144.2651	137.6200	130.6741	126.4081	129.9328	134.0653	141.7724	152.1721	161.2461	(72)
	610.0897	624.6707	598.7045	578.7564	550.3438	528.7554	509.1308	510.1122	525.1982	545.0047	577.1719	597.8886	(73)

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6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North	11.5300				10.6334	0.6300		0.7000		0.7700		37.4691 (74)
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	647.5587	696.2760	720.3794	774.1976	813.6210	810.6013	772.2700	718.8796	671.4909	630.2415	623.3948	629.1246 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.0098	29.0939	29.1767	29.5724	29.6476	30.0029	30.0029	30.0696	29.8650	29.6476	29.4958	29.3388
alpha	2.9340	2.9396	2.9451	2.9715	2.9765	3.0002	3.0002	3.0046	2.9910	2.9765	2.9664	2.9559
util living area	0.9469	0.9319	0.9078	0.8461	0.7411	0.5862	0.4532	0.4982	0.6974	0.8606	0.9254	0.9507 (86)
MIT	18.9696	19.1881	19.5416	20.0738	20.5316	20.8376	20.9445	20.9255	20.7125	20.1591	19.5079	18.9439 (87)
Th 2	20.1344	20.1367	20.1389	20.1495	20.1514	20.1607	20.1607	20.1624	20.1571	20.1514	20.1474	20.1433 (88)
util rest of house	0.9400	0.9231	0.8954	0.8246	0.7038	0.5274	0.3762	0.4204	0.6438	0.8368	0.9144	0.9443 (89)
MIT 2	17.7478	18.0243	18.4703	19.1351	19.6815	20.0250	20.1259	20.1130	19.8990	19.2507	18.4381	17.7209 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.9656	18.2318	18.6613	19.3024	19.8331	20.1699	20.2718	20.2578	20.0440	19.4126	18.6288	17.9389 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.9656	18.2318	18.6613	19.3024	19.8331	20.1699	20.2718	20.2578	20.0440	19.4126	18.6288	17.9389 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9170	0.8980	0.8686	0.7994	0.6884	0.5281	0.3868	0.4297	0.6359	0.8120	0.8891	0.9222 (94)
Useful gains	593.8376	625.2647	625.7569	618.9137	560.0870	428.0859	298.7261	308.9252	427.0187	511.7491	554.2876	580.1986 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1197.9084	1165.2705	1059.9459	894.5152	697.5992	472.0869	311.2125	326.2527	506.1221	755.8869	993.9502	1190.8320 (97)
Space heating kWh	449.4287	362.8839	323.0366	198.4331	102.3091	0.0000	0.0000	0.0000	0.0000	181.6385	316.5571	454.3113 (98a)
Space heating requirement - total per year (kWh/year)	2388.5982											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	449.4287	362.8839	323.0366	198.4331	102.3091	0.0000	0.0000	0.0000	0.0000	181.6385	316.5571	454.3113 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2388.5982											
Space heating per m2	(98c) / (4) = 25.5903 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	449.4287	362.8839	323.0366	198.4331	102.3091	0.0000	0.0000	0.0000	0.0000	181.6385	316.5571	454.3113 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	486.9217	393.1570	349.9855	214.9871	110.8441	0.0000	0.0000	0.0000	0.0000	196.7915	342.9654	492.2116 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	249.9459	221.1575	235.4502	208.4423	202.9722	183.9085	182.3440	189.0850	190.5839	211.2784	223.0989	247.4260 (64)
Efficiency of water heater (217)m	85.3595	85.1630	84.7694	83.9495	82.6058	79.8000	79.8000	79.8000	79.8000	83.7227	84.8441	79.8000 (216)
Fuel for water heating, kWh/month	292.8157	259.6875	277.7536	248.2947	245.7118	230.4618	228.5012	236.9487	238.8269	252.3551	262.9515	289.7130 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	28.3278	22.7256	20.4619	14.9913	11.5797	9.4607	10.5634	13.7307	17.8348	23.4002	26.4305	29.1151 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-43.0360	-60.3393	-86.2393	-96.3687	-103.3845	-96.2774	-95.0720	-90.0173	-81.0086	-68.7195	-47.1904	-37.2451 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-25.2980	-53.1175	-105.4060	-158.0775	-208.8072	-209.7533	-207.2977	-175.6182	-128.8470	-75.8957	-33.7521	-20.0133 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	2587.8637	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3064.0215	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	228.6216	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2306.7817	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3659.7251	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2587.8637	0.2100	543.4514 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3064.0215	0.2100	643.4445 (264)
Space and water heating			1186.8959 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	228.6216	0.1443	32.9972 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-904.8983	0.1347	-121.9051
PV Unit electricity exported	-1401.8834	0.1259	-176.5500
Total			-298.4551 (269)
Total CO2, kg/year			933.3672 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.0000 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2587.8637	1.1300	2924.2860 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3064.0215	1.1300	3462.3443 (278)
Space and water heating			6386.6303 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	228.6216	1.5338	350.6674 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-904.8983	1.4979	-1355.4456
PV Unit electricity exported	-1401.8834	0.4623	-648.0622
Total			-2003.5078 (283)
Total Primary energy kWh/year			4863.8907 (286)
Target Primary Energy Rate (TPER)			52.1100 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 238.0170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)

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Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3196 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													(23c)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.5300	1.1450	13.2023			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			46.6700	0.1000	4.6670	75.0000	3500.2500	(28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060	9.0000	330.3000	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300	(30)
Total net area of external elements Aum(A, m2)			143.5200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5590			(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			110.0000			9.0000	990.0000	(32c)
Internal Floor 1			46.6700			18.0000	840.0600	(32d)
Internal Ceiling 1			46.6700			9.0000	420.0300	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 9154.6700 (34)
List of Thermal Bridges 98.0787 (35)

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425
E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	17.7000	0.0500	0.8850
E5 Ground floor (normal)	9.8400	0.1600	1.5744
E6 Intermediate floor within a dwelling	9.8400	0.0000	0.0000
E18 Party wall between dwellings	15.3000	0.0600	0.9180
E25 Staggered party wall between dwellings	5.1000	0.0600	0.3060
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752
P1 Party wall - Ground floor	18.9600	0.0800	1.5168
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9043 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 40.4633 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124	(38)
Heat transfer coeff	86.2587	86.0054	85.7572	84.5911	84.3729	83.3573	83.3573	83.1692	83.7485	84.3729	84.8143	85.2757	(39)
Average = Sum(39)m / 12 =												84.5900	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9241	0.9214	0.9188	0.9063	0.9039	0.8930	0.8930	0.8910	0.8972	0.9039	0.9087	0.9136	(40)
HLP (average)												0.9063	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687 (42)
Hot water usage for mixer showers													(42a)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Hot water usage for baths	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	(42b)
Hot water usage for other uses	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	(42c)
Average daily hot water use (litres/day)												65.7573	(43)

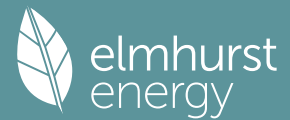
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	71.7412	69.7731	67.6244	64.9502	62.5645	60.0851	59.5701	61.7144	63.9137	66.4598	69.1576	71.6405	(44)
Energy conte	113.6205	99.3559	103.9362	88.9136	84.2238	73.8817	72.0449	76.4153	78.8119	90.1853	98.5277	112.1718	(45)
Energy content (annual)										Total = Sum(45)m =		1092.0887	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	96.5775	84.4526	88.3458	75.5765	71.5902	62.7994	61.2381	64.9530	66.9901	76.6575	83.7486	95.3460	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h 96.5775 84.4526 88.3458 75.5765 71.5902 62.7994 61.2381 64.9530 66.9901 76.6575 83.7486 95.3460 (64)
Total per year (kWh/year) = Sum(64)m = 928.2754 (64)
Electric shower(s) 928 (64)

12Total per year (kWh/year)
Heat gains from water heating, kWh/month 37.9519 33.4157 35.5204 31.7140 30.9580 28.1582 28.1832 29.2987 29.5674 32.5983 34.1185 37.6440 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	51.0106	49.7258	47.7425	44.0472	41.6102	39.1087	37.8806	39.3800	41.0658	43.8150	47.3868	50.5968 (72)
Total internal gains	495.4670	511.3329	488.3332	475.5386	451.3341	437.1899	420.6033	419.5594	432.1987	444.0472	469.3866	484.2392 (73)

6. Solar gains

[Jan]	Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	11.5300		10.6334		0.6300		0.7000		0.7700		37.4691 (74)	
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	532.9361	582.9382	610.0082	670.9797	714.6112	719.0359	683.7426	628.3268	578.4914	529.2840	515.6095	515.4753 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.4807	29.5675	29.6531	30.0618	30.1396	30.5068	30.5068	30.5758	30.3643	30.1396	29.9827	29.8205
alpha	2.9654	2.9712	2.9769	3.0041	3.0093	3.0338	3.0338	3.0384	3.0243	3.0093	2.9988	2.9880
util living area	0.9663	0.9542	0.9350	0.8812	0.7845	0.6314	0.4955	0.5479	0.7511	0.9002	0.9511	0.9693 (86)
MIT	18.7784	19.0095	19.3810	19.9553	20.4580	20.8068	20.9321	20.9069	20.6523	20.0299	19.3375	18.7515 (87)
Th 2	20.1470	20.1493	20.1516	20.1622	20.1642	20.1734	20.1734	20.1751	20.1698	20.1642	20.1601	20.1560 (88)
util rest of house	0.9617	0.9480	0.9257	0.8632	0.7503	0.5727	0.4152	0.4674	0.7010	0.8814	0.9434	0.9651 (89)
MIT 2	18.0962	18.3258	18.6939	19.2596	19.7337	20.0453	20.1394	20.1257	19.9205	19.3407	18.6601	18.0757 (90)
Living area fraction	18.2178	18.4477	18.8164	19.3836	19.8628	20.1810	20.2807	20.2650	20.0510	19.4636	18.7808	18.1962 (91)
MIT	18.2178	18.4477	18.8164	19.3836	19.8628	20.1810	20.2807	20.2650	20.0510	19.4636	18.7808	18.1962 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2178	18.4477	18.8164	19.3836	19.8628	20.1810	20.2807	20.2650	20.0510	19.4636	18.7808	18.1962 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9479	0.9318	0.9071	0.8435	0.7366	0.5733	0.4261	0.4767	0.6930	0.8623	0.9270	0.9521 (94)
Useful gains	505.1626	543.1842	553.3448	565.9458	526.3583	412.2426	291.3285	299.4948	400.9090	456.3918	477.9621	490.7775 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1200.5336	1165.1763	1056.2163	886.8222	688.7230	465.2195	306.8136	321.4482	498.3874	747.8442	990.7018	1193.5369 (97)
Space heating kWh	517.3561	417.9787	374.1364	231.0310	120.7994	0.0000	0.0000	0.0000	0.0000	216.8406	369.1726	522.8530 (98a)
Space heating requirement - total per year (kWh/year)												2770.1677
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	517.3561	417.9787	374.1364	231.0310	120.7994	0.0000	0.0000	0.0000	0.0000	216.8406	369.1726	522.8530 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2770.1677
Space heating per m ²												29.6782 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	783.5582	616.8437	632.0858	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7491	0.8154	0.7776	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	586.9517	502.9777	491.5146	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	777.3301	739.0574	677.0741	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	137.0724	175.6433	138.0562	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	34.2681	43.9108	34.5141	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												112.6930 (107)
Energy for space heating												29.6782 (99)
Energy for space cooling												1.2073 (108)
Total												30.8856 (109)
Fabric Energy Efficiency (DFEE)												30.9 (109)

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SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			11.5300	1.1450	13.2023		(27)
Ground Floor			46.6700	0.1300	6.0671		(28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060		(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337		(30)
Total net area of external elements Aum(A, m ²)			143.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.9591		(33)
Party Wall 1			96.7000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 98.0787 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425
E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	17.7000	0.0500	0.8850
E5 Ground floor (normal)	9.8400	0.1600	1.5744
E6 Intermediate floor within a dwelling	9.8400	0.0000	0.0000
E18 Party wall between dwellings	15.3000	0.0600	0.9180
E25 Staggered party wall between dwellings	5.1000	0.0600	0.3060
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752
P1 Party wall - Ground floor	18.9600	0.0800	1.5168
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.9043 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	41.8634 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124 (38)
Heat transfer coeff	87.6588	87.4055	87.1573	85.9912	85.7730	84.7574	84.7574	84.5693	85.1486	85.7730	86.2144	86.6758 (39)
Average = Sum(39)m / 12 =												85.9901

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9391	0.9364	0.9338	0.9213	0.9189	0.9080	0.9080	0.9060	0.9122	0.9189	0.9237	0.9286 (40)
HLP (average)												0.9213
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

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Assumed occupancy												2.6687 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800 (42b)
Hot water usage for other uses	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605 (42c)
Average daily hot water use (litres/day)												65.7573 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	71.7412	69.7731	67.6244	64.9502	62.5645	60.0851	59.5701	61.7144	63.9137	66.4598	69.1576	71.6405 (44)
Energy content (annual)	113.6205	99.3559	103.9362	88.9136	84.2238	73.8817	72.0449	76.4153	78.8119	90.1853	98.5277	112.1718 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
WWHRS	96.5775	84.4526	88.3458	75.5765	71.5902	62.7994	61.2381	64.9530	66.9901	76.6575	83.7486	95.3460 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	96.5775	84.4526	88.3458	75.5765	71.5902	62.7994	61.2381	64.9530	66.9901	76.6575	83.7486	95.3460 (64)
12Total per year (kWh/year)												928.2754 (64)
Electric shower(s)	55.2300	49.2104	53.7359	51.2795	52.2417	49.8335	51.4946	52.2417	51.2795	53.7359	52.7254	55.2300 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												628.2380 (64a)
Heat gains from water heating, kWh/month	37.9519	33.4157	35.5204	31.7140	30.9580	28.1582	28.1832	29.2987	29.5674	32.5983	34.1185	37.6440 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	51.0106	49.7258	47.7425	44.0472	41.6102	39.1087	37.8806	39.3800	41.0658	43.8150	47.3868	50.5968 (72)
Total internal gains	495.4670	511.3329	488.3332	475.5386	451.3341	437.1899	420.6033	419.5594	432.1987	444.0472	469.3866	484.2392 (73)

6. Solar gains

[Jan]													
				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d		Gains W	
North				11.5300	10.6334	0.6300	0.7000			0.7700		37.4691 (74)	
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)	
Total gains	532.9361	582.9382	610.0082	670.9797	714.6112	719.0359	683.7426	628.3268	578.4914	529.2840	515.6095	515.4753 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.0098	29.0939	29.1767	29.5724	29.6476	30.0029	30.0029	30.0696	29.8650	29.6476	29.4958	29.3388
alpha	2.9340	2.9396	2.9451	2.9715	2.9765	3.0002	3.0002	3.0046	2.9910	2.9765	2.9664	2.9559
util living area	0.9666	0.9547	0.9358	0.8831	0.7881	0.6368	0.5013	0.5537	0.7552	0.9017	0.9516	0.9695 (86)
MIT	18.7356	18.9675	19.3429	19.9236	20.4360	20.7957	20.9271	20.9006	20.6368	20.0024	19.3009	18.7082 (87)
Th 2	20.1344	20.1367	20.1389	20.1495	20.1514	20.1607	20.1607	20.1624	20.1571	20.1514	20.1474	20.1433 (88)
util rest of house	0.9620	0.9484	0.9265	0.8651	0.7539	0.5775	0.4193	0.4718	0.7049	0.8830	0.9439	0.9653 (89)
MIT 2	18.0452	18.2758	18.6476	19.2199	19.7036	20.0252	20.1243	20.1098	19.8968	19.3051	18.6153	18.0243 (90)
Living area fraction	18.1683	18.3991	18.7715	19.3453	19.8342	20.1626	20.2674	20.2508	20.0287	19.4294	18.7375	18.1462 (91)
MIT	18.1683	18.3991	18.7715	19.3453	19.8342	20.1626	20.2674	20.2508	20.0287	19.4294	18.7375	18.1462 (92)
Temperature adjustment	18.1683	18.3991	18.7715	19.3453	19.8342	20.1626	20.2674	20.2508	20.0287	19.4294	18.7375	18.1462 (93)
adjusted MIT	18.1683	18.3991	18.7715	19.3453	19.8342	20.1626	20.2674	20.2508	20.0287	19.4294	18.7375	18.1462 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	505.2281	543.3619	553.7186	566.9669	528.4453	415.3365	294.2030	302.1949	402.8253	457.0366	478.1520	490.8239 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												

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Space heating kWh	1215.6749	1179.8968	1069.5534	898.2051	697.6930	471.4702	310.8394	325.6572	504.8217	757.3221	1003.3231	1208.7976	(97)
Space heating requirement - total per year (kWh/year)	528.5724	427.7514	383.7811	238.4915	125.9203	0.0000	0.0000	0.0000	0.0000	223.4124	378.1232	534.1724	(98a)
Solar heating kWh												2840.2248	
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating kWh	528.5724	427.7514	383.7811	238.4915	125.9203	0.0000	0.0000	0.0000	0.0000	223.4124	378.1232	534.1724	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2840.2248	
Space heating per m2										(98c) / (4) =		30.4288	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	796.7192	627.2045	642.7265	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7407	0.8078	0.7695	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	590.1286	506.6633	494.5572	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	777.3301	739.0574	677.0741	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	134.7851	172.9012	135.7925	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	33.6963	43.2253	33.9481	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement													(107)
Energy for space heating													110.8697
Energy for space cooling													30.4288
Total													1.1878
Fabric Energy Efficiency (TFEE)													31.6166

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)	
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1260 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3760	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756	(22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.5300	1.1450	13.2023			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			46.6700	0.1000	4.6670	75.0000	3500.2500	(28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060	9.0000	330.3000	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300	(30)

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Total net area of external elements Aum(A, m2)	143.5200				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	31.5590			(33)
Party Wall 1	96.7000	0.0000	0.0000	20.0000	1934.0000 (32)
GF	80.0000			9.0000	720.0000 (32c)
FF	110.0000			9.0000	990.0000 (32c)
Internal Floor 1	46.6700			18.0000	840.0600 (32d)
Internal Ceiling 1	46.6700			9.0000	420.0300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9154.6700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 98.0787 (35)

List of Thermal Bridges					
K1 Element	Length	Psi-value	Total		
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904		
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425		
E3 Sill	7.9200	0.0500	0.3960		
E4 Jamb	17.7000	0.0500	0.8850		
E5 Ground floor (normal)	9.8400	0.1600	1.5744		
E6 Intermediate floor within a dwelling	9.8400	0.0000	0.0000		
E18 Party wall between dwellings	15.3000	0.0600	0.9180		
E25 Staggered party wall between dwellings	5.1000	0.0600	0.3060		
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752		
P1 Party wall - Ground floor	18.9600	0.0800	1.5168		
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000		

Thermal bridges (Sum(L x Psi) calculated using Appendix K) (36a) = 8.9043 (36)
Point Thermal Bridges 0.0000
Total fabric heat loss (33) + (36) + (36a) = 40.4633 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124	(39)
Average = Sum(39)m / 12 =	86.2587	86.0054	85.7572	84.5911	84.3729	83.3573	83.3573	83.1692	83.7485	84.3729	84.8143	85.2757	(39)
												84.5900	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.9241	0.9214	0.9188	0.9063	0.9039	0.8930	0.8930	0.8910	0.8972	0.9039	0.9087	0.9136	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

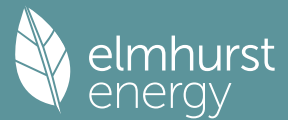
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687 (42)
Hot water usage for mixer showers													
Hot water usage for baths	86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768	(42a)
Hot water usage for other uses	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	(42b)
Average daily hot water use (litres/day)	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	(42c)
												145.2373	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173	(44)
Energy content (annual)	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951	(46)
Store volume													300.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7368 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	126.0530	113.1930	111.4224	102.2107	102.0077	104.9224	104.8529	114.7886	119.5102	131.0716	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	(71)
Water heating gains (Table 5)	177.7434	174.9358	169.4261	157.2125	149.7613	141.9594	137.1072	141.0248	145.6291	154.2858	165.9864	176.1715	(72)
Total internal gains	687.9424	685.0915	664.3208	625.7179	587.8197	550.6715	530.6333	534.5942	554.4595	592.5056	634.6532	671.1845	(73)

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6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	11.5300				10.6334		0.6300		0.7000	0.7700	37.4691 (74)
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	31.2361 (83)
Total gains	725.4115	756.6968	785.9958	821.1590	851.0968	832.5175	793.7726	743.3616	700.7522	677.7424	702.4205 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.4807	29.5675	29.6531	30.0618	30.1396	30.5068	30.5068	30.5758	30.3643	30.1396	29.9827	29.8205
alpha	2.9654	2.9712	2.9769	3.0041	3.0093	3.0338	3.0338	3.0384	3.0243	3.0093	2.9988	2.9880
util living area	0.9305	0.9172	0.8880	0.8260	0.7193	0.5693	0.4371	0.4790	0.6751	0.8378	0.9084	0.9357 (86)
MIT	19.1625	19.3405	19.6880	20.1655	20.5828	20.8553	20.9518	20.9356	20.7459	20.2509	19.6468	19.1313 (87)
Th 2	20.1470	20.1493	20.1516	20.1622	20.1642	20.1734	20.1734	20.1751	20.1698	20.1642	20.1601	20.1560 (88)
util rest of house	0.9220	0.9070	0.8737	0.8029	0.6814	0.5116	0.3630	0.4040	0.6214	0.8118	0.8955	0.9277 (89)
MIT 2	17.9968	18.2216	18.6579	19.2525	19.7476	20.0529	20.1432	20.1326	19.9430	19.3672	18.6174	17.9634 (90)
Living area fraction	fLA = Living area / (4) =											0.1783 (91)
MIT	18.2046	18.4211	18.8415	19.4153	19.8965	20.1960	20.2873	20.2757	20.0861	19.5247	18.8009	18.1716 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2046	18.4211	18.8415	19.4153	19.8965	20.1960	20.2873	20.2757	20.0861	19.5247	18.8009	18.1716 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8970	0.8810	0.8470	0.7794	0.6682	0.5133	0.3736	0.4135	0.6155	0.7886	0.8697	0.9036 (94)
Useful gains	650.7009	666.6149	665.7422	640.0101	568.6958	427.2994	296.5398	307.4149	431.3201	534.4697	592.1524	634.7395 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1199.3913	1162.8880	1058.3745	889.4968	691.5655	466.4632	307.3661	322.3418	501.3280	753.0044	992.4041	1191.4413 (97)
Space heating kWh	408.2257	333.4955	292.1185	179.6304	91.4151	0.0000	0.0000	0.0000	0.0000	162.5898	288.1812	414.1861 (98a)
Space heating requirement - total per year (kWh/year)												2169.8422
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	408.2257	333.4955	292.1185	179.6304	91.4151	0.0000	0.0000	0.0000	0.0000	162.5898	288.1812	414.1861 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2169.8422
Space heating per m2												(98c) / (4) = 23.2466 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)											0.0000 (201)	
Fraction of space heat from main system(s)											1.0000 (202)	
Efficiency of main space heating system 1 (in %)											249.9000 (206)	
Efficiency of main space heating system 2 (in %)											0.0000 (207)	
Efficiency of secondary/supplementary heating system, %											0.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	408.2257	333.4955	292.1185	179.6304	91.4151	0.0000	0.0000	0.0000	0.0000	162.5898	288.1812	414.1861 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	163.3556	133.4516	116.8941	71.8809	36.5807	0.0000	0.0000	0.0000	0.0000	65.0619	115.3186	165.7407 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	177.8890	157.4333	167.2603	146.7607	142.1308	127.8975	125.9601	130.9664	132.4357	147.9126	157.6110	175.8802 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												868.2842	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1790.1376	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												242.5617	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2900.9835	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	868.2842	16.4900	143.1801	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1790.1376	16.4900	295.1937	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	242.5617	16.4900	39.9984	(250)
Additional standing charges			0.0000	(251)
Total energy cost			478.3722	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2449	(257)
SAP value		79.8208	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	868.2842	0.1546	134.2489	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1790.1376	0.1409	252.2626	(264)
Space and water heating			386.5115	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	242.5617	0.1443	35.0092	(268)
Total CO2, kg/year			421.5207	(272)
CO2 emissions per m2			4.5200	(273)
EI value			95.9170	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080	(1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	238.0170	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1260 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3760 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3196 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Adj infilt rate	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Effective ac	0.2877	0.2637	0.2557	0.2557	0.2637	0.2317	0.2477	0.2237	0.2237	0.2397	0.2237	0.2557	(22b)
	0.5414	0.5348	0.5327	0.5327	0.5348	0.5269	0.5307	0.5250	0.5250	0.5287	0.5250	0.5327	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.5300	1.1450	13.2023			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			46.6700	0.1000	4.6670	75.0000	3500.2500	(28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060	9.0000	330.3000	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300	(30)
Total net area of external elements Aum(A, m2)			143.5200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 31.5590			(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			110.0000			9.0000	990.0000	(32c)
Internal Floor 1			46.6700			18.0000	840.0600	(32d)
Internal Ceiling 1			46.6700			9.0000	420.0300	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 9154.6700 (34)
List of Thermal Bridges 98.0787 (35)

K1 Element	Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904	
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425	
E3 Sill	7.9200	0.0500	0.3960	
E4 Jamb	17.7000	0.0500	0.8850	
E5 Ground floor (normal)	9.8400	0.1600	1.5744	
E6 Intermediate floor within a dwelling	9.8400	0.0000	0.0000	
E18 Party wall between dwellings	15.3000	0.0600	0.9180	
E25 Staggered party wall between dwellings	5.1000	0.0600	0.3060	
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752	
P1 Party wall - Ground floor	18.9600	0.0800	1.5168	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.9043	(36)
Point Thermal bridges			0.0000	(36a) =
Total fabric heat loss			40.4633	(33) + (36) + (36a) =

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	42.5228	42.0037	41.8407	41.8407	42.0037	41.3818	41.6827	41.2389	41.2389	41.5298	41.2389	41.8407	(38)
Average = Sum(39)m / 12 =	82.9861	82.4670	82.3040	82.3040	82.4670	81.8451	82.1460	81.7022	81.7022	81.9931	81.7022	82.3040	(39)
												82.1602	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.8891	0.8835	0.8818	0.8818	0.8835	0.8768	0.8801	0.8753	0.8753	0.8784	0.8753	0.8818	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687	(42)
Hot water usage for mixer showers														
86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768	(42a)		
Hot water usage for baths														
29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	(42b)		
Hot water usage for other uses														
41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	(42c)		
Average daily hot water use (litres/day)													145.2373	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173	(44)	
Energy content (annual)	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340	(45)	
Distribution loss (46)m = 0.15 x (45)m										Total =	Sum (45)m =	2412.3938		
37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951	(46)		
Water storage loss:														
Store volume													300.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.7368	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													1.2281	(55)
Total storage loss														
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)		
If cylinder contains dedicated solar storage														
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)		
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)		
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)		
Total heat required for water heating calculated for each month														
311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662	(62)		
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	

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Output from w/h	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
	Total per year (kWh/year) = Sum(64)m =											3134.5309 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	126.0530	113.1930	111.4224	102.2107	102.0077	104.9224	104.8529	114.7886	119.5102	131.0716 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	(71)
Water heating gains (Table 5)	177.7434	174.9358	169.4261	157.2125	149.7613	141.9594	137.1072	141.0248	145.6291	154.2858	165.9864	176.1715	(72)
Total internal gains	687.9424	685.0915	664.3208	625.7179	587.8197	550.6715	530.6333	534.5942	554.4595	592.5056	634.6532	671.1845	(73)

6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	11.5300		13.0723		0.6300		0.7000		0.7700		46.0630 (74)	
Solar gains	46.0630	78.1341	133.1561	221.7956	289.9619	335.2033	307.1640	247.0841	171.6243	99.6585	57.2009	37.3234 (83)
Total gains	734.0055	763.2256	797.4769	847.5135	877.7816	885.8748	837.7974	781.6784	726.0838	692.1641	691.8541	708.5078 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.6432	30.8361	30.8972	30.8972	30.8361	31.0704	30.9566	31.1248	31.1248	31.0144	31.1248	30.8972
alpha	3.0429	3.0557	3.0598	3.0598	3.0557	3.0714	3.0638	3.0750	3.0750	3.0676	3.0750	3.0598
util living area	0.9167	0.9049	0.8656	0.7875	0.6483	0.4675	0.3434	0.3551	0.6001	0.7856	0.8833	0.9224 (86)
MIT	19.4471	19.5675	19.9333	20.3593	20.7387	20.9320	20.9805	20.9795	20.8467	20.4856	19.9369	19.4219 (87)
Th 2	20.1768	20.1815	20.1830	20.1830	20.1815	20.1872	20.1845	20.1885	20.1885	20.1859	20.1885	20.1830 (88)
util rest of house	0.9064	0.8933	0.8487	0.7604	0.6037	0.4058	0.2693	0.2769	0.5395	0.7516	0.8669	0.9127 (89)
MIT 2	18.3739	18.5269	18.9825	19.4994	19.9349	20.1371	20.1747	20.1785	20.0620	19.6614	18.9968	18.3470 (90)
Living area fraction	FLA = Living area / (4) =											0.1783 (91)
MIT	18.5652	18.7124	19.1520	19.6527	20.0782	20.2788	20.3183	20.3213	20.2019	19.8083	19.1644	18.5386 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5652	18.7124	19.1520	19.6527	20.0782	20.2788	20.3183	20.3213	20.2019	19.8083	19.1644	18.5386 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8813	0.8679	0.8237	0.7407	0.5977	0.4130	0.2817	0.2900	0.5406	0.7339	0.8420	0.8883	(94)
Useful gains	646.9012	662.4018	656.8567	627.7610	524.6263	365.8365	236.0035	226.6752	392.5251	508.0034	582.5325	629.3361	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1109.1251	1089.5852	975.4690	819.1487	600.2110	382.9395	239.7284	230.5046	433.1746	656.6266	895.8167	1097.8243	(97)
Space heating kWh	343.8945	287.0672	237.0475	137.7992	56.2350	0.0000	0.0000	0.0000	0.0000	110.5756	225.5646	348.5552	(98a)
Space heating requirement - total per year (kWh/year)												1746.7389	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	343.8945	287.0672	237.0475	137.7992	56.2350	0.0000	0.0000	0.0000	0.0000	110.5756	225.5646	348.5552	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1746.7389	
Space heating per m2												(98c) / (4) =	18.7137 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
343.8945	287.0672	237.0475	137.7992	56.2350	0.0000	0.0000	0.0000	0.0000	0.0000	110.5756	225.5646	348.5552 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	137.6129	114.8728	94.8570	55.1417	22.5030	0.0000	0.0000	0.0000	0.0000	44.2479	90.2620	139.4779 (211)
Space heating efficiency (main heating system 2)												

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	177.8890	157.4333	167.2603	146.7607	142.1308	127.8975	125.9601	130.9664	132.4357	147.9126	157.6110	175.8802	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												698.9751	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1790.1376	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												242.5617	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2731.6745	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	698.9751	26.0600	182.1529	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1790.1376	26.0600	466.5099	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	242.5617	26.0600	63.2116	(250)
Additional standing charges			0.0000	(251)
Total energy cost			711.8744	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	698.9751	0.1553	108.5615	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1790.1376	0.1409	252.2626	(264)
Space and water heating			360.8241	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	242.5617	0.1443	35.0092	(268)
Total CO2, kg/year			395.8333	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	698.9751	1.5750	1100.9123	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1790.1376	1.5211	2722.9151	(278)
Space and water heating			3823.8274	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	242.5617	1.5338	372.0493	(282)
Total Primary energy kWh/year			4195.8767	(286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:

C 80

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Current environmental impact rating:

A 96

N Solar water heating
U Solar photovoltaic panels
V2 Wind turbine
Recommended
Recommended
Not applicable

Recommended measures:
N Solar water heating
U Solar photovoltaic panels
SAP change
Cost change
CO2 change
+ 2.2
-£ 102
-49 kg (12.3%)
+ 6.1
-£ 245
-126 kg (36.5%)

Recommended measures
Solar water heating
Solar photovoltaic panels
Typical annual savings
£102
£245
£347
0.52 kg/m²
1.36 kg/m²
1.88 kg/m²
Energy efficiency
B 82
B 88
Environmental impact
A 96
A 97

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £712	Potential £610	Saving £102
Electricity			
Space heating	£182	£203	-£21
Water heating	£467	£343	£123
Lighting	£63	£63	£0
Generated (PV)	-£10	-£245	£245
Total cost of fuels	£712	£365	£347
Total cost of uses	£712	£364	£347
Delivered energy	29 kWh/m²	15 kWh/m²	14 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	2 kg/m²	2 kg/m²
Primary energy	45 kWh/m²	24 kWh/m²	21 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1260 (8)
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered
Blower Door
5.0000 (17)
0.3760 (18)
2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

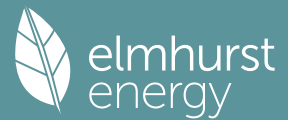
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	177.7434	174.9358	167.9253	149.7085	136.0040	127.9519	123.0997	128.0178	139.6259	152.7850	165.9864	176.1715 (72)
Total internal gains	687.9424	685.0915	662.8200	618.2139	574.0623	536.6641	516.6259	521.5873	548.4563	591.0048	634.6532	671.1845 (73)

6. Solar gains

[Jan]	Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	11.5300		10.6334		0.6300		0.7000		0.7700		37.4691 (74)	
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	725.4115	756.6968	784.4950	813.6550	837.3394	818.5100	779.7651	730.3547	694.7490	676.2416	680.8761	702.4205 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.4807	29.5675	29.6531	30.0618	30.1396	30.5068	30.5068	30.5758	30.3643	30.1396	29.9827	29.8205
alpha	2.9654	2.9712	2.9769	3.0041	3.0093	3.0338	3.0338	3.0384	3.0243	3.0093	2.9988	2.9880
util living area	0.9305	0.9172	0.8885	0.8288	0.7257	0.5764	0.4438	0.4861	0.6786	0.8384	0.9084	0.9357 (86)
MIT	19.1625	19.3405	19.6856	20.1560	20.5718	20.8502	20.9497	20.9330	20.7420	20.2489	19.6468	19.1313 (87)
Th 2	20.1470	20.1493	20.1516	20.1622	20.1642	20.1734	20.1734	20.1751	20.1698	20.1642	20.1601	20.1560 (88)
util rest of house	0.9220	0.9070	0.8742	0.8060	0.6881	0.5186	0.3690	0.4104	0.6250	0.8125	0.8955	0.9277 (89)
MIT 2	17.9968	18.2216	18.6550	19.2415	19.7359	20.0483	20.1418	20.1307	19.9392	19.3649	18.6174	17.9634 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2046	18.4211	18.8387	19.4045	19.8849	20.1913	20.2858	20.2737	20.0824	19.5225	18.8009	18.1716 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.2046	18.4211	18.8387	19.4045	19.8849	20.1913	20.2858	20.2737	20.0824	19.5225	18.8009	18.1716 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8970	0.8810	0.8475	0.7823	0.6743	0.5199	0.3795	0.4198	0.6189	0.7893	0.8697	0.9036 (94)
Useful gains	650.7009	666.6149	664.8438	636.4996	564.6458	425.5409	295.9408	306.6274	429.9703	533.7462	592.1524	634.7395 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1199.3913	1162.8880	1058.1334	888.5886	690.5825	466.0753	307.2409	322.1755	501.0129	752.8170	992.4041	1191.4413 (97)
Space heating kWh	408.2257	333.4955	292.6074	181.5041	93.6969	0.0000	0.0000	0.0000	0.0000	162.9887	288.1812	414.1861 (98a)
Space heating requirement - total per year (kWh/year)	2174.8856											
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	408.2257	333.4955	292.6074	181.5041	93.6969	0.0000	0.0000	0.0000	0.0000	162.9887	288.1812	414.1861 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2174.8856											
Space heating per m ²	(98c) / (4) = 23.3007 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	408.2257	333.4955	292.6074	181.5041	93.6969	0.0000	0.0000	0.0000	0.0000	162.9887	288.1812	414.1861 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	163.3556	133.4516	117.0898	72.6307	37.4938	0.0000	0.0000	0.0000	0.0000	65.2216	115.3186	165.7407 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	311.4837	259.4849	232.1764	167.8515	127.2637	110.7894	107.5761	130.5222	167.4206	228.7830	275.9769	307.9662 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (217)

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Fuel for water heating, kWh/month	177.8890	148.1924	132.5965	95.8604	72.6806	63.2721	61.4370	74.5415	95.6143	130.6585	157.6110	175.8802	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.1091	-56.9938	-85.6302	-98.5751	-105.5056	-95.0525	-93.6728	-88.4938	-78.3914	-65.9452	-42.8569	-32.5902	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												870.3024	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1386.2334	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												242.5617	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-881.8165	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1697.2810	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	870.3024	16.4900	143.5129	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1386.2334	16.4900	228.5899	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	242.5617	16.4900	39.9984	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-881.8165	16.4900	-145.4115	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-145.4115	(252)
Total energy cost			279.8816	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.7283	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	88.1937	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	870.3024	0.1546	134.5283	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1386.2334	0.1450	200.9589	(264)
Space and water heating			335.4872	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	242.5617	0.1443	35.0092	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-881.8165	0.1344	-118.4864	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-118.4864	(269)
Total CO2, kg/year			263.1070	(272)
CO2 emissions per m2			2.8200	(273)
EI value			97.4515	
EI rating			97	(274)
EI band			A	

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.2877	0.2637	0.2557	0.2557	0.2637	0.2317	0.2477	0.2237	0.2237	0.2397	0.2237	0.2557 (22b)
Effective ac	0.5414	0.5348	0.5327	0.5327	0.5348	0.5269	0.5307	0.5250	0.5250	0.5287	0.5250	0.5327 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			11.5300	1.1450	13.2023		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			46.6700	0.1000	4.6670	75.0000	3500.2500 (28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060	9.0000	330.3000 (29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300 (30)
Total net area of external elements Aum(A, m ²)			143.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5590		(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)
FF			110.0000			9.0000	990.0000 (32c)
Internal Floor 1			46.6700			18.0000	840.0600 (32d)
Internal Ceiling 1			46.6700			9.0000	420.0300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 9154.6700 (34)
98.0787 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425
E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	17.7000	0.0500	0.8850
E5 Ground floor (normal)	9.8400	0.1600	1.5744
E6 Intermediate floor within a dwelling	9.8400	0.0000	0.0000
E18 Party wall between dwellings	15.3000	0.0600	0.9180
E25 Staggered party wall between dwellings	5.1000	0.0600	0.3060
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752
P1 Party wall - Ground floor	18.9600	0.0800	1.5168
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 40.4633 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

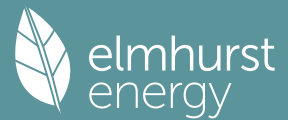
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.5228	42.0037	41.8407	41.8407	42.0037	41.3818	41.6827	41.2389	41.2389	41.5298	41.2389	41.8407 (38)
Heat transfer coeff	82.9861	82.4670	82.3040	82.3040	82.4670	81.8451	82.1460	81.7022	81.7022	81.9931	81.7022	82.3040 (39)
Average = Sum(39)m / 12 =												82.1602

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8891	0.8835	0.8818	0.8818	0.8835	0.8768	0.8801	0.8753	0.8753	0.8784	0.8753	0.8818 (40)
HLP (average)												0.8802
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Hot water usage for mixer showers
2.6687 (42)

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Hot water usage for baths	86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768 (42a)
Hot water usage for other uses	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800 (42b)
Average daily hot water use (litres/day)	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605 (42c)
												145.2373 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173 (44)
Distribution loss (46)m = 0.15 x (45)m	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340 (45)
										Total = Sum(45)m =		2412.3938
Water storage loss:	37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951 (46)
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7368 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	311.4837	275.6657	291.4770	250.2243	236.0767	211.3418	207.5292	217.2257	226.4921	257.5992	275.9769	307.9662 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												761.8610 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												761.8610
Solar input	-1.8066	-20.9016	-66.2724	-94.0035	-118.5966	-119.4269	-116.0534	-103.7445	-72.6012	-40.8605	-7.5938	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	309.6771	254.7641	225.2046	156.2208	117.4800	91.9148	91.4758	113.4813	153.8909	216.7387	268.3831	307.9662 (64)
												2307.1975 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	124.9364	107.7902	101.1869	92.1254	91.5862	95.2453	100.5306	113.6720	119.5102	131.0716 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	177.7434	174.9358	167.9253	149.7085	136.0040	127.9519	123.0997	128.0178	139.6259	152.7850	165.9864	176.1715 (72)
Total internal gains	687.9424	685.0915	662.8200	618.2139	574.0623	536.6641	516.6259	521.5873	548.4563	591.0048	634.6532	671.1845 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	W/m2	Specific data	factor	W
				or Table 6b	Table 6d	
North	11.5300	13.0723	0.6300	0.7000	0.7700	46.0630 (74)
Solar gains	46.0630	78.1341	133.1561	221.7956	289.9619	335.2033
Total gains	734.0055	763.2256	795.9761	840.0095	864.0242	871.8674

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.6432	30.8361	30.8972	30.8972	30.8361	31.0704	30.9566	31.1248	31.1248	31.0144	31.1248	30.8972
alpha	3.0429	3.0557	3.0598	3.0598	3.0557	3.0714	3.0638	3.0750	3.0750	3.0676	3.0750	3.0598
util living area	0.9167	0.9049	0.8661	0.7906	0.6549	0.4738	0.3489	0.3606	0.6036	0.7863	0.8833	0.9224 (86)
MIT	19.4471	19.5675	19.9311	20.3513	20.7310	20.9295	20.9796	20.9786	20.8442	20.4840	19.9369	19.4219 (87)
Th 2	20.1768	20.1815	20.1830	20.1830	20.1815	20.1872	20.1845	20.1885	20.1885	20.1859	20.1885	20.1830 (88)
util rest of house												

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MIT 2	0.9064	0.8933	0.8493	0.7637	0.6104	0.4116	0.2737	0.2814	0.5430	0.7525	0.8669	0.9127 (89)
Living area fraction	18.3739	18.5269	18.9799	19.4902	19.9271	20.1351	20.1742	20.1780	20.0597	19.6596	18.9968	18.3470 (90)
MIT	18.5652	18.7124	19.1495	19.6437	20.0704	20.2767	20.3178	20.3207	fLA = Living area / (4) =			0.1783 (91)
Temperature adjustment									20.1995	19.8066	19.1644	18.5386 (92)
adjusted MIT	18.5652	18.7124	19.1495	19.6437	20.0704	20.2767	20.3178	20.3207	20.1995	19.8066	19.1644	18.5386 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8813	0.8679	0.8242	0.7438	0.6039	0.4187	0.2862	0.2946	0.5439	0.7347	0.8420	0.8883	(94)
Useful gains	646.9012	662.4018	656.0382	624.7824	521.8200	365.0130	235.7901	226.4574	391.6568	507.4281	582.5325	629.3361	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1109.1251	1089.5852	975.2575	818.4092	599.5682	382.7675	239.6849	230.4602	432.9835	656.4849	895.8167	1097.8243	(97)
Space heating kWh	343.8945	287.0672	237.4992	139.4113	57.8447	0.0000	0.0000	0.0000	0.0000	110.8982	225.5646	348.5552	(98a)
Space heating requirement - total per year (kWh/year)												1750.7350	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	343.8945	287.0672	237.4992	139.4113	57.8447	0.0000	0.0000	0.0000	0.0000	110.8982	225.5646	348.5552	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1750.7350	
Space heating per m2											(98c) / (4) =	18.7565	(99)

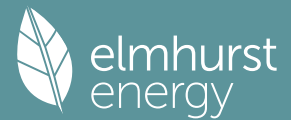
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	343.8945	287.0672	237.4992	139.4113	57.8447	0.0000	0.0000	0.0000	0.0000	110.8982	225.5646	348.5552	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	137.6129	114.8728	95.0377	55.7868	23.1471	0.0000	0.0000	0.0000	0.0000	44.3770	90.2620	139.4779	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	309.6771	254.7641	225.2046	156.2208	117.4800	91.9148	91.4758	113.4813	153.8909	216.7387	268.3831	307.9662	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	176.8573	145.4963	128.6148	89.2181	67.0931	52.4928	52.2420	64.8094	87.8875	123.7799	153.2742	175.8802	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-44.8714	-59.7671	-88.3242	-102.6708	-107.0312	-100.7553	-98.5205	-94.1733	-84.1848	-71.6168	-50.1292	-37.6541	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												700.5742	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1317.6457	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												242.5617	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-939.6986	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1401.0830	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year

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Space heating - main system 1	700.5742	26.0600	182.5696 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1317.6457	26.0600	343.3785 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	242.5617	26.0600	63.2116 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-939.6986	26.0600	-244.8855
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-244.8855 (252)
Total energy cost			365.1222 (255)

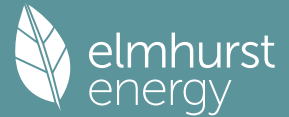
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	700.5742	0.1553	108.7840 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1317.6457	0.1458	192.1256 (264)
Space and water heating			300.9095 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	242.5617	0.1443	35.0092 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-939.6986	0.1346	-126.4918
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-126.4918 (269)
Total CO2, kg/year			220.5239 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	700.5742	1.5749	1103.3347 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1317.6457	1.5394	2028.3462 (278)
Space and water heating			3131.6809 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	242.5617	1.5338	372.0493 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-939.6986	1.4975	-1407.1900
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1407.1900 (283)
Total Primary energy kWh/year			2217.5642 (286)

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Property Reference	FURNERS LANE 14				Issued on Date	12/09/2024	
Assessment Reference	PLANNING			Prop Type Ref			
Property	Plot 14, Furners Lane, Henfield, West Sussex, BN5						
SAP Rating	79 C		DER	4.90		TER	10.87
Environmental	96 A		% DER < TER				54.92
CO ₂ Emissions (t/year)	0.37		DFEE	31.58		TFEE	32.32
Compliance Check	See BREL		% DFEE < TFEE				2.28
% DPER < TPER	8.59		DPER	51.87		TPER	56.74
Assessor Details	Mr. Alexander Pelling					Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			40.6700	0.1000	4.0670	75.0000	3050.2500 (28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782	9.0000	278.9100 (29a)
Joists FF	40.6700		40.6700	0.1100	4.4737	9.0000	366.0300 (30)
Total net area of external elements Aum(A, m ²)			125.1000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.4582		(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)
FF			95.0000			9.0000	855.0000 (32c)
Internal Floor 1			40.6700			18.0000	732.0600 (32d)
Internal Ceiling 1			40.6700			9.0000	366.0300 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				8302.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							102.0688 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E10 Eaves (insulation at ceiling level)				8.5800	0.0600		0.5148
E18 Party wall between dwellings				20.4000	0.0600		1.2240

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P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752	
P1 Party wall - Ground floor	18.9600	0.0800	1.5168	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000	
E2 Other lintels (including other steel lintels)	8.2600	0.0500	0.4130	
E3 Sill	7.3300	0.0500	0.3665	
E4 Jamb	15.3000	0.0500	0.7650	
E5 Ground floor (normal)	8.5800	0.1600	1.3728	
E6 Intermediate floor within a dwelling	8.5800	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				8.4481 (36)
Point Thermal bridges				0.0000
Total fabric heat loss		(33) + (36) + (36a) =		36.9063 (37)

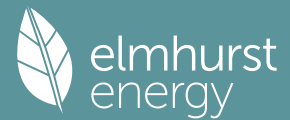
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.4839	Feb 40.2408	Mar 40.0025	Apr 38.8834	May 38.6740	Jun 37.6992	Jul 37.6992	Aug 37.5187	Sep 38.0747	Oct 38.6740	Nov 39.0976	Dec 39.5404 (38)
Heat transfer coeff	77.3902	77.1471	76.9088	75.7897	75.5803	74.6055	74.6055	74.4250	74.9810	75.5803	76.0039	76.4467 (39)
Average = Sum(39)m / 12 =												75.7887
HLP	Jan 0.9514	Feb 0.9485	Mar 0.9455	Apr 0.9318	May 0.9292	Jun 0.9172	Jul 0.9172	Aug 0.9150	Sep 0.9218	Oct 0.9292	Nov 0.9344	Dec 0.9398 (40)
HLP (average)												0.9318
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.4878 (42)
Hot water usage for mixer showers												
	82.4148	81.1763	79.3715	75.9184	73.3700	70.5282	68.9128	70.7040	72.6674	75.7187	79.2460	82.0990 (42a)
Hot water usage for baths	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798 (42b)
Hot water usage for other uses	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075 (42c)
Average daily hot water use (litres/day)												138.8469 (43)
Daily hot water use	Jan 150.9984	Feb 147.8785	Mar 144.0197	Apr 138.0100	May 133.1810	Jun 127.9690	Jul 125.8612	Aug 129.7022	Sep 133.7679	Oct 139.2533	Nov 145.3597	Dec 150.5864 (44)
Energy content	239.1445	210.5770	221.3529	188.9288	179.2873	157.3528	152.2182	160.5984	164.9492	188.9654	207.0916	235.7819 (45)
Energy content (annual)										Total = Sum(45)m =		2306.2480
Distribution loss (46)m = 0.15 x (45)m												
	35.8717	31.5866	33.2029	28.3393	26.8931	23.6029	22.8327	24.0898	24.7424	28.3448	31.0637	35.3673 (46)
Water storage loss:												
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7368 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss												
	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (56)
If cylinder contains dedicated solar storage												
	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
FV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3028.3851 (64)
Electric shower(s)												3028 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	128.5813	114.3343	122.6656	110.3018	108.6788	99.8028	99.6783	102.4647	102.3286	111.8967	116.3409	127.4632 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan 124.3897	Feb 124.3897	Mar 124.3897	Apr 124.3897	May 124.3897	Jun 124.3897	Jul 124.3897	Aug 124.3897	Sep 124.3897	Oct 124.3897	Nov 124.3897	Dec 124.3897 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	121.6009	134.6296	121.6009	125.6543	121.6009	125.6543	121.6009	121.6009	125.6543	121.6009	125.6543	121.6009 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	222.2183	224.5242	218.7134	206.3427	190.7270	176.0504	166.2455	163.9396	169.7505	182.1211	197.7369	212.4134 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118 (71)
Water heating gains (Table 5)												
	172.8243	170.1403	164.8731	153.1970	146.0736	138.6150	133.9762	137.7214	142.1231	150.3988	161.5846	171.3215 (72)
Total internal gains	579.9605	592.6111	568.5043	548.5109	521.7184	500.6366	482.1396	483.5788	497.8447	517.4378	548.2927	568.6528 (73)

6. Solar gains												
[Jan]												
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
North	10.8200				10.6334		0.6300		0.7000		0.7700	35.1618 (74)
Solar gains	35.1618	67.1960	114.1824	183.4062	247.0649	264.4903	246.9355	195.9118	137.2842	79.9880	43.3766	29.3126 (83)
Total gains	615.1223	659.8071	682.6867	731.9171	768.7833	765.1269	729.0751	679.4906	635.1290	597.4258	591.6693	597.9654 (84)

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7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7995	29.8934	29.9860	30.4288	30.5131	30.9118	30.9118	30.9867	30.7570	30.5131	30.3430	30.1673
alpha	2.9866	2.9929	2.9991	3.0286	3.0342	3.0608	3.0608	3.0658	3.0505	3.0342	3.0229	3.0112
util living area	0.9398	0.9233	0.8964	0.8291	0.7175	0.5591	0.4278	0.4713	0.6714	0.8441	0.9155	0.9439 (86)
MIT	19.1022	19.3167	19.6602	20.1699	20.5947	20.8662	20.9561	20.9404	20.7557	20.2453	19.6238	19.0793 (87)
Th 2	20.1240	20.1265	20.1290	20.1406	20.1428	20.1529	20.1529	20.1548	20.1490	20.1428	20.1384	20.1338 (88)
util rest of house	0.9320	0.9133	0.8825	0.8056	0.6783	0.5001	0.3529	0.3949	0.6159	0.8179	0.9031	0.9366 (89)
MIT 2	17.9035	18.1742	18.6061	19.2399	19.7419	20.0435	20.1261	20.1164	19.9340	19.3432	18.5718	17.8809 (90)
Living area fraction												0.2496 (91)
MIT	18.2027	18.4593	18.8692	19.4720	19.9547	20.2489	20.3333	20.3221	20.1391	19.5683	18.8343	18.1800 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2027	18.4593	18.8692	19.4720	19.9547	20.2489	20.3333	20.3221	20.1391	19.5683	18.8343	18.1800 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9096	0.8895	0.8579	0.7847	0.6690	0.5070	0.3694	0.4106	0.6152	0.7974	0.8795	0.9151 (94)
Useful gains	559.5404	586.8889	585.6863	574.3257	514.3001	387.9562	269.2856	278.9989	390.7439	476.3830	520.3865	547.1821 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1075.9301	1046.0639	951.2987	801.2510	623.8922	421.4365	278.5221	291.9011	452.8168	677.8273	891.8559	1068.7220 (97)
Space heating kWh	384.1939	308.5656	272.0156	163.3862	81.5365	0.0000	0.0000	0.0000	0.0000	149.8746	267.4580	388.0257 (98a)
Space heating requirement - total per year (kWh/year)												2015.0561
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	384.1939	308.5656	272.0156	163.3862	81.5365	0.0000	0.0000	0.0000	0.0000	149.8746	267.4580	388.0257 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2015.0561
Space heating per m2										(98c) / (4) =		24.7732 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	384.1939	308.5656	272.0156	163.3862	81.5365	0.0000	0.0000	0.0000	0.0000	149.8746	267.4580	388.0257 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	153.7391	123.4756	108.8498	65.3806	32.6277	0.0000	0.0000	0.0000	0.0000	59.9738	107.0260	155.2724 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	171.6029	151.8982	161.4421	141.7947	137.4183	123.7616	121.9591	126.7450	128.0999	142.9455	152.1675	169.6825 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	25.8516	20.7391	18.6732	13.6808	10.5675	8.6337	9.6400	12.5304	16.2758	21.3547	24.1201	26.5701 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												806.3450 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1729.5175 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												208.6369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												

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PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2744.4993 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	806.3450	0.1547	124.7526 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1729.5175	0.1409	243.6801 (264)
Space and water heating			368.4327 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	208.6369	0.1443	30.1127 (268)
Total CO2, kg/year			398.5455 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.9000 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	806.3450	1.5728	1268.2168 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1729.5175	1.5210	2630.5580 (278)
Space and water heating			3898.7748 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	208.6369	1.5338	320.0142 (282)
Total Primary energy kWh/year			4218.7890 (286)
Dwelling Primary energy Rate (DPER)			51.8700 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.4170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			10.8200	1.1450	12.3893		(27)

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Ground Floor			40.6700	0.1300	5.2871	(28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782	(29a)
Joists FF	40.6700		40.6700	0.1100	4.4737	(30)
Total net area of external elements Aum(A, m2)			125.1000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.6783	(33)
Party Wall 1			96.7000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

102.0688 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	8.5800	0.0600	0.5148
E18 Party wall between dwellings	20.4000	0.0600	1.2240
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752
P1 Party wall - Ground floor	18.9600	0.0800	1.5168
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.2600	0.0500	0.4130
E3 Sill	7.3300	0.0500	0.3665
E4 Jamb	15.3000	0.0500	0.7650
E5 Ground floor (normal)	8.5800	0.1600	1.3728
E6 Intermediate floor within a dwelling	8.5800	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

8.4481 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 38.1264 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.4839	40.2408	40.0025	38.8834	38.6740	37.6992	37.6992	37.5187	38.0747	38.6740	39.0976	39.5404
Heat transfer coeff	78.6103	78.3672	78.1289	77.0098	76.8004	75.8256	75.8256	75.6451	76.2011	76.8004	77.2240	77.6668
Average = Sum(39)m / 12 =												77.0088

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9664	0.9635	0.9605	0.9468	0.9442	0.9322	0.9322	0.9300	0.9368	0.9442	0.9494	0.9548
HLP (average)												0.9468
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4878 (42)

Hot water usage for mixer showers 65.9319 64.9410 63.4972 60.7347 58.6960 56.4225 55.1303 56.5632 58.1339 60.5749 63.3968 65.6792 (42a)

Hot water usage for baths 28.4761 28.0532 27.4576 26.3595 25.5373 24.6256 24.1331 24.7245 25.3684 26.3440 27.4647 28.3798 (42b)

Hot water usage for other uses 40.1075 38.6490 37.1906 35.7321 34.2737 32.8152 32.8152 34.2737 35.7321 37.1906 38.6490 40.1075 (42c)

Average daily hot water use (litres/day) 123.6501 (43)

Daily hot water use 134.5154 131.6432 128.1454 122.8264 118.5070 113.8634 112.0786 115.5614 119.2345 124.1095 129.5105 134.1666 (44)

Energy conte 213.0396 187.4582 196.9547 168.1432 159.5332 140.0083 135.5494 143.0891 147.0280 168.4155 184.5115 210.0724 (45)

Energy content (annual) Total = Sum(45)m = 2053.8030

Distribution loss (46)m = 0.15 x (45)m 31.9559 28.1187 29.5432 25.2215 23.9300 21.0012 20.3324 21.4634 22.0542 25.2623 27.6767 31.5109 (46)

Water storage loss: 300.0000 (47)

Store volume 2.1127 (48)

a) If manufacturer declared loss factor is known (kWh/day): 0.5400 (49)

Temperature factor from Table 2b 1.1409 (55)

Enter (49) or (54) in (55) 1.1409 (55)

Total storage loss 35.3664 31.9439 35.3664 34.2256 35.3664 34.2256 35.3664 35.3664 34.2256 35.3664 34.2256 35.3664 (56)

If cylinder contains dedicated solar storage 35.3664 31.9439 35.3664 34.2256 35.3664 34.2256 35.3664 35.3664 34.2256 35.3664 34.2256 35.3664 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 271.6684 240.4133 255.5835 224.8807 218.1620 196.7458 194.1782 201.7179 203.7656 227.0443 241.2490 268.7012 (62)

WWHRS -30.1413 -26.6572 -27.9139 -23.1138 -21.5412 -18.4330 -17.2780 -18.3734 -19.0715 -22.4832 -25.4707 -29.5831 (63a)

PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h 241.5271 213.7561 227.6697 201.7669 196.6208 178.3129 176.9002 183.3445 184.6941 204.5611 215.7783 239.1181 (64)

12Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 2464.0498 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month 117.7387 104.6939 112.3905 101.2976 99.9479 91.9428 91.9732 94.4802 94.2769 102.9012 106.7401 116.7521 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts 124.3897 124.3897 124.3897 124.3897 124.3897 124.3897 124.3897 124.3897 124.3897 124.3897 124.3897 124.3897 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 121.6009 134.6296 121.6009 125.6543 121.6009 125.6543 121.6009 121.6009 125.6543 121.6009 125.6543 121.6009 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 222.2183 224.5242 218.7134 206.3427 190.7270 176.0504 166.2455 163.9396 169.7505 182.1211 197.7369 212.4134 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 35.4390 35.4390 35.4390 35.4390 35.4390 35.4390 35.4390 35.4390 35.4390 35.4390 35.4390 35.4390 (69)

Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)

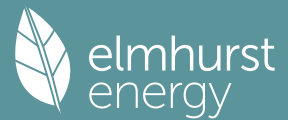
Losses e.g. evaporation (negative values) (Table 5) -99.5118 -99.5118 -99.5118 -99.5118 -99.5118 -99.5118 -99.5118 -99.5118 -99.5118 -99.5118 -99.5118 -99.5118 (71)

Water heating gains (Table 5) 158.2509 155.7945 151.0625 140.6912 134.3385 127.6983 123.6199 126.9895 130.9401 138.3081 148.2502 156.9249 (72)

Total internal gains 565.3871 578.2652 554.6937 536.0051 509.9833 489.7199 471.7833 472.8469 486.6618 505.3470 534.9582 554.2562 (73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	10.8200				10.6334		0.6300		0.7000		0.7700		35.1618 (74)	
Solar gains	35.1618	67.1960	114.1824	183.4062	247.0649	264.4903	246.9355	195.9118	137.2842	79.9880	43.3766	29.3126	(83)	
Total gains	600.5489	645.4612	668.8761	719.4113	757.0482	754.2102	718.7188	668.7587	623.9460	585.3350	578.3348	583.5688	(84)	
7. Mean internal temperature (heating season)														
Temperature during heating periods in the living area from Table 9, Th1 (C)														
Utilisation factor for gains for living area, nil,m (see Table 9a)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	29.3370	29.4280	29.5177	29.9467	30.0283	30.4144	30.4144	30.4869	30.2645	30.0283	29.8636	29.6934		
alpha	2.9558	2.9619	2.9678	2.9964	3.0019	3.0276	3.0276	3.0325	3.0176	3.0019	2.9909	2.9796		
util living area	0.9437	0.9278	0.9022	0.8371	0.7279	0.5708	0.4387	0.4832	0.6836	0.8524	0.9207	0.9476	(86)	
MIT	19.0287	19.2468	19.5981	20.1228	20.5653	20.8533	20.9509	20.9336	20.7349	20.2014	19.5618	19.0051	(87)	
Th 2	20.1114	20.1139	20.1164	20.1279	20.1301	20.1402	20.1402	20.1421	20.1363	20.1301	20.1257	20.1211	(88)	
util rest of house	0.9362	0.9183	0.8887	0.8140	0.6888	0.5106	0.3614	0.4047	0.6279	0.8268	0.9088	0.9406	(89)	
MIT 2	17.8035	18.0790	18.5214	19.1749	19.6994	20.0202	20.1104	20.0994	19.9025	19.2825	18.4871	17.7799	(90)	
Living area fraction	fLA = Living area / (4) =													
MIT	18.1093	18.3705	18.7901	19.4115	19.9155	20.2281	20.3201	20.3076	20.1103	19.5118	18.7553	18.0857	(92)	
Temperature adjustment	0.0000													
adjusted MIT	18.1093	18.3705	18.7901	19.4115	19.9155	20.2281	20.3201	20.3076	20.1103	19.5118	18.7553	18.0857	(93)	
8. Space heating requirement														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9141	0.8945	0.8638	0.7921	0.6782	0.5171	0.3781	0.4205	0.6261	0.8054	0.8851	0.9194	(94)	
Useful gains	548.9545	577.3435	577.7754	569.8623	513.4667	390.0057	271.7471	281.1839	390.6273	471.4244	511.9025	536.5189	(95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Heat loss rate W	1085.5538	1055.6425	960.2130	809.4859	630.9545	426.7562	282.0825	295.5891	457.9893	684.4307	900.0679	1078.4575	(97)	
Space heating kWh	399.2299	321.4169	284.5335	172.5290	87.4109	0.0000	0.0000	0.0000	0.0000	158.4767	279.4791	403.2023	(98a)	
Space heating requirement - total per year (kWh/year)													2106.2784	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)	
Solar heating contribution - total per year (kWh/year)													0.0000	
Space heating kWh	399.2299	321.4169	284.5335	172.5290	87.4109	0.0000	0.0000	0.0000	0.0000	158.4767	279.4791	403.2023	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)													2106.2784	
Space heating per m2	(98c) / (4) =												25.8947 (99)	
9a. Energy requirements - Individual heating systems, including micro-CHP														
Fraction of space heat from secondary/supplementary system (Table 11)														
Fraction of space heat from main system(s)														
Efficiency of main space heating system 1 (in %)														
Efficiency of main space heating system 2 (in %)														
Efficiency of secondary/supplementary heating system, %														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	399.2299	321.4169	284.5335	172.5290	87.4109	0.0000	0.0000	0.0000	0.0000	158.4767	279.4791	403.2023	(98)	
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)	
Space heating fuel (main heating system)	432.5351	348.2307	308.2703	186.9220	94.7031	0.0000	0.0000	0.0000	0.0000	171.6974	302.7943	436.8389	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	241.5271	213.7561	227.6697	201.7669	196.6208	178.3129	176.9002	183.3445	184.6941	204.5611	215.7783	239.1181	(64)	
Efficiency of water heater	85.1789	84.9723	84.5609	83.7107	82.3692	79.8000	79.8000	79.8000	79.8000	83.4940	84.6409	79.8000	(216)	
Fuel for water heating, kWh/month	283.5528	251.5598	269.2374	241.0287	238.7068	223.4497	221.6795	229.7550	231.4462	245.0009	254.9338	280.5829	(219)	
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)	
Lighting	25.2663	20.2695	18.2505	13.3711	10.3282	8.4382	9.4217	12.2467	15.9073	20.8712	23.5740	25.9685	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-37.8975	-53.3412	-76.5404	-85.8970	-92.4781	-86.2591	-85.1957	-80.5106	-72.2039	-60.9308	-41.6351	-32.7751	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-21.6514	-45.5294	-90.4665	-135.8371	-179.5775	-180.4276	-178.3007	-150.9742	-110.6722	-65.0923	-28.9012	-17.1221	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													2281.9917 (211)	
Space heating fuel - main system 2													0.0000 (213)	

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2970.9337 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	203.9133 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2010.2166 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3532.6220 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2281.9917	0.2100	479.2183 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2970.9337	0.2100	623.8961 (264)
Space and water heating			1103.1143 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	203.9133	0.1443	29.4310 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-805.6644	0.1346	-108.4626
PV Unit electricity exported	-1204.5522	0.1259	-151.6581
Total			-260.1207 (269)
Total CO2, kg/year			884.3538 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.8700 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2281.9917	1.1300	2578.6507 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2970.9337	1.1300	3357.1550 (278)
Space and water heating			5935.8057 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	203.9133	1.5338	312.7690 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-805.6644	1.4976	-1206.5258
PV Unit electricity exported	-1204.5522	0.4622	-556.6899
Total			-1763.2157 (283)
Total Primary energy kWh/year			4615.4597 (286)
Target Primary Energy Rate (TPER)			56.7400 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

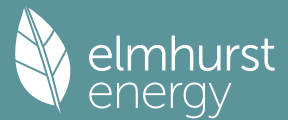
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)

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Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3354 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			10.8200	1.1450	12.3893			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			40.6700	0.1000	4.0670	75.0000	3050.2500	(28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782	9.0000	278.9100	(29a)
Joists FF	40.6700		40.6700	0.1100	4.4737	9.0000	366.0300	(30)
Total net area of external elements Aum(A, m2)			125.1000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.4582			(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			95.0000			9.0000	855.0000	(32c)
Internal Floor 1			40.6700			18.0000	732.0600	(32d)
Internal Ceiling 1			40.6700			9.0000	366.0300	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 8302.2800 (34)
List of Thermal Bridges
102.0688 (35)

K1 Element	Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)	8.5800	0.0600	0.5148	
E18 Party wall between dwellings	20.4000	0.0600	1.2240	
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752	
P1 Party wall - Ground floor	18.9600	0.0800	1.5168	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000	
E2 Other lintels (including other steel lintels)	8.2600	0.0500	0.4130	
E3 Sill	7.3300	0.0500	0.3665	
E4 Jamb	15.3000	0.0500	0.7650	
E5 Ground floor (normal)	8.5800	0.1600	1.3728	
E6 Intermediate floor within a dwelling	8.5800	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				8.4481 (36)
Point Thermal Bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	36.9063 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	40.4839	40.2408	40.0025	38.8834	38.6740	37.6992	37.6992	37.5187	38.0747	38.6740	39.0976	39.5404	(38)
Average = Sum(39)m / 12 =	77.3902	77.1471	76.9088	75.7897	75.5803	74.6055	74.6055	74.4250	74.9810	75.5803	76.0039	76.4467	(39)
													75.7887
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9514	0.9485	0.9455	0.9318	0.9292	0.9172	0.9172	0.9150	0.9218	0.9292	0.9344	0.9398	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
													0.9318
													31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4878 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Hot water usage for other uses	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798	(42b)
Average daily hot water use (litres/day)	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075	(42c)
													62.8632 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	68.5836	66.7022	64.6482	62.0917	59.8110	57.4408	56.9484	58.9982	61.1006	63.5346	66.1137	68.4873	(44)
Energy content (annual)	108.6196	94.9831	99.3619	85.0004	80.5171	70.6302	68.8741	73.0521	75.3431	86.2158	94.1911	107.2346	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
WWHRS	92.3267	80.7356	84.4576	72.2503	68.4395	60.0357	58.5430	62.0943	64.0416	73.2835	80.0625	91.1494	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
	92.3267	80.7356	84.4576	72.2503	68.4395	60.0357	58.5430	62.0943	64.0416	73.2835	80.0625	91.1494	(64)
													887.4197 (64)
12Total per year (kWh/year)													
Electric shower(s)	52.8004	47.0456	51.3720	49.0237	49.9436	47.6413	49.2294	49.9436	49.0237	51.3720	50.4060	52.8004	(64a)
													600.6017 (64a)
Heat gains from water heating, kWh/month	36.2818	31.9453	33.9574	30.3185	29.5958	26.9193	26.9431	28.0095	28.2663	31.1639	32.6171	35.9875	(65)

5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	121.6009	134.6296	121.6009	125.6543	121.6009	125.6543	121.6009	121.6009	125.6543	121.6009	125.6543	121.6009 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.2183	224.5242	218.7134	206.3427	190.7270	176.0504	166.2455	163.9396	169.7505	182.1211	197.7369	212.4134 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118 (71)
Water heating gains (Table 5)	48.7658	47.5377	45.6417	42.1090	39.7793	37.3878	36.2138	37.6471	39.2588	41.8869	45.3016	48.3702 (72)
Total internal gains	452.9020	467.0084	446.2729	434.4229	412.4241	399.4094	384.3772	383.5046	394.9805	405.9259	429.0096	442.7015 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W		
-----				-----				-----					
North				10.8200	10.6334	0.6300	0.7000			0.7700	35.1618 (74)		
-----				-----				-----					
Solar gains	35.1618	67.1960	114.1824	183.4062	247.0649	264.4903	246.9355	195.9118	137.2842	79.9880	43.3766	29.3126 (83)	
Total gains	488.0638	534.2044	560.4552	617.8291	659.4890	663.8998	631.3127	579.4164	532.2647	485.9139	472.3862	472.0141 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7995	29.8934	29.9860	30.4288	30.5131	30.9118	30.9118	30.9867	30.7570	30.5131	30.3430	30.1673
alpha	2.9866	2.9929	2.9991	3.0286	3.0342	3.0608	3.0608	3.0658	3.0505	3.0342	3.0229	3.0112
util living area	0.9653	0.9528	0.9325	0.8761	0.7755	0.6194	0.4837	0.5363	0.7423	0.8964	0.9495	0.9684 (86)
MIT	18.8181	19.0502	19.4223	19.9944	20.4872	20.8217	20.9384	20.9148	20.6716	20.0612	19.3747	18.7929 (87)
Th 2	20.1240	20.1265	20.1290	20.1406	20.1428	20.1529	20.1529	20.1548	20.1490	20.1428	20.1384	20.1338 (88)
util rest of house	0.9604	0.9461	0.9225	0.8569	0.7396	0.5590	0.4022	0.4541	0.6900	0.8765	0.9413	0.9639 (89)
MIT 2	18.1159	18.3465	18.7147	19.2776	19.7400	20.0368	20.1230	20.1109	19.9172	19.3516	18.6778	18.0977 (90)
Living area fraction	18.2911	18.5221	18.8913	19.4565	19.9265	20.2327	20.3265	20.3115	20.1055	19.5287	18.8517	18.2712 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2911	18.5221	18.8913	19.4565	19.9265	20.2327	20.3265	20.3115	20.1055	19.5287	18.8517	18.2712 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9469	0.9304	0.9048	0.8391	0.7295	0.5651	0.4196	0.4702	0.6870	0.8592	0.9256	0.9512 (94)
Useful gains	462.1700	497.0455	507.0907	518.4081	481.1261	375.1513	264.9052	272.4170	365.6805	417.5163	437.2278	448.9927 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1082.7748	1050.9071	953.0010	800.0736	621.7610	420.2325	278.0155	291.1135	450.2962	674.8330	893.1770	1075.6997 (97)
Space heating kWh	461.7299	372.1950	331.7573	202.7992	104.6323	0.0000	0.0000	0.0000	0.0000	191.4436	328.2834	466.2700 (98a)
Space heating requirement - total per year (kWh/year)												2459.1107
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	461.7299	372.1950	331.7573	202.7992	104.6323	0.0000	0.0000	0.0000	0.0000	191.4436	328.2834	466.2700 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2459.1107
Space heating per m ²										(98c) / (4) =		30.2325 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	701.2920	552.0810	565.6302	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7647	0.8289	0.7922	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	536.2435	457.6342	448.0912	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	722.1042	686.6343	628.4349	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	133.8197	170.3761	134.1758	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	33.4549	42.5940	33.5439	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												109.5929 (107)
Energy for space heating												30.2325 (99)
Energy for space cooling												1.3473 (108)
Total												31.5798 (109)
Fabric Energy Efficiency (DFEE)												31.6 (109)

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SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	30.0000 / (5) = 0.1446 (8)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	Yes
Pressure test	Blower Door
Pressure Test Method	5.0000 (17)
Measured/design AP50	0.3946 (18)
Infiltration rate	2 (19)
Number of sides sheltered	
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)

3. Heat losses and heat loss parameter

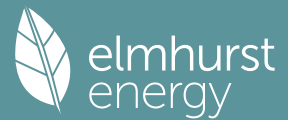
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Ground Floor			40.6700	0.1300	5.2871		(28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782		(29a)
Joists FF	40.6700		40.6700	0.1100	4.4737		(30)
Total net area of external elements Aum(A, m ²)			125.1000				(31)
Fabric heat loss, W/K = Sum (A x U)					29.6783		(32)
Party Wall 1			96.7000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							102.0688 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)				8.5800	0.0600	0.5148	
E18 Party wall between dwellings				20.4000	0.0600	1.2240	
P4 Party wall - Roof (insulation at ceiling level)				18.9600	0.1200	2.2752	
P1 Party wall - Ground floor				18.9600	0.0800	1.5168	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				18.9600	0.0000	0.0000	
E2 Other lintels (including other steel lintels)				8.2600	0.0500	0.4130	
E3 Sill				7.3300	0.0500	0.3665	
E4 Jamb				15.3000	0.0500	0.7650	
E5 Ground floor (normal)				8.5800	0.1600	1.3728	
E6 Intermediate floor within a dwelling				8.5800	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						8.4481	(36)
Point Thermal bridges						0.0000	(36a)
Total fabric heat loss						38.1264	(33) + (36) + (36a) = (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	40.4839	40.2408	40.0025	38.8834	38.6740	37.6992	37.6992	37.5187	38.0747	38.6740	39.0976	39.5404 (38)
Heat transfer coeff	78.6103	78.3672	78.1289	77.0098	76.8004	75.8256	75.8256	75.6451	76.2011	76.8004	77.2240	77.6668 (39)
Average = Sum(39)m / 12 =												77.0088
HLP	0.9664	0.9635	0.9605	0.9468	0.9442	0.9322	0.9322	0.9300	0.9368	0.9442	0.9494	Dec 0.9548 (40)
HLP (average)												0.9468
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4878 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)

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Hot water usage for baths	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798 (42b)
Hot water usage for other uses	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075 (42c)
Average daily hot water use (litres/day)												62.8632 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	68.5836	66.7022	64.6482	62.0917	59.8110	57.4408	56.9484	58.9982	61.1006	63.5346	66.1137	68.4873 (44)
Distribution loss (46)m = 0.15 x (45)m	108.6196	94.9831	99.3619	85.0004	80.5171	70.6302	68.8741	73.0521	75.3431	86.2158	94.1911	107.2346 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	92.3267	80.7356	84.4576	72.2503	68.4395	60.0357	58.5430	62.0943	64.0416	73.2835	80.0625	91.1494 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	92.3267	80.7356	84.4576	72.2503	68.4395	60.0357	58.5430	62.0943	64.0416	73.2835	80.0625	91.1494 (64)
12Total per year (kWh/year)												887.4197 (64)
Electric shower(s)	52.8004	47.0456	51.3720	49.0237	49.9436	47.6413	49.2294	49.9436	49.0237	51.3720	50.4060	52.8004 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												600.6017 (64a)
Heat gains from water heating, kWh/month	36.2818	31.9453	33.9574	30.3185	29.5958	26.9193	26.9431	28.0095	28.2663	31.1639	32.6171	35.9875 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	121.6009	134.6296	121.6009	125.6543	121.6009	125.6543	121.6009	121.6009	125.6543	121.6009	125.6543	121.6009 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.2183	224.5242	218.7134	206.3427	190.7270	176.0504	166.2455	163.9396	169.7505	182.1211	197.7369	212.4134 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118 (71)
Water heating gains (Table 5)	48.7658	47.5377	45.6417	42.1090	39.7793	37.3878	36.2138	37.6471	39.2588	41.8869	45.3016	48.3702 (72)
Total internal gains	452.9020	467.0084	446.2729	434.4229	412.4241	399.4094	384.3772	383.5046	394.9805	405.9259	429.0096	442.7015 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				10.8200	10.6334	0.6300		0.7000	0.7700		35.1618 (74)	
Solar gains	35.1618	67.1960	114.1824	183.4062	247.0649	264.4903	246.9355	195.9118	137.2842	79.9880	43.3766	29.3126 (83)
Total gains	488.0638	534.2044	560.4552	617.8291	659.4890	663.8998	631.3127	579.4164	532.2647	485.9139	472.3862	472.0141 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.3370	29.4280	29.5177	29.9467	30.0283	30.4144	30.4144	30.4869	30.2645	30.0283	29.8636	29.6934
alpha	2.9558	2.9619	2.9678	2.9964	3.0019	3.0276	3.0276	3.0325	3.0176	3.0019	2.9909	2.9796
util living area	0.9656	0.9532	0.9333	0.8780	0.7792	0.6248	0.4893	0.5419	0.7465	0.8979	0.9500	0.9686 (86)
MIT	18.7765	19.0096	19.3854	19.9638	20.4662	20.8114	20.9339	20.9091	20.6569	20.0346	19.3393	18.7509 (87)
Th 2	20.1114	20.1139	20.1164	20.1279	20.1301	20.1402	20.1402	20.1421	20.1363	20.1301	20.1257	20.1211 (88)
util rest of house	0.9607	0.9466	0.9233	0.8589	0.7432	0.5637	0.4063	0.4584	0.6939	0.8781	0.9418	0.9642 (89)
MIT 2	18.0662	18.2978	18.6697	19.2391	19.7110	20.0175	20.1082	20.0953	19.8942	19.3169	18.6342	18.0476 (90)
Living area fraction									fLA = Living area / (4) =			0.2496 (91)
MIT	18.2435	18.4754	18.8483	19.4199	19.8995	20.2156	20.3143	20.2984	20.0846	19.4961	18.8102	18.2231 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2435	18.4754	18.8483	19.4199	19.8995	20.2156	20.3143	20.2984	20.0846	19.4961	18.8102	18.2231 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9471	0.9308	0.9054	0.8407	0.7325	0.5694	0.4238	0.4745	0.6904	0.8605	0.9260	0.9513 (94)
Ext temp.	462.2394	497.2216	507.4552	519.3884	483.1011	378.0235	267.5461	274.9065	367.4766	418.1338	437.4153	449.0441 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1096.1004	1063.8689	964.7602	810.1380	629.7233	425.8096	281.6362	294.8953	456.0297	683.2205	904.3055	1089.1323 (97)
Space heating requirement - total per year (kWh/year)	471.5926	380.7870	340.2349	209.3397	109.0869	0.0000	0.0000	0.0000	0.0000	197.2244	336.1610	476.2256 (98a)
												2520.6521

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Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	471.5926	380.7870	340.2349	209.3397	109.0869	0.0000	0.0000	0.0000	0.0000	197.2244	336.1610	476.2256 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2520.6521
Space heating per m2												(98c) / (4) = 30.9891 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	712.7610	561.1097	574.9030	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7566	0.8217	0.7844	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	539.2663	461.0845	450.9630	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	722.1042	686.6343	628.4349	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	131.6433	167.8091	132.0391	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												fc = cooled area / (4) = 1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	32.9108	41.9523	33.0098	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												107.8729 (107)
Energy for space heating												30.9891 (99)
Energy for space cooling												1.3262 (108)
Total												32.3153 (109)
Fabric Energy Efficiency (TFEE)												32.3 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.4170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			40.6700	0.1000	4.0670	75.0000	3050.2500 (28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782	9.0000	278.9100 (29a)
Joists FF	40.6700		40.6700	0.1100	4.4737	9.0000	366.0300 (30)
Total net area of external elements Aum(A, m2)			125.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.4582		(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)

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FF	95.0000	9.0000	855.0000 (32c)
Internal Floor 1	40.6700	18.0000	732.0600 (32d)
Internal Ceiling 1	40.6700	9.0000	366.0300 (32e)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 8302.2800 (34)
 Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 102.0688 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	8.5800	0.0600	0.5148
E10 Eaves (insulation at ceiling level)	20.4000	0.0600	1.2240
E18 Party wall between dwellings	18.9600	0.1200	2.2752
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.0800	1.5168
P1 Party wall - Ground floor	18.9600	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	8.2600	0.0500	0.4130
E2 Other lintels (including other steel lintels)	7.3300	0.0500	0.3665
E3 Sill	15.3000	0.0500	0.7650
E4 Jamb	8.5800	0.1600	1.3728
E5 Ground floor (normal)	8.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.4481 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 36.9063 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.4839	40.2408	40.0025	38.8834	38.6740	37.6992	37.6992	37.5187	38.0747	38.6740	39.0976	39.5404 (38)
Heat transfer coeff	77.3902	77.1471	76.9088	75.7897	75.5803	74.6055	74.6055	74.4250	74.9810	75.5803	76.0039	76.4467 (39)
Average = $\text{Sum}(39)\text{m} / 12 =$												75.7887
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9514	0.9485	0.9455	0.9318	0.9292	0.9172	0.9172	0.9150	0.9218	0.9292	0.9344	0.9398 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4878 (42)
Hot water usage for mixer showers	82.4148	81.1763	79.3715	75.9184	73.3700	70.5282	68.9128	70.7040	72.6674	75.7187	79.2460	82.0990 (42a)
Hot water usage for baths	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798 (42b)
Hot water usage for other uses	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075 (42c)
Average daily hot water use (litres/day)												138.8469 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	150.9984	147.8785	144.0197	138.0100	133.1810	127.9690	125.8612	129.7022	133.7679	139.2533	145.3597	150.5864 (44)
Energy content (annual)	239.1445	210.5770	221.3529	188.9288	179.2873	157.3528	152.2182	160.5984	164.9492	188.9654	207.0916	235.7819 (45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$												2306.2480
Water storage loss:	35.8717	31.5866	33.2029	28.3393	26.8931	23.6029	22.8327	24.0898	24.7424	28.3448	31.0637	35.3673 (46)
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7368 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	128.5813	114.3343	122.6656	110.3018	108.6788	99.8028	99.6783	102.4647	102.3286	111.8967	116.3409	127.4632 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.5347	26.2325	21.3337	16.1510	12.0730	10.1926	11.0134	14.3157	19.2145	24.3972	28.4751	30.3556 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.6691	335.1108	326.4378	307.9742	284.6671	262.7618	248.1277	244.6860	253.3589	271.8226	295.1296	317.0350 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118 (71)
Water heating gains (Table 5)	172.8243	170.1403	164.8731	153.1970	146.0736	138.6150	133.9762	137.7214	142.1231	150.3988	161.5846	171.3215 (72)
Total internal gains	639.1986	636.6541	617.8151	582.4926	547.9842	513.7398	495.2878	498.8935	516.8669	551.7890	590.3598	623.8825 (73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	10.8200				10.6334	0.6300		0.7000		0.7700	35.1618 (74)
Solar gains	35.1618	67.1960	114.1824	183.4062	247.0649	264.4903	246.9355	195.9118	137.2842	79.9880	29.3126 (83)
Total gains	674.3604	703.8500	731.9975	765.8988	795.0491	778.2301	742.2233	694.8053	654.1511	631.7771	653.1951 (84)
7. Mean internal temperature (heating season)											
Temperature during heating periods in the living area from Table 9, Th1 (C)											21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)											
tau	29.7995	29.8934	29.9860	30.4288	30.5131	30.9118	30.9118	30.9867	30.7570	30.5131	30.3430
alpha	2.9866	2.9929	2.9991	3.0286	3.0342	3.0608	3.0608	3.0658	3.0505	3.0342	3.0229
util living area	0.9259	0.9117	0.8806	0.8149	0.7040	0.5519	0.4212	0.4625	0.6591	0.8273	0.9021
MIT	19.2253	19.4032	19.7471	20.2160	20.6166	20.8709	20.9579	20.9434	20.7684	20.2946	19.7040
Th 2	20.1240	20.1265	20.1290	20.1406	20.1428	20.1529	20.1529	20.1548	20.1490	20.1428	20.1384
util rest of house	0.9166	0.9006	0.8651	0.7902	0.6644	0.4932	0.3471	0.3871	0.6034	0.7995	0.8882
MIT 2	18.0565	18.2809	18.7114	19.2935	19.7650	20.0477	20.1273	20.1185	19.9461	19.3998	18.6697
Living area fraction	18.3482	18.5610	18.9699	19.5237	19.9775	20.2531	20.3346	20.3244	20.1513	19.6231	18.9278
MIT	18.3482	18.5610	18.9699	19.5237	19.9775	20.2531	20.3346	20.3244	20.1513	19.6231	18.9278
Temperature adjustment											0.0000
adjusted MIT	18.3482	18.5610	18.9699	19.5237	19.9775	20.2531	20.3346	20.3244	20.1513	19.6231	18.9278
8. Space heating requirement											
Utilisation	0.8928	0.8760	0.8406	0.7702	0.6561	0.5004	0.3635	0.4027	0.6035	0.7801	0.8642
Useful gains	602.0920	616.6050	615.3139	589.9262	521.6515	389.4436	269.7845	279.8328	394.8004	492.8392	547.6616
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000
Heat loss rate W	1087.1902	1053.9043	959.0466	805.1703	625.6195	421.7542	278.6237	292.0725	453.7338	681.9709	898.9615
Space heating kWh	360.9131	293.8651	255.7371	154.9757	77.3522	0.0000	0.0000	0.0000	0.0000	140.7140	252.9359
Space heating requirement - total per year (kWh/year)											365.8401 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Solar heating contribution - total per year (kWh/year)											0.0000 (98b)
Space heating kWh	360.9131	293.8651	255.7371	154.9757	77.3522	0.0000	0.0000	0.0000	0.0000	140.7140	252.9359
Space heating requirement after solar contribution - total per year (kWh/year)											365.8401 (98c)
Space heating per m2										(98c) / (4) =	23.3874 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP											
Fraction of space heat from secondary/supplementary system (Table 11)											0.0000 (201)
Fraction of space heat from main system(s)											1.0000 (202)
Efficiency of main space heating system 1 (in %)											249.9000 (206)
Efficiency of main space heating system 2 (in %)											0.0000 (207)
Efficiency of secondary/supplementary heating system, %											0.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	360.9131	293.8651	255.7371	154.9757	77.3522	0.0000	0.0000	0.0000	0.0000	140.7140	252.9359
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000
Space heating fuel (main heating system)	144.4230	117.5931	102.3358	62.0151	30.9533	0.0000	0.0000	0.0000	0.0000	56.3081	101.2149
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water heating	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453
Water heating requirement											
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000
Fuel for water heating, kWh/month	171.6029	151.8982	161.4421	141.7947	137.4183	123.7616	121.9591	126.7450	128.0999	142.9455	152.1675
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Lighting	25.8516	20.7391	18.6732	13.6808	10.5675	8.6337	9.6400	12.5304	16.2758	21.3547	24.1201
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Annual totals kWh/year											
Space heating fuel - main system 1											761.2378 (211)
Space heating fuel - main system 2											0.0000 (213)
Space heating fuel - secondary											0.0000 (215)

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Efficiency of water heater	175.1000	
Water heating fuel used	1729.5175	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	208.6369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2699.3922	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	761.2378	16.4900	125.5281 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1729.5175	16.4900	285.1974 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	208.6369	16.4900	34.4042 (250)
Additional standing charges			0.0000 (251)
Total energy cost			445.1298 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2684 (257)
SAP value		79.4396
SAP rating (Section 12)		79 (258)
SAP band		C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	761.2378	0.1547	117.7709 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1729.5175	0.1409	243.6801 (264)
Space and water heating			361.4510 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	208.6369	0.1443	30.1127 (268)
Total CO2, kg/year			391.5637 (272)
CO2 emissions per m2			4.8100 (273)
EI value			95.8470
EI rating			96 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

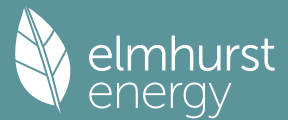
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.4170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)

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Infiltration rate		0.3946 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3354 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Adj infilt rate	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Effective ac	0.3019	0.2767	0.2684	0.2684	0.2767	0.2432	0.2600	0.2348	0.2348	0.2516	0.2348	0.2684	(22b)
	0.5456	0.5383	0.5360	0.5360	0.5383	0.5296	0.5338	0.5276	0.5276	0.5316	0.5276	0.5360	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			10.8200	1.1450	12.3893			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			40.6700	0.1000	4.0670	75.0000	3050.2500	(28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782	9.0000	278.9100	(29a)
Joists FF	40.6700		40.6700	0.1100	4.4737	9.0000	366.0300	(30)
Total net area of external elements Aum(A, m2)			125.1000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	28.4582		(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			95.0000			9.0000	855.0000	(32c)
Internal Floor 1			40.6700			18.0000	732.0600	(32d)
Internal Ceiling 1			40.6700			9.0000	366.0300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8302.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		102.0688 (35)

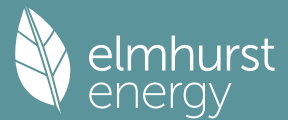
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	8.5800	0.0600	0.5148
E18 Party wall between dwellings	20.4000	0.0600	1.2240
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752
P1 Party wall - Ground floor	18.9600	0.0800	1.5168
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.2600	0.0500	0.4130
E3 Sill	7.3300	0.0500	0.3665
E4 Jamb	15.3000	0.0500	0.7650
E5 Ground floor (normal)	8.5800	0.1600	1.3728
E6 Intermediate floor within a dwelling	8.5800	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.4481 (36)
Point Thermal Bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =		36.9063 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	37.3430	36.8448	36.6884	36.6884	36.8448	36.2479	36.5367	36.1107	36.1107	36.3899	36.1107	36.6884	(38)
Average = Sum(39)m / 12 =	74.2493	73.7511	73.5947	73.5947	73.7511	73.1542	73.4431	73.0170	73.0170	73.2962	73.0170	73.5947	(39)
												73.4567	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9128	0.9067	0.9048	0.9048	0.9067	0.8994	0.9029	0.8977	0.8977	0.9011	0.8977	0.9048	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4878 (42)
Hot water usage for mixer showers	82.4148	81.1763	79.3715	75.9184	73.3700	70.5282	68.9128	70.7040	72.6674	75.7187	79.2460	82.0990	(42a)
Hot water usage for baths	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798	(42b)
Hot water usage for other uses	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075	(42c)
Average daily hot water use (litres/day)													138.8469 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	150.9984	147.8785	144.0197	138.0100	133.1810	127.9690	125.8612	129.7022	133.7679	139.2533	145.3597	150.5864	(44)
Energy content (annual)	239.1445	210.5770	221.3529	188.9288	179.2873	157.3528	152.2182	160.5984	164.9492	188.9654	207.0916	235.7819	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =			2306.2480
Water storage loss:	35.8717	31.5866	33.2029	28.3393	26.8931	23.6029	22.8327	24.0898	24.7424	28.3448	31.0637	35.3673	(46)
Store volume													300.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7368 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)

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Heat gains from water heating, kWh/month
128.5813 114.3343 122.6656 110.3018 108.6788 99.8028 99.6783 102.4647 102.3286 111.8967 116.3409 127.4632 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.5347	26.2325	21.3337	16.1510	12.0730	10.1926	11.0134	14.3157	19.2145	24.3972	28.4751	30.3556	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.6691	335.1108	326.4378	307.9742	284.6671	262.7618	248.1277	244.6860	253.3589	271.8226	295.1296	317.0350	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	(71)
Water heating gains (Table 5)	172.8243	170.1403	164.8731	153.1970	146.0736	138.6150	133.9762	137.7214	142.1231	150.3988	161.5846	171.3215	(72)
Total internal gains	639.1986	636.6541	617.8151	582.4926	547.9842	513.7398	495.2878	498.8935	516.8669	551.7890	590.3598	623.8825	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W

North					10.8200	13.0723	0.6300		0.7000		0.7700		43.2266 (74)	

Solar gains	43.2266	73.3227	124.9565	208.1378	272.1065	314.5620	288.2493	231.8691	161.0559	93.5217	53.6785	35.0250 (83)		
Total gains	682.4252	709.9768	742.7716	790.6304	820.0907	828.3018	783.5371	730.7625	677.9228	645.3107	644.0384	658.9076 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.0601	31.2699	31.3364	31.3364	31.2699	31.5250	31.4010	31.5843	31.5843	31.4639	31.5843	31.3364	
alpha	3.0707	3.0847	3.0891	3.0891	3.0847	3.1017	3.0934	3.1056	3.1056	3.0976	3.1056	3.0891	
util living area	0.9109	0.8983	0.8564	0.7742	0.6311	0.4506	0.3296	0.3409	0.5826	0.7723	0.8751	0.9169	(86)
MIT	19.5138	19.6349	19.9941	20.4066	20.7645	20.9409	20.9834	20.9825	20.8633	20.5238	19.9945	19.4899	(87)
Th 2	20.1566	20.1618	20.1634	20.1634	20.1618	20.1680	20.1650	20.1695	20.1695	20.1666	20.1695	20.1634	(88)
util rest of house	0.8998	0.8857	0.8382	0.7454	0.5851	0.3887	0.2562	0.2635	0.5207	0.7364	0.8573	0.9063	(89)
MIT 2	18.4397	18.5934	19.0392	19.5366	19.9430	20.1255	20.1570	20.1612	20.0590	19.6870	19.0502	18.4152	(90)
Living area fraction	18.7077	18.8533	19.2775	19.7537	20.1480	20.3290	20.3632	20.3662	20.2598	19.8959	19.2859	18.6834	(91)
MIT	18.7077	18.8533	19.2775	19.7537	20.1480	20.3290	20.3632	20.3662	20.2598	19.8959	19.2859	18.6834	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7077	18.8533	19.2775	19.7537	20.1480	20.3290	20.3632	20.3662	20.2598	19.8959	19.2859	18.6834	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8762	0.8620	0.8158	0.7298	0.5843	0.4010	0.2739	0.2822	0.5278	0.7234	0.8350	0.8833	(94)
Useful gains	597.9454	612.0331	605.9753	577.0413	479.1553	332.1315	214.6237	206.1895	357.8057	466.8076	537.7500	581.9975	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1002.9389	984.8236	881.4832	739.9014	541.9248	345.9469	217.6277	209.2818	391.3534	593.3960	809.4589	992.3072	(97)
Space heating kWh	301.3152	250.5152	204.9779	117.2593	46.7005	0.0000	0.0000	0.0000	0.0000	94.1817	195.6304	305.2704	(98a)
Space heating requirement - total per year (kWh/year)												1515.8506	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	301.3152	250.5152	204.9779	117.2593	46.7005	0.0000	0.0000	0.0000	0.0000	94.1817	195.6304	305.2704	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1515.8506	
Space heating per m2										(98c) / (4) =		18.6360	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	301.3152	250.5152	204.9779	117.2593	46.7005	0.0000	0.0000	0.0000	0.0000	94.1817	195.6304	305.2704	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	120.5743	100.2462	82.0240	46.9225	18.6877	0.0000	0.0000	0.0000	0.0000	37.6878	78.2835	122.1570	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

N	Solar water heating	Recommended
U	Solar photovoltaic panels	Recommended

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V2 Wind turbine

Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.4	-£ 101	-48 kg (13.2%)
U Solar photovoltaic panels	+ 6.5	-£ 237	-123 kg (38.4%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£101	0.60 kg/m ²	B 82	A 96
Solar photovoltaic panels	£237	1.51 kg/m ²	B 88	A 97
Total Savings	£338	2.10 kg/m ²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £663	Potential £562	Saving £101
Electricity			
Space heating	£158	£179	-£21
Water heating	£451	£328	£122
Lighting	£54	£54	£0
Generated (PV)	-£0	-£237	£237
Total cost of fuels	£663	£325	£338
Total cost of uses	£663	£324	£338
Delivered energy	31 kWh/m ²	15 kWh/m ²	16 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m ²	5 kg/m ²	2 kg/m ²	2 kg/m ²
Primary energy	48 kWh/m ²	24 kWh/m ²	24 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

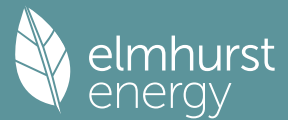
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3946	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			40.6700	0.1000	4.0670	75.0000	3050.2500 (28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782	9.0000	278.9100 (29a)
Joists FF	40.6700		40.6700	0.1100	4.4737	9.0000	366.0300 (30)
Total net area of external elements Aum(A, m ²)			125.1000				(31)

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Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	28.4582				(33)
Party Wall 1	96.7000	0.0000	0.0000	20.0000	1934.0000	(32)
GF	80.0000			9.0000	720.0000	(32c)
FF	95.0000			9.0000	855.0000	(32c)
Internal Floor 1	40.6700			18.0000	732.0600	(32d)
Internal Ceiling 1	40.6700			9.0000	366.0300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8302.2800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		102.0688	(35)

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	8.5800	0.0600	0.5148	
E10 Eaves (insulation at ceiling level)	20.4000	0.0600	1.2240	
E18 Party wall between dwellings	18.9600	0.1200	2.2752	
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.0800	1.5168	
P1 Party wall - Ground floor	18.9600	0.0000	0.0000	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	8.2600	0.0500	0.4130	
E2 Other lintels (including other steel lintels)	7.3300	0.0500	0.3665	
E3 Sill	15.3000	0.0500	0.7650	
E4 Jamb	8.5800	0.1600	1.3728	
E5 Ground floor (normal)	8.5800	0.0000	0.0000	
E6 Intermediate floor within a dwelling				8.4481 (36)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				0.0000
Point Thermal bridges				(36a) =
Total fabric heat loss				(33) + (36) + (36a) = 36.9063 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.4839	40.2408	40.0025	38.8834	38.6740	37.6992	37.6992	37.5187	38.0747	38.6740	39.0976	39.5404	(38)
Heat transfer coeff	77.3902	77.1471	76.9088	75.7897	75.5803	74.6055	74.6055	74.4250	74.9810	75.5803	76.0039	76.4467	(39)
Average = Sum(39)m / 12 =												75.7887	
HLP	0.9514	0.9485	0.9455	0.9318	0.9292	0.9172	0.9172	0.9150	0.9218	0.9292	0.9344	0.9398	(40)
HLP (average)												0.9318	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4878	(42)
Hot water usage for mixer showers	82.4148	81.1763	79.3715	75.9184	73.3700	70.5282	68.9128	70.7040	72.6674	75.7187	79.2460	82.0990	(42a)	
Hot water usage for baths	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798	(42b)	
Hot water usage for other uses	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075	(42c)	
Average daily hot water use (litres/day)												138.8469	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	150.9984	147.8785	144.0197	138.0100	133.1810	127.9690	125.8612	129.7022	133.7679	139.2533	145.3597	150.5864	(44)	
Energy conte	239.1445	210.5770	221.3529	188.9288	179.2873	157.3528	152.2182	160.5984	164.9492	188.9654	207.0916	235.7819	(45)	
Energy content (annual)										Total = Sum(45)m =		2306.2480		
Distribution loss (46)m = 0.15 x (45)m	35.8717	31.5866	33.2029	28.3393	26.8931	23.6029	22.8327	24.0898	24.7424	28.3448	31.0637	35.3673	(46)	
Water storage loss:														
Store volume												300.0000	(47)	
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)	
Volume factor from Table 2a												0.7368	(52)	
Temperature factor from Table 2b												0.5400	(53)	
Enter (49) or (54) in (55)												1.2281	(55)	
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)	
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	300.4767	265.9738	281.2894	241.5290	227.8251	204.0998	200.5235	209.8341	218.9001	248.9018	266.4453	297.1140	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Aperture area of solar collector													3.0000 (H1)	
Zero-loss collector efficiency													0.8000 (H2)	
Collector linear heat loss coefficient													1.8000 (H3)	
Collector 2nd order heat loss coefficient													0.0000 (H4)	
Collector loop efficiency													0.9000 (H5)	
Incidence angle modifier													1.0000 (H6)	
Overshading factor													0.8000 (H8)	
Overall heat loss coefficient of system													6.5000 (H10)	
Heat loss coefficient of collector loop													3.9667 (H11)	
Dedicated solar storage volume													75.0000 (H12)	
Effective solar volume													75.0000 (H14)	
Reference volume													225.0000 (H15)	
Storage tank correction coefficient													1.3161 (H16)	
Heat delivered to hot water													637.2916 (H24)	
Heat delivered to space heating													0.0000 (H29)	
Solar input													637.2916	
Solar input	-0.0000	-16.1873	-59.0716	-81.8647	-107.8735	-99.6484	-99.0362	-86.0462	-58.7811	-28.7826	-0.0000	-0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h	300.4767	249.7866	222.2177	159.6643	119.9516	104.4514	101.4873	123.7879	160.1190	220.1192	266.4453	297.1140	(64)	
										Total per year (kWh/year) = Sum(64)m =		2325.6211	(64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
													0.0000 (64a)	
Heat gains from water heating, kWh/month	128.5813	114.3343	121.5490	104.8989	98.4433	89.7174	89.2568	92.7876	98.0063	110.7801	116.3409	127.4632	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	29.5347	26.2325	21.3337	16.1510	12.0730	10.1926	11.0134	14.3157	19.2145	24.3972	28.4751	30.3556 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	331.6691	335.1108	326.4378	307.9742	284.6671	262.7618	248.1277	244.6860	253.3589	271.8226	295.1296	317.0350 (68)
Pumps, fans	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118 (71)
Total internal gains	172.8243	170.1403	163.3723	145.6930	132.3163	124.6075	119.9688	124.7144	136.1199	148.8980	161.5846	171.3215 (72)
	639.1986	636.6541	616.3143	574.9886	534.2269	499.7323	481.2803	485.8865	510.8637	550.2882	590.3598	623.8825 (73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2			g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North				10.8200	10.6334			0.6300	0.7000	0.7700		35.1618 (74)
Solar gains	35.1618	67.1960	114.1824	183.4062	247.0649	264.4903	246.9355	195.9118	137.2842	79.9880	43.3766	29.3126 (83)
Total gains	674.3604	703.8500	730.4967	758.3948	781.2918	764.2226	728.2158	681.7984	648.1479	630.2763	633.7364	653.1951 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	29.7995	29.8934	29.9860	30.4288	30.5131	30.9118	30.9118	30.9867	30.7570	30.5131	30.3430	30.1673
util living area	2.9866	2.9929	2.9991	3.0286	3.0342	3.0608	3.0608	3.0658	3.0505	3.0342	3.0229	3.0112
	0.9259	0.9117	0.8811	0.8180	0.7110	0.5596	0.4283	0.4699	0.6629	0.8281	0.9021	0.9313 (86)
MIT	19.2253	19.4032	19.7445	20.2061	20.6053	20.8659	20.9559	20.9409	20.7645	20.2925	19.7040	19.1963 (87)
Th 2	20.1240	20.1265	20.1290	20.1406	20.1428	20.1529	20.1529	20.1548	20.1490	20.1428	20.1384	20.1338 (88)
util rest of house	0.9166	0.9006	0.8657	0.7936	0.6716	0.5005	0.3533	0.3937	0.6073	0.8003	0.8882	0.9226 (89)
MIT 2	18.0565	18.2809	18.7083	19.2820	19.7531	20.0433	20.1261	20.1168	19.9424	19.3974	18.6697	18.0267 (90)
Living area fraction	18.3482	18.5610	18.9669	19.5126	19.9658	20.2486	20.3332	20.3224	20.1475	19.6208	18.9278	18.3186 (92)
MIT	18.3482	18.5610	18.9669	19.5126	19.9658	20.2486	20.3332	20.3224	20.1475	19.6208	18.9278	18.3186 (93)
Temperature adjustment												0.0000
adjusted MIT	18.3482	18.5610	18.9669	19.5126	19.9658	20.2486	20.3332	20.3224	20.1475	19.6208	18.9278	18.3186 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8928	0.8760	0.8411	0.7734	0.6628	0.5075	0.3697	0.4094	0.6072	0.7808	0.8642	0.8996 (94)
Ext temp.	602.0920	616.6050	614.4385	586.5564	517.8570	387.8511	269.2520	279.1281	393.5471	492.1428	547.6616	587.6031 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1087.1902	1053.9043	958.8182	804.3261	624.7295	421.4140	278.5152	291.9277	453.4511	681.7962	898.9615	1079.3237 (97)
Space heating requirement - total per year (kWh/year)	360.9131	293.8651	256.2185	156.7941	79.5132	0.0000	0.0000	0.0000	0.0000	141.1021	252.9359	365.8401 (98a)
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	360.9131	293.8651	256.2185	156.7941	79.5132	0.0000	0.0000	0.0000	0.0000	141.1021	252.9359	365.8401 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1907.1822
Space heating per m2										(98c) / (4) =		23.4470 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	360.9131	293.8651	256.2185	156.7941	79.5132	0.0000	0.0000	0.0000	0.0000	141.1021	252.9359	365.8401 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	144.4230	117.5931	102.5284	62.7428	31.8180	0.0000	0.0000	0.0000	0.0000	56.4634	101.2149	146.3946 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating	300.4767	249.7866	222.2177	159.6643	119.9516	104.4514	101.4873	123.7879	160.1190	220.1192	266.4453	297.1140 (64)
Water heating requirement	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Efficiency of water heater (217)m	171.6029	142.6537	126.9091	91.1846	68.5046	59.6525	57.9596	70.6956	91.4443	125.7106	152.1675	169.6825 (219)
Fuel for water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Space cooling fuel requirement (221)m	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Pumps and Fa	25.8516	20.7391	18.6732	13.6808	10.5675	8.6337	9.6400	12.5304	16.2758	21.3547	24.1201	26.5701 (232)
Lighting												
Electricity generated by PVs (Appendix M) (negative quantity)												

10a. Fuel costs - using Table 12 prices

11a. SAP rating - Individual heating systems

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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Full SAP Calculation Printout



	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3019	0.2767	0.2684	0.2684	0.2767	0.2432	0.2600	0.2348	0.2348	0.2516	0.2348	0.2684 (22b)
Effective ac	0.5456	0.5383	0.5360	0.5360	0.5383	0.5296	0.5338	0.5276	0.5276	0.5316	0.5276	0.5360 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			40.6700	0.1000	4.0670	75.0000	3050.2500 (28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782	9.0000	278.9100 (29a)
Joists FF	40.6700		40.6700	0.1100	4.4737	9.0000	366.0300 (30)
Total net area of external elements Aum(A, m ²)			125.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.4582		(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)
FF			95.0000			9.0000	855.0000 (32c)
Internal Floor 1			40.6700			18.0000	732.0600 (32d)
Internal Ceiling 1			40.6700			9.0000	366.0300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8302.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							102.0688 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)				8.5800	0.0600	0.5148	
E18 Party wall between dwellings				20.4000	0.0600	1.2240	
P4 Party wall - Roof (insulation at ceiling level)				18.9600	0.1200	2.2752	
P1 Party wall - Ground floor				18.9600	0.0800	1.5168	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				18.9600	0.0000	0.0000	
E2 Other lintels (including other steel lintels)				8.2600	0.0500	0.4130	
E3 Sill				7.3300	0.0500	0.3665	
E4 Jamb				15.3000	0.0500	0.7650	
E5 Ground floor (normal)				8.5800	0.1600	1.3728	
E6 Intermediate floor within a dwelling				8.5800	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4481 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	36.9063 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	37.3430	36.8448	36.6884	36.6884	36.8448	36.2479	36.5367	36.1107	36.1107	36.3899	36.1107	36.6884 (38)
Average = Sum(39)m / 12 =	74.2493	73.7511	73.5947	73.5947	73.7511	73.1542	73.4431	73.0170	73.0170	73.2962	73.0170	73.5947 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9128	0.9067	0.9048	0.9048	0.9067	0.8994	0.9029	0.8977	0.8977	0.9011	0.8977	0.9048 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4878 (42)
Hot water usage for mixer showers												
	82.4148	81.1763	79.3715	75.9184	73.3700	70.5282	68.9128	70.7040	72.6674	75.7187	79.2460	82.0990 (42a)
Hot water usage for baths												
	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798 (42b)
Hot water usage for other uses												
	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075 (42c)
Average daily hot water use (litres/day)												138.8469 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Daily hot water use	150.9984	147.8785	144.0197	138.0100	133.1810	127.9690	125.8612	129.7022	133.7679	139.2533	145.3597	150.5864 (44)
Energy content (annual)	239.1445	210.5770	221.3529	188.9288	179.2873	157.3528	152.2182	160.5984	164.9492	188.9654	207.0916	235.7819 (45)
Distribution loss (46)m = 0.15 x (45)m	35.8717	31.5866	33.2029	28.3393	26.8931	23.6029	22.8327	24.0898	24.7424	28.3448	31.0637	35.3673 (46)
Water storage loss:												
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7368 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	300.4767	265.9738	281.2894	241.5290	227.8251	204.0998	200.5235	209.8341	218.9001	248.9018	266.4453	297.1140 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												755.9954 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												755.9954
Solar input	-1.8659	-20.8871	-65.9918	-93.3576	-117.5003	-118.1747	-114.8330	-102.8256	-72.1672	-40.7470	-7.6452	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	298.6109	245.0867	215.2976	148.1713	110.3248	85.9251	85.6904	107.0085	146.7329	208.1548	258.8001	297.1140 (64)
												Total per year (kWh/year) = Sum(64)m = 2206.9173 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	128.5813	114.3343	121.5490	104.8989	98.4433	89.7174	89.2568	92.7876	98.0063	110.7801	116.3409	127.4632 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.5347	26.2325	21.3337	16.1510	12.0730	10.1926	11.0134	14.3157	19.2145	24.3972	28.4751	30.3556 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.6691	335.1108	326.4378	307.9742	284.6671	262.7618	248.1277	244.6860	253.3589	271.8226	295.1296	317.0350 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118 (71)
Water heating gains (Table 5)	172.8243	170.1403	163.3723	145.6930	132.3163	124.6075	119.9688	124.7144	136.1199	148.8980	161.5846	171.3215 (72)
Total internal gains	639.1986	636.6541	616.3143	574.9886	534.2269	499.7323	481.2803	485.8865	510.8637	550.2882	590.3598	623.8825 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W		
-----				-----				-----				-----	
North				10.8200	13.0723	0.6300	0.7000			0.7700	43.2266 (74)		
-----				-----				-----				-----	
Solar gains	43.2266	73.3227	124.9565	208.1378	272.1065	314.5620	288.2493	231.8691	161.0559	93.5217	53.6785	35.0250 (83)	
Total gains	682.4252	709.9768	741.2708	783.1264	806.3334	814.2943	769.5296	717.7556	671.9196	643.8099	644.0384	658.9076 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.0601	31.2699	31.3364	31.3364	31.2699	31.5250	31.4010	31.5843	31.5843	31.4639	31.5843	31.3364
alpha	3.0707	3.0847	3.0891	3.0891	3.0847	3.1017	3.0934	3.1056	3.1056	3.0976	3.1056	3.0891
util living area	0.9109	0.8983	0.8570	0.7776	0.6383	0.4572	0.3352	0.3466	0.5864	0.7732	0.8751	0.9169 (86)
MIT	19.5138	19.6349	19.9917	20.3982	20.7567	20.9384	20.9825	20.9817	20.8608	20.5221	19.9945	19.4899 (87)
Th 2	20.1566	20.1618	20.1634	20.1634	20.1618	20.1680	20.1650	20.1695	20.1695	20.1666	20.1695	20.1634 (88)
util rest of house	0.8998	0.8857	0.8388	0.7491	0.5923	0.3947	0.2607	0.2681	0.5244	0.7373	0.8573	0.9063 (89)
MIT 2	18.4397	18.5934	19.0364	19.5271	19.9353	20.1237	20.1566	20.1608	20.0568	19.6852	19.0502	18.4152 (90)
Living area fraction									fLA = Living area / (4) =			0.2496 (91)
MIT	18.7077	18.8533	19.2749	19.7445	20.1403	20.3270	20.3627	20.3657	20.2575	19.8941	19.2859	18.6834 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7077	18.8533	19.2749	19.7445	20.1403	20.3270	20.3627	20.3657	20.2575	19.8941	19.2859	18.6834 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8762	0.8620	0.8164	0.7332	0.5910	0.4070	0.2787	0.2870	0.5313	0.7242	0.8350	0.8833	(94)
Useful gains	597.9454	612.0331	605.1842	574.2168	476.5795	331.4048	214.4369	205.9984	357.0171	466.2623	537.7500	581.9975	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1002.9389	984.8236	881.2853	739.2242	541.3551	345.7995	217.5903	209.2435	391.1856	593.2664	809.4589	992.3072	(97)
Space heating kWh	301.3152	250.5152	205.4192	118.8053	48.1931	0.0000	0.0000	0.0000	0.0000	94.4911	195.6304	305.2704	(98a)
Space heating requirement - total per year (kWh/year)												1519.6398	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	301.3152	250.5152	205.4192	118.8053	48.1931	0.0000	0.0000	0.0000	0.0000	94.4911	195.6304	305.2704	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1519.6398	
Space heating per m2										(98c) / (4) =		18.6826	(99)

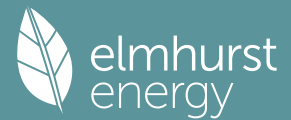
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	301.3152	250.5152	205.4192	118.8053	48.1931	0.0000	0.0000	0.0000	0.0000	94.4911	195.6304	305.2704	(98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating fuel (main heating system)	120.5743	100.2462	82.2006	47.5411	19.2849	0.0000	0.0000	0.0000	0.0000	37.8115	78.2835	122.1570	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	298.6109	245.0867	215.2976	148.1713	110.3248	85.9251	85.6904	107.0085	146.7329	208.1548	258.8001	297.1140	(64)	
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
Fuel for water heating, kWh/month	170.5373	139.9696	122.9569	84.6210	63.0068	49.0720	48.9380	61.1128	83.7995	118.8777	147.8013	169.6825	(219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)	
Lighting	25.8516	20.7391	18.6732	13.6808	10.5675	8.6337	9.6400	12.5304	16.2758	21.3547	24.1201	26.5701	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-44.2464	-58.6582	-86.0886	-99.1637	-102.6981	-96.3579	-94.2916	-90.5339	-81.5635	-69.9302	-49.2980	-37.1771	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													608.0992	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													175.1000	
Water heating fuel used													1260.3754	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													80.0000	(231)
Electricity for lighting (calculated in Appendix L)													208.6369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-910.0071	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													1247.1043	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	608.0992	26.0600	158.4706	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1260.3754	26.0600	328.4538	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	208.6369	26.0600	54.3708	(250)
Additional standing charges			0.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-910.0071	26.0600	-237.1479
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-237.1479 (252)
Total energy cost			324.9954 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	608.0992	0.1554	94.4885 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1260.3754	0.1460	183.9554 (264)
Space and water heating			278.4438 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	208.6369	0.1443	30.1127 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-910.0071	0.1348	-122.6398
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-122.6398 (269)
Total CO2, kg/year			197.0137 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	608.0992	1.5753	957.9314 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1260.3754	1.5399	1940.8603 (278)
Space and water heating			2898.7918 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	208.6369	1.5338	320.0142 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-910.0071	1.4981	-1363.2708
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1363.2708 (283)
Total Primary energy kWh/year			1976.5591 (286)

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Property Reference	FURNERS LANE 15				Issued on Date	12/09/2024	
Assessment Reference	PLANNING			Prop Type Ref			
Property	Plot 15, Furners Lane, Henfield, West Sussex, BN5						
SAP Rating	79 C	DER	4.87	TER	10.96		
Environmental	96 A	% DER < TER				55.57	
CO ₂ Emissions (t/year)	0.42	DFEE	35.78	TFEE	36.25		
Compliance Check	See BREL	% DFEE < TFEE				1.29	
% DPER < TPER	10.17	DPER	51.44	TPER	57.26		
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001	
Client	ELIVIA HOMES EASTERN, Pete Bland						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1260 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3760	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3196 (21)

Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756	(22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			11.5300	1.1450	13.2023		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			46.6700	0.1100	5.1337	75.0000	3500.2500 (28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090	9.0000	765.4500 (29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300 (30)
Total net area of external elements Aum(A, m ²)			191.8700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.7287		(33)
Party Wall 1			48.3500	0.0000	0.0000	20.0000	967.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)
FF			110.0000			9.0000	990.0000 (32c)
Internal Floor 1			46.6700			18.0000	840.0600 (32d)
Internal Ceiling 1			46.6700			9.0000	420.0300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8622.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							92.3808 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)				9.8400	0.0600	0.5904	
E18 Party wall between dwellings				10.2000	0.0600	0.6120	

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P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
P1 Party wall - Ground floor	9.4800	0.0800	0.7584
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425
E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	17.7000	0.0500	0.8850
E5 Ground floor (normal)	19.3200	0.1600	3.0912
E6 Intermediate floor within a dwelling	19.3200	0.0000	0.0000
E16 Corner (normal)	10.2000	0.0900	0.9180
E12 Gable (insulation at ceiling level)	9.4800	0.0600	0.5688

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss

(33) + (36) + (36a) = 50.1286 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124 (38)
Average = Sum(39)m / 12 =	95.9240	95.6707	95.4225	94.2564	94.0382	93.0226	93.0226	92.8345	93.4138	94.0382	94.4796	94.9410 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0277	1.0250	1.0223	1.0098	1.0075	0.9966	0.9966	0.9946	1.0008	1.0075	1.0122	1.0172 (40)
HLP (average)												1.0098
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.6687 (42)
Hot water usage for mixer showers	86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768 (42a)
Hot water usage for baths	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800 (42b)
Hot water usage for other uses	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605 (42c)
Average daily hot water use (litres/day)												145.2373 (43)
Daily hot water use	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173 (44)
Energy content (annual)	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340 (45)
Distribution loss (46)m = 0.15 x (45)m	37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951 (46)
Water storage loss:												
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7368 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
12Total per year (kWh/year)												3135.5309 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	126.0530	113.1930	111.4224	102.2107	102.0077	104.9224	104.8529	114.7886	119.5102	131.0716 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	177.7434	174.9358	169.4261	157.2125	149.7613	141.9594	137.1072	141.0248	145.6291	154.2858	165.9864	176.1715 (72)
Total internal gains	625.1999	639.5429	613.0168	591.7039	562.4852	540.0406	519.8299	521.2042	536.7620	557.5181	590.9862	612.8139 (73)

6. Solar gains												
[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m2	Table 6a	Specific data	Specific data	factor	W					
			W/m2	or Table 6b	or Table 6c	Table 6d						
North		11.5300	10.6334	0.6300	0.7000	0.7700	37.4691 (74)					

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Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	662.6690	711.1482	734.6918	787.1451	825.7623	821.8866	782.9691	729.9716	683.0547	642.7548	637.2091	644.0500 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.9701	25.0362	25.1013	25.4118	25.4708	25.7489	25.7489	25.8011	25.6411	25.4708	25.3518	25.2286
alpha	2.6647	2.6691	2.6734	2.6941	2.6981	2.7166	2.7166	2.7201	2.7094	2.6981	2.6901	2.6819
util living area	0.9419	0.9273	0.9043	0.8470	0.7502	0.6053	0.4757	0.5196	0.7089	0.8599	0.9209	0.9457 (86)
MIT	18.6572	18.8873	19.2731	19.8571	20.3841	20.7627	20.9107	20.8842	20.6118	19.9730	19.2491	18.6281 (87)
Th 2	20.0603	20.0626	20.0648	20.0752	20.0771	20.0862	20.0862	20.0878	20.0827	20.0771	20.0732	20.0691 (88)
util rest of house	0.9344	0.9180	0.8913	0.8251	0.7122	0.5432	0.3912	0.4352	0.6537	0.8354	0.9093	0.9387 (89)
MIT 2	17.3160	17.6071	18.0943	18.8249	19.4584	19.8874	20.0301	20.0111	19.7336	18.9795	18.0743	17.2845 (90)
Living area fraction	17.5551	17.8353	18.3045	19.0089	19.6234	20.0435	20.1871	20.1667	19.8902	19.1566	18.2837	0.1783 (91)
MIT	17.5551	17.8353	18.3045	19.0089	19.6234	20.0435	20.1871	20.1667	19.8902	19.1566	18.2837	17.5240 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5551	17.8353	18.3045	19.0089	19.6234	20.0435	20.1871	20.1667	19.8902	19.1566	18.2837	17.5240 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9071	0.8884	0.8599	0.7947	0.6911	0.5401	0.4010	0.4430	0.6407	0.8055	0.8795	0.9124 (94)
Useful gains	601.1298	631.8045	631.7624	625.5316	570.6814	443.8891	313.9810	323.3729	437.6039	517.7424	560.4485	587.6344 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1271.4820	1237.5294	1126.4131	952.8289	745.1066	506.3644	333.6822	349.6823	540.8797	804.6513	1056.6308	1264.9934 (97)
Space heating kWh	498.7420	407.0471	368.0201	235.6540	129.7724	0.0000	0.0000	0.0000	0.0000	213.4602	357.2513	503.9551 (98a)
Space heating requirement - total per year (kWh/year)												2713.9023
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	498.7420	407.0471	368.0201	235.6540	129.7724	0.0000	0.0000	0.0000	0.0000	213.4602	357.2513	503.9551 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2713.9023
Space heating per m2										(98c) / (4) =		29.0754 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	498.7420	407.0471	368.0201	235.6540	129.7724	0.0000	0.0000	0.0000	0.0000	213.4602	357.2513	503.9551 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	199.5766	162.8840	147.2670	94.2993	51.9297	0.0000	0.0000	0.0000	0.0000	85.4183	142.9577	201.6627 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	177.8890	157.4333	167.2603	146.7607	142.1308	127.8975	125.9601	130.9664	132.4357	147.9126	157.6110	175.8802 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1085.9953 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1790.1376 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												242.5617 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3118.6946 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1085.9953	0.1543	167.5383 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1790.1376	0.1409	252.2626 (264)
Space and water heating			419.8009 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	242.5617	0.1443	35.0092 (268)
Total CO2, kg/year			454.8101 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8700 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1085.9953	1.5712	1706.2722 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1790.1376	1.5211	2722.9151 (278)
Space and water heating			4429.1873 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	242.5617	1.5338	372.0493 (282)
Total Primary energy kWh/year			4801.2366 (286)
Dwelling Primary energy Rate (DPER)			51.4400 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1260 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3760	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj inflt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K

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TER Opaque door			1.9500	1.0000	1.9500	(26)
TER Opening Type (Uw = 1.20)			11.5300	1.1450	13.2023	(27)
Ground Floor			46.6700	0.1300	6.0671	(28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	(30)
Total net area of external elements Aum(A, m2)			191.8700			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6621	(33)
Party Wall 1			48.3500	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

92.3808 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904
E18 Party wall between dwellings	10.2000	0.0600	0.6120
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
P1 Party wall - Ground floor	9.4800	0.0800	0.7584
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425
E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	17.7000	0.0500	0.8850
E5 Ground floor (normal)	19.3200	0.1600	3.0912
E6 Intermediate floor within a dwelling	19.3200	0.0000	0.0000
E16 Corner (normal)	10.2000	0.0900	0.9180
E12 Gable (insulation at ceiling level)	9.4800	0.0600	0.5688

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

9.3999 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 51.0620 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124	(38)
Heat transfer coeff	96.8574	96.6041	96.3559	95.1898	94.9716	93.9560	93.9560	93.7679	94.3472	94.9716	95.4130	95.8744	(39)
Average = Sum(39)m / 12 =												95.1887	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0377	1.0350	1.0323	1.0198	1.0175	1.0066	1.0066	1.0046	1.0108	1.0175	1.0222	1.0272	(40)
HLP (average)												1.0198	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687 (42)
Hot water usage for mixer showers													
68.9657	67.9292	66.4190	63.5293	61.3969	59.0188	57.6670	59.1659	60.8089	63.3623	66.3139	68.7014	(42a)	
Hot water usage for baths													
29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	(42b)	
Hot water usage for other uses													
41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	(42c)	
Average daily hot water use (litres/day)												129.3413	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.7069	137.7023	134.0434	128.4795	123.9613	119.1039	117.2372	120.8803	124.7225	129.8220	135.4716	140.3420	(44)
Energy content	222.8453	196.0863	206.0197	175.8821	166.8758	146.4521	141.7882	149.6751	153.7954	176.1673	193.0041	219.7416	(45)
Energy content (annual)										Total = Sum(45)m =		2148.3328	
Distribution loss (46)m = 0.15 x (45)m													
33.4268	29.4129	30.9030	26.3823	25.0314	21.9678	21.2682	22.4513	23.0693	26.4251	28.9506	32.9612	(46)	
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1409	(55)
Total storage loss													
35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)	
If cylinder contains dedicated solar storage													
35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
281.4741	249.0413	264.6485	232.6196	225.5046	203.1897	200.4170	208.3039	210.5329	234.7961	249.7417	278.3704	(62)	
WWHRS	-31.5282	-27.8838	-29.1983	-24.1774	-22.5324	-19.2812	-18.0730	-19.2188	-19.9490	-23.5177	-26.6427	-30.9444	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	249.9459	221.1575	235.4502	208.4423	202.9722	183.9085	182.3440	189.0850	190.5839	211.2784	223.0989	247.4260	(64)
								Total per year (kWh/year) = Sum(64)m =				2545.6928	(64)
12Total per year (kWh/year)												2546	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)
Heat gains from water heating, kWh/month													
120.9991	107.5627	115.4046	103.8708	102.3893	94.0854	94.0476	96.6700	96.5270	105.4787	109.5639	119.9671	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	(71)
Water heating gains (Table 5)	162.6332	160.0636	155.1137	144.2651	137.6200	130.6741	126.4081	129.9328	134.0653	141.7724	152.1721	161.2461	(72)
Total internal gains	610.0897	624.6707	598.7045	578.7564	550.3438	528.7554	509.1308	510.1122	525.1982	545.0047	577.1719	597.8886	(73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W

North				11.5300	10.6334	0.6300	0.7000			0.7700			37.4691 (74)

Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361	(83)
Total gains	647.5587	696.2760	720.3794	774.1976	813.6210	810.6013	772.2700	718.8796	671.4909	630.2415	623.3948	629.1246	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.7294	24.7943	24.8581	25.1627	25.2205	25.4931	25.4931	25.5442	25.3874	25.2205	25.1038	24.9830
alpha	2.6486	2.6530	2.6572	2.6775	2.6814	2.6995	2.6995	2.7029	2.6925	2.6814	2.6736	2.6655
util living area	0.9450	0.9308	0.9086	0.8526	0.7575	0.6139	0.4842	0.5290	0.7178	0.8658	0.9249	0.9486 (86)
MIT	18.5996	18.8322	19.2237	19.8183	20.3580	20.7496	20.9047	20.8765	20.5924	19.9368	19.2000	18.5702 (87)
Th 2	20.0520	20.0543	20.0565	20.0669	20.0688	20.0778	20.0778	20.0795	20.0744	20.0688	20.0649	20.0608 (88)
util rest of house	0.9378	0.9218	0.8959	0.8311	0.7198	0.5514	0.3981	0.4432	0.6627	0.8420	0.9136	0.9419 (89)
MIT 2	17.2389	17.5335	18.0283	18.7731	19.4232	19.8679	20.0180	19.9976	19.7071	18.9310	18.0084	17.2068 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.4815	17.7650	18.2414	18.9594	19.5898	20.0251	20.1761	20.1543	19.8649	19.1103	18.2208	17.4499 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.4815	17.7650	18.2414	18.9594	19.5898	20.0251	20.1761	20.1543	19.8649	19.1103	18.2208	17.4499 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9109	0.8925	0.8645	0.8002	0.6977	0.5475	0.4078	0.4506	0.6486	0.8115	0.8841	0.9161 (94)
Useful gains	589.8568	621.4265	622.7911	619.4825	567.6871	443.7887	314.9552	323.9557	435.5367	511.4704	551.1175	576.3131 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1276.7269	1242.8159	1131.3496	957.5528	749.3098	509.7158	335.9966	352.0307	543.9043	808.2371	1061.0697	1270.3212 (97)
Space heating kWh	511.0313	417.5736	378.3676	243.4106	135.1273	0.0000	0.0000	0.0000	0.0000	220.7945	367.1656	516.3421 (98a)
Space heating requirement - total per year (kWh/year)	2789.8125											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	511.0313	417.5736	378.3676	243.4106	135.1273	0.0000	0.0000	0.0000	0.0000	220.7945	367.1656	516.3421 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2789.8125											
Space heating per m2	(98c) / (4) = 29.8887 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	511.0313	417.5736	378.3676	243.4106	135.1273	0.0000	0.0000	0.0000	0.0000	220.7945	367.1656	516.3421 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	553.6634	452.4091	409.9324	263.7168	146.4001	0.0000	0.0000	0.0000	0.0000	239.2139	397.7959	559.4172 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	249.9459	221.1575	235.4502	208.4423	202.9722	183.9085	182.3440	189.0850	190.5839	211.2784	223.0989	247.4260 (64)
Efficiency of water heater (217)m	85.6280	85.4627	85.1177	84.4085	83.1689	79.8000	79.8000	79.8000	79.8000	84.1587	85.1694	79.8000 (216)
Fuel for water heating, kWh/month	291.8973	258.7768	276.6172	246.9447	244.0481	230.4618	228.5012	236.9487	238.8269	251.0475	261.9472	288.8131 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	28.3278	22.7256	20.4619	14.9913	11.5797	9.4607	10.5634	13.7307	17.8348	23.4002	26.4305	29.1151 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-43.0360	-60.3393	-86.2393	-96.3687	-103.3845	-96.2774	-95.0720	-90.0173	-81.0086	-68.7195	-47.1904	-37.2451 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-25.2980	-53.1175	-105.4060	-158.0775	-208.8072	-209.7533	-207.2977	-175.6182	-128.8470	-75.8957	-33.7521	-20.0133 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3022.5487	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3054.8305	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												228.6216	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2306.7817	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												4085.2191	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3022.5487	0.2100	634.7352 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3054.8305	0.2100	641.5144 (264)
Space and water heating			1276.2496 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	228.6216	0.1443	32.9972 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-904.8983	0.1347	-121.9051
PV Unit electricity exported	-1401.8834	0.1259	-176.5500
Total			-298.4551 (269)
Total CO2, kg/year			1022.7210 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.9600 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3022.5487	1.1300	3415.4801 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3054.8305	1.1300	3451.9584 (278)
Space and water heating			6867.4385 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	228.6216	1.5338	350.6674 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-904.8983	1.4979	-1355.4456
PV Unit electricity exported	-1401.8834	0.4623	-648.0622
Total			-2003.5078 (283)
Total Primary energy kWh/year			5344.6988 (286)
Target Primary Energy Rate (TPER)			57.2600 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)

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Infiltration rate													0.3760 (18)
Number of sides sheltered													2 (19)
Shelter factor													(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) = 0.3196 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infiltr rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.5300	1.1450	13.2023			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			46.6700	0.1100	5.1337	75.0000	3500.2500	(28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090	9.0000	765.4500	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300	(30)
Total net area of external elements Aum(A, m2)			191.8700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 40.7287			(33)
Party Wall 1			48.3500	0.0000	0.0000	20.0000	967.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			110.0000			9.0000	990.0000	(32c)
Internal Floor 1			46.6700			18.0000	840.0600	(32d)
Internal Ceiling 1			46.6700			9.0000	420.0300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8622.8200 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 92.3808 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904
E18 Party wall between dwellings	10.2000	0.0600	0.6120
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
P1 Party wall - Ground floor	9.4800	0.0800	0.7584
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425
E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	17.7000	0.0500	0.8850
E5 Ground floor (normal)	19.3200	0.1600	3.0912
E6 Intermediate floor within a dwelling	19.3200	0.0000	0.0000
E16 Corner (normal)	10.2000	0.0900	0.9180
E12 Gable (insulation at ceiling level)	9.4800	0.0600	0.5688

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.3999 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 50.1286 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124	(38)
Average = Sum(39)m / 12 =	95.9240	95.6707	95.4225	94.2564	94.0382	93.0226	93.0226	92.8345	93.4138	94.0382	94.4796	94.9410	(39)
												94.2553	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0277	1.0250	1.0223	1.0098	1.0075	0.9966	0.9966	0.9946	1.0008	1.0075	1.0122	1.0172	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	(42b)
Hot water usage for other uses	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	(42c)
Average daily hot water use (litres/day)													65.7573 (43)

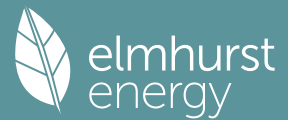
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	71.7412	69.7731	67.6244	64.9502	62.5645	60.0851	59.5701	61.7144	63.9137	66.4598	69.1576	71.6405	(44)
Energy content (annual)	113.6205	99.3559	103.9362	88.9136	84.2238	73.8817	72.0449	76.4153	78.8119	90.1853	98.5277	112.1718	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 1092.0887
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	96.5775	84.4526	88.3458	75.5765	71.5902	62.7994	61.2381	64.9530	66.9901	76.6575	83.7486	95.3460	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	96.5775	84.4526	88.3458	75.5765	71.5902	62.7994	61.2381	64.9530	66.9901	76.6575	83.7486	95.3460	(64)
Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 928.2754 (64)

Electric shower(s) 928 (64)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 628.2380 (64a)

Heat gains from water heating, kWh/month

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37.9519 33.4157 35.5204 31.7140 30.9580 28.1582 28.1832 29.2987 29.5674 32.5983 34.1185 37.6440 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	(71)
Water heating gains (Table 5)	51.0106	49.7258	47.7425	44.0472	41.6102	39.1087	37.8806	39.3800	41.0658	43.8150	47.3868	50.5968	(72)
Total internal gains	495.4670	511.3329	488.3332	475.5386	451.3341	437.1899	420.6033	419.5594	432.1987	444.0472	469.3866	484.2392	(73)

6. Solar gains

[Jan]														
	Area				Solar flux		g		FF		Access		Gains	
	m2				Table 6a		Specific data		Specific data		factor		W	
					W/m2		or Table 6b		or Table 6c		Table 6d			
North	11.5300				10.6334		0.6300		0.7000		0.7700		37.4691 (74)	
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361	(83)	
Total gains	532.9361	582.9382	610.0082	670.9797	714.6112	719.0359	683.7426	628.3268	578.4914	529.2840	515.6095	515.4753	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	24.9701	25.0362	25.1013	25.4118	25.4708	25.7489	25.7489	25.8011	25.6411	25.4708	25.3518	25.2286	21.0000 (85)
alpha	2.6647	2.6691	2.6734	2.6941	2.6981	2.7166	2.7166	2.7201	2.7094	2.6981	2.6901	2.6819	
util living area	0.9638	0.9522	0.9341	0.8852	0.7984	0.6588	0.5286	0.5797	0.7686	0.9024	0.9493	0.9668	(86)
MIT	18.3924	18.6368	19.0461	19.6815	20.2660	20.7051	20.8839	20.8477	20.5160	19.7918	19.0144	18.3617	(87)
Th 2	20.0603	20.0626	20.0648	20.0752	20.0771	20.0862	20.0862	20.0878	20.0827	20.0771	20.0732	20.0691	(88)
util rest of house	0.9589	0.9456	0.9245	0.8672	0.7641	0.5971	0.4392	0.4918	0.7177	0.8835	0.9412	0.9622	(89)
MIT 2	17.6624	17.9053	18.3110	18.9378	19.4934	19.8897	20.0280	20.0069	19.7348	19.0543	18.2886	17.6378	(90)
Living area fraction	17.7925	18.0357	18.4420	19.0704	19.6311	20.0351	20.1806	20.1568	19.8741	19.1857	18.4180	17.7668	(91)
MIT	17.7925	18.0357	18.4420	19.0704	19.6311	20.0351	20.1806	20.1568	19.8741	19.1857	18.4180	17.7668	(92)
Temperature adjustment	17.7925	18.0357	18.4420	19.0704	19.6311	20.0351	20.1806	20.1568	19.8741	19.1857	18.4180	17.7668	(93)
adjusted MIT	17.7925	18.0357	18.4420	19.0704	19.6311	20.0351	20.1806	20.1568	19.8741	19.1857	18.4180	17.7668	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9425	0.9266	0.9028	0.8433	0.7450	0.5933	0.4491	0.4990	0.7044	0.8605	0.9219	0.9467	(94)
Useful gains	502.2776	540.1625	550.7092	565.8317	532.3783	426.5971	307.0716	313.5248	407.4710	455.4476	475.3583	488.0137	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1294.2554	1256.7057	1139.5391	958.6213	745.8289	505.5841	333.0794	348.7589	539.3797	807.3873	1069.3174	1288.0487	(97)
Space heating kWh	589.2315	481.5171	438.0895	282.8085	158.8072	0.0000	0.0000	0.0000	0.0000	261.8432	427.6506	595.2260	(98a)
Space heating requirement - total per year (kWh/year)												3235.1735	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	589.2315	481.5171	438.0895	282.8085	158.8072	0.0000	0.0000	0.0000	0.0000	261.8432	427.6506	595.2260	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3235.1735	
Space heating per m ²												34.6601	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	874.4121	688.3669	705.5421	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6866	0.7563	0.7160	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	600.3880	520.6447	505.1390	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	777.3301	739.0574	677.0741	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	127.3983	162.4990	127.9197	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.8496	40.6248	31.9799	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												104.4543	(107)
Energy for space heating												34.6601	(99)
Energy for space cooling												1.1191	(108)
Total												35.7792	(109)
Fabric Energy Efficiency (DFEE)												35.8	(109)

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SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	30.0000 / (5) = 0.1260 (8)
Pressure Test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			11.5300	1.1450	13.2023		(27)
Ground Floor			46.6700	0.1300	6.0671		(28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090		(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337		(30)
Total net area of external elements Aum (A, m ²)			191.8700				(31)
Fabric heat loss, W/K = Sum (A x U)							(32)
Party Wall 1			48.3500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							92.3808 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)				9.8400	0.0600	0.5904	
E18 Party wall between dwellings				10.2000	0.0600	0.6120	
P4 Party wall - Roof (insulation at ceiling level)				9.4800	0.1200	1.1376	
P1 Party wall - Ground floor				9.4800	0.0800	0.7584	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				9.4800	0.0000	0.0000	
E2 Other lintels (including other steel lintels)				8.8500	0.0500	0.4425	
E3 Sill				7.9200	0.0500	0.3960	
E4 Jamb				17.7000	0.0500	0.8850	
E5 Ground floor (normal)				19.3200	0.1600	3.0912	
E6 Intermediate floor within a dwelling				19.3200	0.0000	0.0000	
E16 Corner (normal)				10.2000	0.0900	0.9180	
E12 Gable (insulation at ceiling level)				9.4800	0.0600	0.5688	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3999 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 51.0620 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124 (38)
Heat transfer coeff	96.8574	96.6041	96.3559	95.1898	94.9716	93.9560	93.9560	93.7679	94.3472	94.9716	95.4130	95.8744 (39)
Average = Sum(39)m / 12 =												95.1887
HLP	1.0377	1.0350	1.0323	1.0198	1.0175	1.0066	1.0066	1.0046	1.0108	1.0175	1.0222	1.0272 (40)
HLP (average)												1.0198
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6687 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	(42b)
Hot water usage for other uses												
41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	(42c)
Average daily hot water use (litres/day)												65.7573 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
71.7412	69.7731	67.6244	64.9502	62.5645	60.0851	59.5701	61.7144	63.9137	66.4598	69.1576	71.6405	(44)
Energy content (annual)	113.6205	99.3559	103.9362	88.9136	84.2238	73.8817	72.0449	76.4153	78.8119	90.1853	98.5277	112.1718 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1092.0887
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
96.5775	84.4526	88.3458	75.5765	71.5902	62.7994	61.2381	64.9530	66.9901	76.6575	83.7486	95.3460	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	96.5775	84.4526	88.3458	75.5765	71.5902	62.7994	61.2381	64.9530	66.9901	76.6575	83.7486	95.3460 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 928.2754 (64)
Electric shower(s)	55.2300	49.2104	53.7359	51.2795	52.2417	49.8335	51.4946	52.2417	51.2795	53.7359	52.7254	55.2300 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 628.2380 (64a)
Heat gains from water heating, kWh/month												
37.9519	33.4157	35.5204	31.7140	30.9580	28.1582	28.1832	29.2987	29.5674	32.5983	34.1185	37.6440 (65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	51.0106	49.7258	47.7425	44.0472	41.6102	39.1087	37.8806	39.3800	41.0658	43.8150	47.3868	50.5968 (72)
Total internal gains	495.4670	511.3329	488.3332	475.5386	451.3341	437.1899	420.6033	419.5594	432.1987	444.0472	469.3866	484.2392 (73)

6. Solar gains

[Jan]												Gains
	Area				Solar flux		g		FF		Access	W
	m2				Table 6a		Specific data		Specific data		factor	
					W/m2		or Table 6b		or Table 6c		Table 6d	
North	11.5300				10.6334		0.6300		0.7000		0.7700	37.4691 (74)
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	532.9361	582.9382	610.0082	670.9797	714.6112	719.0359	683.7426	628.3268	578.4914	529.2840	515.6095	515.4753 (84)

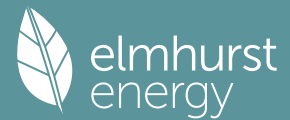
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.7294	24.7943	24.8581	25.1627	25.2205	25.4931	25.4931	25.5442	25.3874	25.2205	25.1038	24.9830
alpha	2.6486	2.6530	2.6572	2.6775	2.6814	2.6995	2.6995	2.7029	2.6925	2.6814	2.6736	2.6655
util living area	0.9639	0.9524	0.9345	0.8862	0.8002	0.6617	0.5318	0.5829	0.7707	0.9031	0.9495	0.9669 (86)
MIT	18.3652	18.6102	19.0217	19.6609	20.2510	20.6967	20.8798	20.8427	20.5052	19.7740	18.9911	18.3343 (87)
Th 2	20.0520	20.0543	20.0565	20.0669	20.0688	20.0778	20.0778	20.0795	20.0744	20.0688	20.0649	20.0608 (88)
util rest of house	0.9590	0.9458	0.9249	0.8681	0.7658	0.5996	0.4415	0.4942	0.7196	0.8842	0.9415	0.9623 (89)
MIT 2	17.6301	17.8736	18.2816	18.9121	19.4734	19.8760	20.0178	19.9960	19.7190	19.0314	18.2602	17.6053 (90)
Living area fraction	17.7612	18.0049	18.4135	19.0456	19.6120	20.0223	20.1715	20.1470	19.8592	19.1638	18.3905	17.7352 (91)
MIT	17.7612	18.0049	18.4135	19.0456	19.6120	20.0223	20.1715	20.1470	19.8592	19.1638	18.3905	17.7352 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7612	18.0049	18.4135	19.0456	19.6120	20.0223	20.1715	20.1470	19.8592	19.1638	18.3905	17.7352 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation	0.9425	0.9267	0.9031	0.8440	0.7464	0.5955	0.4514	0.5012	0.7060	0.8611	0.9221	0.9467 (94)
Useful gains	502.2972	540.2364	550.8777	566.3076	533.3750	428.1540	308.6085	314.9311	408.3890	455.7432	475.4378	488.0236 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1303.8135	1265.9917	1147.9380	965.7594	751.4189	509.4569	335.5594	351.3464	543.3602	813.3187	1077.2625	1297.6810 (97)
Space heating kWh	596.3282	487.7075	444.2129	287.6053	162.2246	0.0000	0.0000	0.0000	0.0000	266.0362	433.3138	602.3851 (98a)
Space heating requirement - total per year (kWh/year)												3279.8135
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	596.3282	487.7075	444.2129	287.6053	162.2246	0.0000	0.0000	0.0000	0.0000	266.0362	433.3138	602.3851 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3279.8135
Space heating per m2												(98c) / (4) = 35.1383 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	883.1860	695.2741	712.6359	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6816	0.7516	0.7110	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	601.9893	522.5496	506.6854	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	777.3301	739.0574	677.0741	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	126.2454	161.0818	126.7692	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.5613	40.2704	31.6923	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												103.5241 (107)
Energy for space heating												35.1383 (99)
Energy for space cooling												1.1091 (108)
Total												36.2475 (109)
Fabric Energy Efficiency (TFEE)												36.2 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	238.0170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

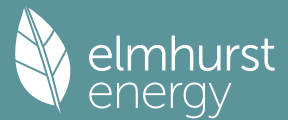
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			11.5300	1.1450	13.2023		(27)

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Total internal gains	177.7434	174.9358	169.4261	157.2125	149.7613	141.9594	137.1072	141.0248	145.6291	154.2858	165.9864	176.1715 (72)
	687.9424	685.0915	664.3208	625.7179	587.8197	550.6715	530.6333	534.5942	554.4595	592.5056	634.6532	671.1845 (73)

6. Solar gains

[Jan]	Area m2			Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d	Gains W	
North	11.5300			10.6334		0.6300		0.7000		0.7700	37.4691 (74)	
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	725.4115	756.6968	785.9958	821.1590	851.0968	832.5175	793.7726	743.3616	700.7522	677.7424	680.8761	702.4205 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.9701	25.0362	25.1013	25.4118	25.4708	25.7489	25.7489	25.8011	25.6411	25.4708	25.3518	25.2286
alpha	2.6647	2.6691	2.6734	2.6941	2.6981	2.7166	2.7166	2.7201	2.7094	2.6981	2.6901	2.6819
util living area	0.9299	0.9176	0.8911	0.8356	0.7394	0.6001	0.4705	0.5125	0.6992	0.8463	0.9097	0.9348 (86)
MIT	18.7779	18.9710	19.3596	19.9039	20.4079	20.7678	20.9131	20.8881	20.6258	20.0234	19.3277	18.7425 (87)
Th 2	20.0603	20.0626	20.0648	20.0752	20.0771	20.0862	20.0862	20.0878	20.0827	20.0771	20.0732	20.0691 (88)
util rest of house	0.9211	0.9073	0.8768	0.8126	0.7008	0.5381	0.3865	0.4286	0.6435	0.8203	0.8968	0.9266 (89)
MIT 2	17.4666	17.7109	18.2001	18.8801	19.4843	19.8921	20.0318	20.0139	19.7474	19.0383	18.1708	17.4274 (90)
Living area fraction	17.7004	17.9355	18.4068	19.0626	19.6490	20.0482	20.1889	20.1698	19.9040	19.2139	18.3770	17.6618 (91)
MIT	17.7004	17.9355	18.4068	19.0626	19.6490	20.0482	20.1889	20.1698	19.9040	19.2139	18.3770	17.6618 (92)
Temperature adjustment	17.7004	17.9355	18.4068	19.0626	19.6490	20.0482	20.1889	20.1698	19.9040	19.2139	18.3770	17.6618 (93)
adjusted MIT	17.7004	17.9355	18.4068	19.0626	19.6490	20.0482	20.1889	20.1698	19.9040	19.2139	18.3770	17.6618 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8919	0.8766	0.8448	0.7827	0.6807	0.5353	0.3964	0.4366	0.6314	0.7909	0.8661	0.8983 (94)
Useful gains	646.9585	663.3488	664.0308	642.7571	579.3360	445.6489	314.6858	324.5615	442.4474	536.0468	589.7261	631.0031 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1285.4178	1247.1162	1136.1759	957.8911	747.5064	506.8057	333.8470	349.9648	542.1727	810.0386	1065.4483	1278.0803 (97)
Space heating kWh	475.0138	392.2917	351.2760	226.8965	125.1188	0.0000	0.0000	0.0000	0.0000	203.8499	342.5200	481.4254 (98a)
Space heating requirement - total per year (kWh/year)												2598.3921
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	475.0138	392.2917	351.2760	226.8965	125.1188	0.0000	0.0000	0.0000	0.0000	203.8499	342.5200	481.4254 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2598.3921
Space heating per m2										(98c) / (4) =		27.8379 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	475.0138	392.2917	351.2760	226.8965	125.1188	0.0000	0.0000	0.0000	0.0000	203.8499	342.5200	481.4254 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	190.0815	156.9795	140.5666	90.7949	50.0675	0.0000	0.0000	0.0000	0.0000	81.5726	137.0628	192.6472 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	177.8890	157.4333	167.2603	146.7607	142.1308	127.8975	125.9601	130.9664	132.4357	147.9126	157.6110	175.8802 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)

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Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													1039.7728	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													175.1000	
Water heating fuel used													1790.1376	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													242.5617	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													3072.4721	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1039.7728	16.4900	171.4585	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1790.1376	16.4900	295.1937	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	242.5617	16.4900	39.9984	(250)
Additional standing charges			0.0000	(251)
Total energy cost			506.6506	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		1.3184	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	78.6279	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1039.7728	0.1543	160.3911	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1790.1376	0.1409	252.2626	(264)
Space and water heating			412.6538	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	242.5617	0.1443	35.0092	(268)
Total CO2, kg/year			447.6629	(272)
CO2 emissions per m2			4.8000	(273)
EI value			95.6638	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)	
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	238.0170 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)

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Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6f)
3 * 10 = 30.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure Test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
30.0000 / (5) = 0.1260 (8)
Yes
Blower Door
5.0000 (17)
0.3760 (18)
2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3196 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate													
Effective ac	0.2877	0.2637	0.2557	0.2557	0.2637	0.2317	0.2477	0.2237	0.2237	0.2397	0.2237	0.2557	(22b)
	0.5414	0.5348	0.5327	0.5327	0.5348	0.5269	0.5307	0.5250	0.5250	0.5287	0.5250	0.5327	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.5300	1.1450	13.2023			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			46.6700	0.1100	5.1337	75.0000	3500.2500	(28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090	9.0000	765.4500	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300	(30)
Total net area of external elements Aum(A, m2)			191.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.7287			(33)
Party Wall 1			48.3500	0.0000	0.0000	20.0000	967.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			110.0000			9.0000	990.0000	(32c)
Internal Floor 1			46.6700			18.0000	840.0600	(32d)
Internal Ceiling 1			46.6700			9.0000	420.0300	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 8622.8200 (34)
List of Thermal Bridges 92.3808 (35)

K1 Element	Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904	
E18 Party wall between dwellings	10.2000	0.0600	0.6120	
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376	
P1 Party wall - Ground floor	9.4800	0.0800	0.7584	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000	
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425	
E3 Sill	7.9200	0.0500	0.3960	
E4 Jamb	17.7000	0.0500	0.8850	
E5 Ground floor (normal)	19.3200	0.1600	3.0912	
E6 Intermediate floor within a dwelling	19.3200	0.0000	0.0000	
E16 Corner (normal)	10.2000	0.0900	0.9180	
E12 Gable (insulation at ceiling level)	9.4800	0.0600	0.5688	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.3999 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.1286 (37)

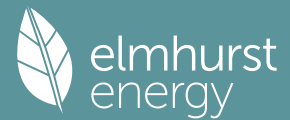
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	42.5228	42.0037	41.8407	41.8407	42.0037	41.3818	41.6827	41.2389	41.2389	41.5298	41.2389	41.8407	(38)
Heat transfer coeff	92.6514	92.1323	91.9693	91.9693	92.1323	91.5104	91.8113	91.3675	91.3675	91.6584	91.3675	91.9693	(39)
Average = Sum(39)m / 12 =												91.8255	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9926	0.9871	0.9853	0.9853	0.9871	0.9804	0.9836	0.9789	0.9789	0.9820	0.9789	0.9853	(40)
HLP (average)												0.9838	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687 (42)
Hot water usage for mixer showers													
	86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768	(42a)
Hot water usage for baths	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	(42b)
Hot water usage for other uses	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	(42c)
Average daily hot water use (litres/day)												145.2373	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173	(44)
Energy conte	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340	(45)
Energy content (annual)										Total = Sum(45)m =		2412.3938	
Distribution loss (46)m = 0.15 x (45)m	37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951	(46)
Water storage loss:													
Store volume												300.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7368	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.2281	(55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

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Total heat required for water heating calculated for each month												
	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
Total per year (kWh/year) = Sum(64)m =												3134.5309 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	126.0530	113.1930	111.4224	102.2107	102.0077	104.9224	104.8529	114.7886	119.5102	131.0716 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	177.7434	174.9358	169.4261	157.2125	149.7613	141.9594	137.1072	141.0248	145.6291	154.2858	165.9864	176.1715 (72)
Total internal gains	687.9424	685.0915	664.3208	625.7179	587.8197	550.6715	530.6333	534.5942	554.4595	592.5056	634.6532	671.1845 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					11.5300	13.0723		0.6300	0.7000	0.7700		46.0630 (74)
Solar gains	46.0630	78.1341	133.1561	221.7956	289.9619	335.2033	307.1640	247.0841	171.6243	99.6585	57.2009	37.3234 (83)
Total gains	734.0055	763.2256	797.4769	847.5135	877.7816	885.8748	837.7974	781.6784	726.0838	692.1641	691.8541	708.5078 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	25.8520	25.9977	26.0438	26.0438	25.9977	26.1744	26.0886	26.2153	26.2153	26.1321	26.2153	26.0438
alpha	2.7235	2.7332	2.7363	2.7363	2.7332	2.7450	2.7392	2.7477	2.7477	2.7421	2.7477	2.7363
util living area	0.9176	0.9070	0.8718	0.8020	0.6751	0.5018	0.3752	0.3876	0.6305	0.8004	0.8878	0.9230 (86)
MIT	19.0807	19.2094	19.6247	20.1244	20.6036	20.8790	20.9606	20.9590	20.7569	20.2947	19.6443	19.0537 (87)
Th 2	20.0895	20.0941	20.0956	20.0956	20.0941	20.0997	20.0970	20.1010	20.1010	20.0984	20.1010	20.0956 (88)
util rest of house	0.9072	0.8954	0.8550	0.7748	0.6286	0.4326	0.2881	0.2959	0.5658	0.7663	0.8714	0.9131 (89)
MIT 2	17.8657	18.0293	18.5487	19.1599	19.7185	20.0104	20.0774	20.0811	19.8993	19.3781	18.5831	17.8363 (90)
Living area fraction	18.0823	18.2397	18.7406	19.3319	19.8763	20.1652	20.2349	20.2376	20.0522	19.5415	18.7723	18.0533 (91)
MIT	18.0823	18.2397	18.7406	19.3319	19.8763	20.1652	20.2349	20.2376	20.0522	19.5415	18.7723	18.0533 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0823	18.2397	18.7406	19.3319	19.8763	20.1652	20.2349	20.2376	20.0522	19.5415	18.7723	18.0533 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8775	0.8651	0.8242	0.7483	0.6163	0.4379	0.3018	0.3103	0.5620	0.7418	0.8411	0.8842 (94)
Useful gains	644.1111	660.2506	657.2755	634.2217	541.0031	387.9353	252.8851	242.5927	408.0637	513.4521	581.9080	626.4347 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	1193.5658	1173.7356	1052.1799	885.8369	651.9544	417.7671	260.2753	250.1271	470.7444	709.5717	965.9651	1182.1136 (97)
Space heating kWh	408.7942	345.0619	293.8088	181.1629	82.5477	0.0000	0.0000	0.0000	0.0000	145.9129	276.5211	413.4251 (98a)
Space heating requirement - total per year (kWh/year)												2147.2349
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	408.7942	345.0619	293.8088	181.1629	82.5477	0.0000	0.0000	0.0000	0.0000	145.9129	276.5211	413.4251 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2147.2349
Space heating per m ²										(98c) / (4) =		23.0044 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												0.0000 (201)
Efficiency of main space heating system 1 (in %)												1.0000 (202)
Efficiency of main space heating system 2 (in %)												249.9000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (207)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												0.0000 (208)

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Space heating efficiency (main heating system 1)	408.7942	345.0619	293.8088	181.1629	82.5477	0.0000	0.0000	0.0000	0.0000	145.9129	276.5211	413.4251 (98)
Space heating fuel (main heating system)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating efficiency (main heating system 2)	163.5831	138.0800	117.5706	72.4942	33.0323	0.0000	0.0000	0.0000	0.0000	58.3885	110.6527	165.4362 (211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	177.8890	157.4333	167.2603	146.7607	142.1308	127.8975	125.9601	130.9664	132.4357	147.9126	157.6110	175.8802 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa (231)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting (232)m	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												859.2376 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1790.1376 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												242.5617 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												2891.9369 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	859.2376	26.0600	223.9173 (240)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1790.1376	26.0600	466.5099 (247)	
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)	
Energy for lighting	242.5617	26.0600	63.2116 (250)	
Additional standing charges			0.0000 (251)	
Total energy cost			753.6388 (255)	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	859.2376	0.1549	133.0876 (261)	
Total CO2 associated with community systems			0.0000 (373)	
Water heating (other fuel)	1790.1376	0.1409	252.2626 (264)	
Space and water heating			385.3502 (265)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)	
Energy for lighting	242.5617	0.1443	35.0092 (268)	
Total CO2, kg/year			420.3593 (272)	

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	859.2376	1.5735	1351.9804 (275)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1790.1376	1.5211	2722.9151 (278)	
Space and water heating			4074.8955 (279)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)	
Energy for lighting	242.5617	1.5338	372.0493 (282)	
Total Primary energy kWh/year			4446.9448 (286)	

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PLANNING

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.2	-£ 102	-49 kg (11.6%)
U Solar photovoltaic panels	+ 6.2	-£ 246	-127 kg (34.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£102	0.52 kg/m²	B 81 A 96
Solar photovoltaic panels	£246	1.36 kg/m²	B 87 A 97
Total Savings	£348	1.89 kg/m²	

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£754	£652	£102
Space heating	£224	£245	-£21
Water heating	£467	£343	£123
Lighting	£63	£63	£0
Generated (PV)	-£0	-£246	£246
Total cost of fuels	£754	£406	£348
Total cost of uses	£754	£405	£348
Delivered energy	31 kWh/m²	17 kWh/m²	14 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m²	5 kg/m²	3 kg/m²	2 kg/m²
Primary energy	48 kWh/m²	26 kWh/m²	21 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	238.0170 (5)

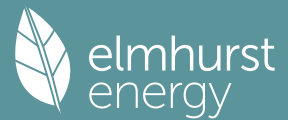
2. Ventilation rate

	m³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

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3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Windows (Uw = 1.20)			11.5300	1.1450	13.2023			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			46.6700	0.1100	5.1337	75.0000	3500.2500	(28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090	9.0000	765.4500	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300	(30)
Total net area of external elements Aum(A, m ²)			191.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.7287			(33)
Party Wall 1			48.3500	0.0000	0.0000	20.0000	967.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			110.0000			9.0000	990.0000	(32c)
Internal Floor 1			46.6700			18.0000	840.0600	(32d)
Internal Ceiling 1			46.6700			9.0000	420.0300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8622.8200 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 92.3808 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904	
E18 Party wall between dwellings	10.2000	0.0600	0.6120	
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376	
P1 Party wall - Ground floor	9.4800	0.0800	0.7584	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000	
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425	
E3 Sill	7.9200	0.0500	0.3960	
E4 Jamb	17.7000	0.0500	0.8850	
E5 Ground floor (normal)	19.3200	0.1600	3.0912	
E6 Intermediate floor within a dwelling	19.3200	0.0000	0.0000	
E16 Corner (normal)	10.2000	0.0900	0.9180	
E12 Gable (insulation at ceiling level)	9.4800	0.0600	0.5688	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.3999 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 50.1286 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

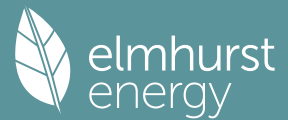
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124	(38)
Heat transfer coeff	95.9240	95.6707	95.4225	94.2564	94.0382	93.0226	93.0226	92.8345	93.4138	94.0382	94.4796	94.9410	(39)
Average = Sum(39)m / 12 =												94.2553	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0277	1.0250	1.0223	1.0098	1.0075	0.9966	0.9966	0.9946	1.0008	1.0075	1.0122	1.0172	(40)
HLP (average)												1.0098	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687 (42)
Hot water usage for mixer showers													
86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768	85.8768	(42a)
Hot water usage for baths													
29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	29.6800	(42b)
Hot water usage for other uses													
41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	41.9605	(42c)
Average daily hot water use (litres/day)													145.2373 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173	(44)
Energy conte	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340	(45)
Energy content (annual)										Total =	Sum(45)m =	2412.3938	
Distribution loss (46)m = 0.15 x (45)m													
37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951	36.9951	(46)
Water storage loss:													
Store volume													300.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7368 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.2281 (55)
Total storage loss													
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	(56)
If cylinder contains dedicated solar storage													
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
311.4837	275.6657	291.4770	250.2243	236.0767	211.3418	207.5292	217.2257	226.4921	257.5992	275.9769	307.9662	307.9662	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.8000 (H2)
Collector linear heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0000 (H4)
Collector loop efficiency													0.9000 (H5)
Incidence angle modifier													1.0000 (H6)
Overshading factor													0.8000 (H8)
Overall heat loss coefficient of system													6.5000 (H10)
Heat loss coefficient of collector loop													3.9667 (H11)
Dedicated solar storage volume													75.0000 (H12)
Effective solar volume													75.0000 (H14)
Reference volume													225.0000 (H15)
Storage tank correction coefficient													1.3161 (H16)
Heat delivered to hot water													641.7638 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													641.7638
Solar input	-0.0000	-16.1808	-59.3006	-82.3728	-108.8130	-100.5524	-99.9531	-86.7035	-59.0714	-28.8162	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
311.4837	259.4849	232.1764	167.8515	127.2637	110.7894	107.5761	130.5222	167.4206	228.7830	275.9769	307.9662	307.9662	(64)
Total per year (kWh/year) = Sum(64)m =													2427.2947 (64)
Electric shower(s)													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	124.9364	107.7902	101.1869	92.1254	91.5862	95.2453	100.5306	113.6720	119.5102	131.0716 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	177.7434	174.9358	167.9253	149.7085	136.0040	127.9519	123.0997	128.0178	139.6259	152.7850	165.9864	176.1715 (72)
Total internal gains	687.9424	685.0915	662.8200	618.2139	574.0623	536.6641	516.6259	521.5873	548.4563	591.0048	634.6532	671.1845 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					11.5300	10.6334		0.6300	0.7000	0.7700		37.4691 (74)
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	725.4115	756.6968	784.4950	813.6550	837.3394	818.5100	779.7651	730.3547	694.7490	676.2416	680.8761	702.4205 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.9701	25.0362	25.1013	25.4118	25.4708	25.7489	25.7489	25.8011	25.6411	25.4708	25.3518	25.2286
alpha	2.6647	2.6691	2.6734	2.6941	2.6981	2.7166	2.7166	2.7201	2.7094	2.6981	2.6901	2.6819
util living area	0.9299	0.9176	0.8915	0.8381	0.7452	0.6070	0.4773	0.5194	0.7025	0.8468	0.9097	0.9348 (86)
MIT	18.7779	18.9710	19.3571	19.8937	20.3951	20.7611	20.9099	20.8843	20.6211	20.0213	19.3277	18.7425 (87)
Th 2	20.0603	20.0626	20.0648	20.0752	20.0771	20.0862	20.0862	20.0878	20.0827	20.0771	20.0732	20.0691 (88)
util rest of house	0.9211	0.9073	0.8772	0.8154	0.7070	0.5449	0.3926	0.4350	0.6469	0.8209	0.8968	0.9266 (89)
MIT 2	17.4666	17.7109	18.1971	18.8681	19.4704	19.8859	20.0296	20.0112	19.7428	19.0359	18.1708	17.4274 (90)
Living area fraction									fLA = Living area / (4) =			0.1783 (91)
MIT	17.7004	17.9355	18.4039	19.0510	19.6353	20.0419	20.1866	20.1668	19.8994	19.2115	18.3770	17.6618 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7004	17.9355	18.4039	19.0510	19.6353	20.0419	20.1866	20.1668	19.8994	19.2115	18.3770	17.6618 (93)

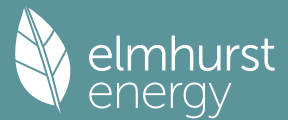
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8919	0.8766	0.8453	0.7854	0.6863	0.5416	0.4024	0.4428	0.6345	0.7916	0.8661	0.8983 (94)
Useful gains	646.9585	663.3488	663.1090	639.0188	574.6828	443.3201	313.7669	323.4076	440.8275	535.2805	589.7261	631.0031 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1285.4178	1247.1162	1135.8974	956.7947	746.2180	506.2215	333.6321	349.6906	541.7411	809.8137	1065.4483	1278.0803 (97)
Space heating kWh	475.0138	392.2917	351.7546	228.7987	127.6222	0.0000	0.0000	0.0000	0.0000	204.2527	342.5200	481.4254 (98a)
Space heating requirement - total per year (kWh/year)												2603.6790
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	475.0138	392.2917	351.7546	228.7987	127.6222	0.0000	0.0000	0.0000	0.0000	204.2527	342.5200	481.4254 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2603.6790
Space heating per m2										(98c) / (4) =		27.8946 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	475.0138	392.2917	351.7546	228.7987	127.6222	0.0000	0.0000	0.0000	0.0000	204.2527	342.5200	481.4254 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	190.0815	156.9795	140.7581	91.5561	51.0693	0.0000	0.0000	0.0000	0.0000	81.7338	137.0628	192.6472 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	311.4837	259.4849	232.1764	167.8515	127.2637	110.7894	107.5761	130.5222	167.4206	228.7830	275.9769	307.9662	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(217)
Fuel for water heating, kWh/month	177.8890	148.1924	132.5965	95.8604	72.6806	63.2721	61.4370	74.5415	95.6143	130.6585	157.6110	175.8802	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.3162	-57.4369	-86.5394	-99.9314	-107.0203	-95.0525	-93.6728	-88.4938	-78.3914	-66.5057	-43.1279	-32.7569	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1041.8884	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1386.2334	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												242.5617	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-887.2453	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1863.4382	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1041.8884	16.4900	171.8074	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1386.2334	16.4900	228.5899	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	242.5617	16.4900	39.9984	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-887.2453	16.4900	-146.3068	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-146.3068	(252)
Total energy cost			307.2810	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.7996	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	87.0380	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1041.8884	0.1542	160.6834	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1386.2334	0.1450	200.9589	(264)
Space and water heating			361.6423	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	242.5617	0.1443	35.0092	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-887.2453	0.1344	-119.2684	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-119.2684	(269)
Total CO2, kg/year			288.4801	(272)
CO2 emissions per m2			3.0900	(273)
EI value			97.2057	
EI rating			97	(274)
EI band			A	

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SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

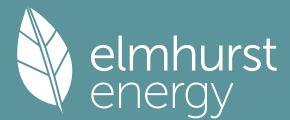
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.2877	0.2637	0.2557	0.2557	0.2637	0.2317	0.2477	0.2237	0.2237	0.2397	0.2237	0.2557 (22b)
Effective ac	0.5414	0.5348	0.5327	0.5327	0.5348	0.5269	0.5307	0.5250	0.5250	0.5287	0.5250	0.5327 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			11.5300	1.1450	13.2023		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			46.6700	0.1100	5.1337	75.0000	3500.2500 (28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090	9.0000	765.4500 (29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300 (30)
Total net area of external elements Aum(A, m ²)			191.8700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	40.7287			(33)
Party Wall 1			48.3500	0.0000	0.0000	20.0000	967.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)
FF			110.0000			9.0000	990.0000 (32c)
Internal Floor 1			46.6700			18.0000	840.0600 (32d)
Internal Ceiling 1			46.6700			9.0000	420.0300 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	8622.8200 (34)			
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							92.3808 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)				9.8400	0.0600	0.5904	
E18 Party wall between dwellings				10.2000	0.0600	0.6120	
P4 Party wall - Roof (insulation at ceiling level)				9.4800	0.1200	1.1376	
P1 Party wall - Ground floor				9.4800	0.0800	0.7584	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				9.4800	0.0000	0.0000	
E2 Other lintels (including other steel lintels)				8.8500	0.0500	0.4425	
E3 Sill				7.9200	0.0500	0.3960	
E4 Jamb				17.7000	0.0500	0.8850	
E5 Ground floor (normal)				19.3200	0.1600	3.0912	
E6 Intermediate floor within a dwelling				19.3200	0.0000	0.0000	
E16 Corner (normal)				10.2000	0.0900	0.9180	
E12 Gable (insulation at ceiling level)				9.4800	0.0600	0.5688	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3999 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	50.1286 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	42.5228	42.0037	41.8407	41.8407	42.0037	41.3818	41.6827	41.2389	41.2389	41.5298	41.2389	41.8407 (38)
Average = Sum(39)m / 12 =	92.6514	92.1323	91.9693	91.9693	92.1323	91.5104	91.8113	91.3675	91.3675	91.6584	91.3675	91.9693 (39)
												91.8255
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9926	0.9871	0.9853	0.9853	0.9871	0.9804	0.9836	0.9789	0.9789	0.9820	0.9789	0.9853 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6687 (42)
Hot water usage for mixer showers												85.8768 (42a)
Hot water usage for baths												29.6800 (42b)
Hot water usage for other uses												41.9605 (42c)
Average daily hot water use (litres/day)												145.2373 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173 (44)
Energy content (annual)	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340 (45)
Distribution loss (46)m = 0.15 x (45)m												2412.3938
Total = Sum(45)m =												2412.3938
Water storage loss:												36.9951 (46)
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												0.0103 (51)
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.7368 (52)
Volume factor from Table 2a												0.5400 (53)
Temperature factor from Table 2b												1.2281 (55)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss												38.0698 (56)
If cylinder contains dedicated solar storage												38.0698 (57)
Primary loss												23.2624 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												307.9662 (62)
WWHRS												0.0000 (63a)
PV diverter												-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												761.8610 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												761.8610
Solar input	-1.8066	-20.9016	-66.2724	-94.0035	-118.5966	-119.4269	-116.0534	-103.7445	-72.6012	-40.8605	-7.5938	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	309.6771	254.7641	225.2046	156.2208	117.4800	91.9148	91.4758	113.4813	153.8909	216.7387	268.3831	307.9662 (64)
Electric shower(s)												2307.1975 (64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	124.9364	107.7902	101.1869	92.1254	91.5862	95.2453	100.5306	113.6720	119.5102	131.0716 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657 (68)
Pumps, fans	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Total internal gains	177.7434	174.9358	167.9253	149.7085	136.0040	127.9519	123.0997	128.0178	139.6259	152.7850	165.9864	176.1715 (72)
	687.9424	685.0915	662.8200	618.2139	574.0623	536.6641	516.6259	521.5873	548.4563	591.0048	634.6532	671.1845 (73)

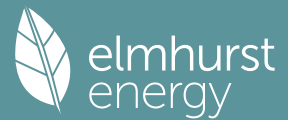
6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains	
	m2	Table 6a	Specific data	Specific data	factor	W	
		W/m2	or Table 6b	or Table 6c	Table 6d		
North	11.5300	13.0723	0.6300	0.7000	0.7700	46.0630 (74)	
Solar gains	46.0630	78.1341	133.1561	221.7956	289.9619	335.2033	307.1640
Total gains	734.0055	763.2256	795.9761	840.0095	864.0242	871.8674	823.7899

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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tau	25.8520	25.9977	26.0438	26.0438	25.9977	26.1744	26.0886	26.2153	26.2153	26.1321	26.2153	26.0438
alpha	2.7235	2.7332	2.7363	2.7363	2.7332	2.7450	2.7392	2.7477	2.7477	2.7421	2.7477	2.7363
util living area	0.9176	0.9070	0.8722	0.8048	0.6813	0.5081	0.3809	0.3934	0.6338	0.8011	0.8878	0.9230 (86)
MIT	19.0807	19.2094	19.6223	20.1154	20.5940	20.8752	20.9591	20.9575	20.7535	20.2929	19.6443	19.0537 (87)
Th 2	20.0895	20.0941	20.0956	20.0956	20.0941	20.0997	20.0970	20.1010	20.1010	20.0984	20.1010	20.0956 (88)
util rest of house	0.9072	0.8954	0.8554	0.7778	0.6349	0.4385	0.2927	0.3006	0.5692	0.7671	0.8714	0.9131 (89)
MIT 2	17.8657	18.0293	18.5459	19.1496	19.7086	20.0074	20.0767	20.0803	19.8963	19.3761	18.5831	17.8363 (90)
Living area fraction									FLA = Living area / (4) =			0.1783 (91)
MIT	18.0823	18.2397	18.7378	19.3218	19.8665	20.1621	20.2340	20.2367	20.0491	19.5395	18.7723	18.0533 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0823	18.2397	18.7378	19.3218	19.8665	20.1621	20.2340	20.2367	20.0491	19.5395	18.7723	18.0533 (93)

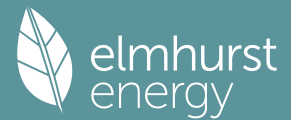
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8775	0.8651	0.8247	0.7511	0.6221	0.4435	0.3065	0.3151	0.5651	0.7425	0.8411	0.8842	(94)
Useful gains	644.1111	660.2506	656.4210	630.9487	537.5488	386.7027	252.5128	242.2166	406.9334	512.8169	581.9080	626.4347	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1193.5658	1173.7356	1051.9297	884.9098	651.0492	417.4766	260.1912	250.0420	470.4603	709.3931	965.9651	1182.1136	(97)
Space heating kWh	408.7942	345.0619	294.2585	182.8520	84.4443	0.0000	0.0000	0.0000	0.0000	146.2527	276.5211	413.4251	(98a)
Space heating requirement - total per year (kWh/year)												2151.6098	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	408.7942	345.0619	294.2585	182.8520	84.4443	0.0000	0.0000	0.0000	0.0000	146.2527	276.5211	413.4251	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2151.6098	
Space heating per m2										(98c) / (4) =		23.0513	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	408.7942	345.0619	294.2585	182.8520	84.4443	0.0000	0.0000	0.0000	0.0000	146.2527	276.5211	413.4251	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	163.5831	138.0800	117.7505	73.1701	33.7912	0.0000	0.0000	0.0000	0.0000	58.5245	110.6527	165.4362	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	309.6771	254.7641	225.2046	156.2208	117.4800	91.9148	91.4758	113.4813	153.8909	216.7387	268.3831	307.9662	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	176.8573	145.4963	128.6148	89.2181	67.0931	52.4928	52.2420	64.8094	87.8875	123.7799	153.2742	175.8802	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-45.1505	-60.2694	-89.3208	-104.1460	-108.3866	-100.7553	-98.5205	-94.1733	-84.1848	-72.2303	-50.4871	-37.8701	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												860.9883	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1317.6457	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												242.5617	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-945.4947	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1555.7010	(238)

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10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	860.9883	26.0600	224.3736 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1317.6457	26.0600	343.3785 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	242.5617	26.0600	63.2116 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-945.4947	26.0600	-246.3959
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-246.3959 (252)
Total energy cost			405.4157 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	860.9883	0.1549	133.3304 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1317.6457	0.1458	192.1256 (264)
Space and water heating			325.4560 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	242.5617	0.1443	35.0092 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-945.4947	0.1347	-127.3327
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-127.3327 (269)
Total CO2, kg/year			244.2294 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	860.9883	1.5733	1354.6296 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1317.6457	1.5394	2028.3462 (278)
Space and water heating			3382.9758 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	242.5617	1.5338	372.0493 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-945.4947	1.4977	-1416.0994
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1416.0994 (283)
Total Primary energy kWh/year			2459.9497 (286)

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Property Reference	FURNERS LANE 16				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 16, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	79 C	DER	4.87	TER	10.96	
Environmental	96 A	% DER < TER				55.57
CO ₂ Emissions (t/year)	0.42	DFEE	35.78	TFEE	36.25	
Compliance Check	See BREL	% DFEE < TFEE				1.29
% DPER < TPER	10.17	DPER	51.44	TPER	57.26	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			11.5300	1.1450	13.2023		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			46.6700	0.1100	5.1337	75.0000	3500.2500 (28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090	9.0000	765.4500 (29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300 (30)
Total net area of external elements Aum(A, m ²)			191.8700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.7287		(33)
Party Wall 1			48.3500	0.0000	0.0000	20.0000	967.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)
FF			110.0000			9.0000	990.0000 (32c)
Internal Floor 1			46.6700			18.0000	840.0600 (32d)
Internal Ceiling 1			46.6700			9.0000	420.0300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8622.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							92.3808 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)				9.8400	0.0600	0.5904	
E18 Party wall between dwellings				10.2000	0.0600	0.6120	

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P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
P1 Party wall - Ground floor	9.4800	0.0800	0.7584
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425
E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	17.7000	0.0500	0.8850
E5 Ground floor (normal)	19.3200	0.1600	3.0912
E6 Intermediate floor within a dwelling	19.3200	0.0000	0.0000
E16 Corner (normal)	10.2000	0.0900	0.9180
E12 Gable (insulation at ceiling level)	9.4800	0.0600	0.5688

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss

(38)m	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124	(38)
Heat transfer coeff	95.9240	95.6707	95.4225	94.2564	94.0382	93.0226	93.0226	92.8345	93.4138	94.0382	94.4796	94.9410	(39)
Average = Sum(39)m / 12 =												94.2553	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0277	1.0250	1.0223	1.0098	1.0075	0.9966	0.9966	0.9946	1.0008	1.0075	1.0122	1.0172	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687	(42)
Hot water usage for mixer showers	86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768	(42a)	
Hot water usage for baths	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	(42b)	
Hot water usage for other uses	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	(42c)	
Average daily hot water use (litres/day)												145.2373	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173	(44)	
Energy content (annual)	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340	(45)	
Distribution loss (46)m = 0.15 x (45)m	37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951	(46)	
Water storage loss:														
Store volume													300.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.7368	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													1.2281	(55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)	
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662	(64)	
12Total per year (kWh/year)													3134.5309	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3135	(64)
													0.0000	(64a)
													0.0000	(64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	126.0530	113.1930	111.4224	102.2107	102.0077	104.9224	104.8529	114.7886	119.5102	131.0716	(65)	

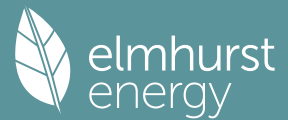
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	(71)
Water heating gains (Table 5)	177.7434	174.9358	169.4261	157.2125	149.7613	141.9594	137.1072	141.0248	145.6291	154.2858	165.9864	176.1715	(72)
Total internal gains	625.1999	639.5429	613.0168	591.7039	562.4852	540.0406	519.8299	521.2042	536.7620	557.5181	590.9862	612.8139	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	11.5300	10.6334	0.6300	0.7000	0.7700	37.4691 (74)

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Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	662.6690	711.1482	734.6918	787.1451	825.7623	821.8866	782.9691	729.9716	683.0547	642.7548	637.2091	644.0500 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.9701	25.0362	25.1013	25.4118	25.4708	25.7489	25.7489	25.8011	25.6411	25.4708	25.3518	25.2286
alpha	2.6647	2.6691	2.6734	2.6941	2.6981	2.7166	2.7166	2.7201	2.7094	2.6981	2.6901	2.6819
util living area	0.9419	0.9273	0.9043	0.8470	0.7502	0.6053	0.4757	0.5196	0.7089	0.8599	0.9209	0.9457 (86)
MIT	18.6572	18.8873	19.2731	19.8571	20.3841	20.7627	20.9107	20.8842	20.6118	19.9730	19.2491	18.6281 (87)
Th 2	20.0603	20.0626	20.0648	20.0752	20.0771	20.0862	20.0862	20.0878	20.0827	20.0771	20.0732	20.0691 (88)
util rest of house	0.9344	0.9180	0.8913	0.8251	0.7122	0.5432	0.3912	0.4352	0.6537	0.8354	0.9093	0.9387 (89)
MIT 2	17.3160	17.6071	18.0943	18.8249	19.4584	19.8874	20.0301	20.0111	19.7336	18.9795	18.0743	17.2845 (90)
Living area fraction	17.5551	17.8353	18.3045	19.0089	19.6234	20.0435	20.1871	20.1667	19.8902	19.1566	18.2837	0.1783 (91)
MIT	17.5551	17.8353	18.3045	19.0089	19.6234	20.0435	20.1871	20.1667	19.8902	19.1566	18.2837	17.5240 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5551	17.8353	18.3045	19.0089	19.6234	20.0435	20.1871	20.1667	19.8902	19.1566	18.2837	17.5240 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9071	0.8884	0.8599	0.7947	0.6911	0.5401	0.4010	0.4430	0.6407	0.8055	0.8795	0.9124 (94)
Useful gains	601.1298	631.8045	631.7624	625.5316	570.6814	443.8891	313.9810	323.3729	437.6039	517.7424	560.4485	587.6344 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1271.4820	1237.5294	1126.4131	952.8289	745.1066	506.3644	333.6822	349.6823	540.8797	804.6513	1056.6308	1264.9934 (97)
Space heating kWh	498.7420	407.0471	368.0201	235.6540	129.7724	0.0000	0.0000	0.0000	0.0000	213.4602	357.2513	503.9551 (98a)
Space heating requirement - total per year (kWh/year)												2713.9023
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	498.7420	407.0471	368.0201	235.6540	129.7724	0.0000	0.0000	0.0000	0.0000	213.4602	357.2513	503.9551 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2713.9023
Space heating per m2										(98c) / (4) =		29.0754 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	498.7420	407.0471	368.0201	235.6540	129.7724	0.0000	0.0000	0.0000	0.0000	213.4602	357.2513	503.9551 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	199.5766	162.8840	147.2670	94.2993	51.9297	0.0000	0.0000	0.0000	0.0000	85.4183	142.9577	201.6627 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	177.8890	157.4333	167.2603	146.7607	142.1308	127.8975	125.9601	130.9664	132.4357	147.9126	157.6110	175.8802 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1085.9953 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1790.1376 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												242.5617 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3118.6946 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1085.9953	0.1543	167.5383 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1790.1376	0.1409	252.2626 (264)
Space and water heating			419.8009 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	242.5617	0.1443	35.0092 (268)
Total CO2, kg/year			454.8101 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8700 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1085.9953	1.5712	1706.2722 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1790.1376	1.5211	2722.9151 (278)
Space and water heating			4429.1873 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	242.5617	1.5338	372.0493 (282)
Total Primary energy kWh/year			4801.2366 (286)
Dwelling Primary energy Rate (DPER)			51.4400 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

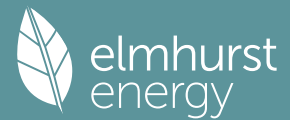
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1260 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3760	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj inflt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K

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TER Opaque door			1.9500	1.0000	1.9500	(26)
TER Opening Type (Uw = 1.20)			11.5300	1.1450	13.2023	(27)
Ground Floor			46.6700	0.1300	6.0671	(28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	(30)
Total net area of external elements Aum(A, m2)			191.8700			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6621	(33)
Party Wall 1			48.3500	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 92.3808 (35)

List of Thermal Bridges						
K1 Element			Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)			9.8400	0.0600	0.5904	
E18 Party wall between dwellings			10.2000	0.0600	0.6120	
P4 Party wall - Roof (insulation at ceiling level)			9.4800	0.1200	1.1376	
P1 Party wall - Ground floor			9.4800	0.0800	0.7584	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)			9.4800	0.0000	0.0000	
E2 Other lintels (including other steel lintels)			8.8500	0.0500	0.4425	
E3 Sill			7.9200	0.0500	0.3960	
E4 Jamb			17.7000	0.0500	0.8850	
E5 Ground floor (normal)			19.3200	0.1600	3.0912	
E6 Intermediate floor within a dwelling			19.3200	0.0000	0.0000	
E16 Corner (normal)			10.2000	0.0900	0.9180	
E12 Gable (insulation at ceiling level)			9.4800	0.0600	0.5688	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.3999 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 51.0620 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124
Average = Sum(39)m / 12 =	96.8574	96.6041	96.3559	95.1898	94.9716	93.9560	93.9560	93.7679	94.3472	94.9716	95.4130	95.8744

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0377	1.0350	1.0323	1.0198	1.0175	1.0066	1.0066	1.0046	1.0108	1.0175	1.0222	1.0272
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687 (42)
Hot water usage for mixer showers													
Hot water usage for baths	68.9657	67.9292	66.4190	63.5293	61.3969	59.0188	57.6670	59.1659	60.8089	63.3623	66.3139	68.7014	(42a)
Hot water usage for other uses	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	(42b)
Average daily hot water use (litres/day)	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	(42c)
Daily hot water use	140.7069	137.7023	134.0434	128.4795	123.9613	119.1039	117.2372	120.8803	124.7225	129.8220	135.4716	140.3420	(44)
Energy content (annual)	222.8453	196.0863	206.0197	175.8821	166.8758	146.4521	141.7882	149.6751	153.7954	176.1673	193.0041	219.7416	(45)
Distribution loss (46)m = 0.15 x (45)m	33.4268	29.4129	30.9030	26.3823	25.0314	21.9678	21.2682	22.4513	23.0693	26.4251	28.9506	32.9612	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1127 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1409 (55)
Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	281.4741	249.0413	264.6485	232.6196	225.5046	203.1897	200.4170	208.3039	210.5329	234.7961	249.7417	278.3704	(62)
WWHRS	-31.5282	-27.8838	-29.1983	-24.1774	-22.5324	-19.2812	-18.0730	-19.2188	-19.9490	-23.5177	-26.6427	-30.9444	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	249.9459	221.1575	235.4502	208.4423	202.9722	183.9085	182.3440	189.0850	190.5839	211.2784	223.0989	247.4260	(64)
12Total per year (kWh/year)													2545.6928 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	120.9991	107.5627	115.4046	103.8708	102.3893	94.0854	94.0476	96.6700	96.5270	105.4787	109.5639	119.9671	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	(71)
Water heating gains (Table 5)	162.6332	160.0636	155.1137	144.2651	137.6200	130.6741	126.4081	129.9328	134.0653	141.7724	152.1721	161.2461	(72)
Total internal gains	610.0897	624.6707	598.7045	578.7564	550.3438	528.7554	509.1308	510.1122	525.1982	545.0047	577.1719	597.8886	(73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W

North				11.5300	10.6334	0.6300	0.7000			0.7700			37.4691 (74)

Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361	(83)
Total gains	647.5587	696.2760	720.3794	774.1976	813.6210	810.6013	772.2700	718.8796	671.4909	630.2415	623.3948	629.1246	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.7294	24.7943	24.8581	25.1627	25.2205	25.4931	25.4931	25.5442	25.3874	25.2205	25.1038	24.9830
alpha	2.6486	2.6530	2.6572	2.6775	2.6814	2.6995	2.6995	2.7029	2.6925	2.6814	2.6736	2.6655
util living area	0.9450	0.9308	0.9086	0.8526	0.7575	0.6139	0.4842	0.5290	0.7178	0.8658	0.9249	0.9486 (86)
MIT	18.5996	18.8322	19.2237	19.8183	20.3580	20.7496	20.9047	20.8765	20.5924	19.9368	19.2000	18.5702 (87)
Th 2	20.0520	20.0543	20.0565	20.0669	20.0688	20.0778	20.0778	20.0795	20.0744	20.0688	20.0649	20.0608 (88)
util rest of house	0.9378	0.9218	0.8959	0.8311	0.7198	0.5514	0.3981	0.4432	0.6627	0.8420	0.9136	0.9419 (89)
MIT 2	17.2389	17.5335	18.0283	18.7731	19.4232	19.8679	20.0180	19.9976	19.7071	18.9310	18.0084	17.2068 (90)
Living area fraction									fLA = Living area / (4) =			0.1783 (91)
MIT	17.4815	17.7650	18.2414	18.9594	19.5898	20.0251	20.1761	20.1543	19.8649	19.1103	18.2208	17.4499 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4815	17.7650	18.2414	18.9594	19.5898	20.0251	20.1761	20.1543	19.8649	19.1103	18.2208	17.4499 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9109	0.8925	0.8645	0.8002	0.6977	0.5475	0.4078	0.4506	0.6486	0.8115	0.8841	0.9161 (94)
Useful gains	589.8568	621.4265	622.7911	619.4825	567.6871	443.7887	314.9552	323.9557	435.5367	511.4704	551.1175	576.3131 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1276.7269	1242.8159	1131.3496	957.5528	749.3098	509.7158	335.9966	352.0307	543.9043	808.2371	1061.0697	1270.3212 (97)
Space heating kWh	511.0313	417.5736	378.3676	243.4106	135.1273	0.0000	0.0000	0.0000	0.0000	220.7945	367.1656	516.3421 (98a)
Space heating requirement - total per year (kWh/year)												2789.8125
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	511.0313	417.5736	378.3676	243.4106	135.1273	0.0000	0.0000	0.0000	0.0000	220.7945	367.1656	516.3421 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2789.8125
Space heating per m2										(98c) / (4) =		29.8887 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	511.0313	417.5736	378.3676	243.4106	135.1273	0.0000	0.0000	0.0000	0.0000	220.7945	367.1656	516.3421 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	553.6634	452.4091	409.9324	263.7168	146.4001	0.0000	0.0000	0.0000	0.0000	239.2139	397.7959	559.4172 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	249.9459	221.1575	235.4502	208.4423	202.9722	183.9085	182.3440	189.0850	190.5839	211.2784	223.0989	247.4260 (64)
Efficiency of water heater (217)m	85.6280	85.4627	85.1177	84.4085	83.1689	79.8000	79.8000	79.8000	79.8000	84.1587	85.1694	79.8000 (216)
Fuel for water heating, kWh/month	291.8973	258.7768	276.6172	246.9447	244.0481	230.4618	228.5012	236.9487	238.8269	251.0475	261.9472	288.8131 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	28.3278	22.7256	20.4619	14.9913	11.5797	9.4607	10.5634	13.7307	17.8348	23.4002	26.4305	29.1151 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-43.0360	-60.3393	-86.2393	-96.3687	-103.3845	-96.2774	-95.0720	-90.0173	-81.0086	-68.7195	-47.1904	-37.2451 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-25.2980	-53.1175	-105.4060	-158.0775	-208.8072	-209.7533	-207.2977	-175.6182	-128.8470	-75.8957	-33.7521	-20.0133 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3022.5487	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3054.8305	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												228.6216	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2306.7817	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												4085.2191	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3022.5487	0.2100	634.7352 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3054.8305	0.2100	641.5144 (264)
Space and water heating			1276.2496 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	228.6216	0.1443	32.9972 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-904.8983	0.1347	-121.9051
PV Unit electricity exported	-1401.8834	0.1259	-176.5500
Total			-298.4551 (269)
Total CO2, kg/year			1022.7210 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.9600 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3022.5487	1.1300	3415.4801 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3054.8305	1.1300	3451.9584 (278)
Space and water heating			6867.4385 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	228.6216	1.5338	350.6674 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-904.8983	1.4979	-1355.4456
PV Unit electricity exported	-1401.8834	0.4623	-648.0622
Total			-2003.5078 (283)
Total Primary energy kWh/year			5344.6988 (286)
Target Primary Energy Rate (TPER)			57.2600 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)

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Infiltration rate												0.3760 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3196 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infiltr rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.5300	1.1450	13.2023			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			46.6700	0.1100	5.1337	75.0000	3500.2500	(28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090	9.0000	765.4500	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300	(30)
Total net area of external elements Aum(A, m2)			191.8700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 40.7287			(33)
Party Wall 1			48.3500	0.0000	0.0000	20.0000	967.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			110.0000			9.0000	990.0000	(32c)
Internal Floor 1			46.6700			18.0000	840.0600	(32d)
Internal Ceiling 1			46.6700			9.0000	420.0300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8622.8200 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 92.3808 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904
E18 Party wall between dwellings	10.2000	0.0600	0.6120
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
P1 Party wall - Ground floor	9.4800	0.0800	0.7584
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425
E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	17.7000	0.0500	0.8850
E5 Ground floor (normal)	19.3200	0.1600	3.0912
E6 Intermediate floor within a dwelling	19.3200	0.0000	0.0000
E16 Corner (normal)	10.2000	0.0900	0.9180
E12 Gable (insulation at ceiling level)	9.4800	0.0600	0.5688

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.3999 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 50.1286 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124 (38)
Average = Sum(39)m / 12 =	95.9240	95.6707	95.4225	94.2564	94.0382	93.0226	93.0226	92.8345	93.4138	94.0382	94.4796	94.9410 (39)
												94.2553

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0277	1.0250	1.0223	1.0098	1.0075	0.9966	0.9966	0.9946	1.0008	1.0075	1.0122	1.0172 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6687 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800 (42b)
Hot water usage for other uses	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605 (42c)
Average daily hot water use (litres/day)												65.7573 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	71.7412	69.7731	67.6244	64.9502	62.5645	60.0851	59.5701	61.7144	63.9137	66.4598	69.1576	71.6405 (44)
Energy content (annual)	113.6205	99.3559	103.9362	88.9136	84.2238	73.8817	72.0449	76.4153	78.8119	90.1853	98.5277	112.1718 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1092.0887
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	96.5775	84.4526	88.3458	75.5765	71.5902	62.7994	61.2381	64.9530	66.9901	76.6575	83.7486	95.3460 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	96.5775	84.4526	88.3458	75.5765	71.5902	62.7994	61.2381	64.9530	66.9901	76.6575	83.7486	95.3460 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 928.2754 (64)
Electric shower(s)	55.2300	49.2104	53.7359	51.2795	52.2417	49.8335	51.4946	52.2417	51.2795	53.7359	52.7254	55.2300 (64a)
Heat gains from water heating, kWh/month												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 628.2380 (64a)

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37.9519 33.4157 35.5204 31.7140 30.9580 28.1582 28.1832 29.2987 29.5674 32.5983 34.1185 37.6440 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	(71)
Water heating gains (Table 5)	51.0106	49.7258	47.7425	44.0472	41.6102	39.1087	37.8806	39.3800	41.0658	43.8150	47.3868	50.5968	(72)
Total internal gains	495.4670	511.3329	488.3332	475.5386	451.3341	437.1899	420.6033	419.5594	432.1987	444.0472	469.3866	484.2392	(73)

6. Solar gains

[Jan]														
	Area				Solar flux		g		FF		Access		Gains	
	m2				Table 6a		Specific data		Specific data		factor		W	
					W/m2		or Table 6b		or Table 6c		Table 6d			
North	11.5300				10.6334		0.6300		0.7000		0.7700		37.4691 (74)	
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361	(83)	
Total gains	532.9361	582.9382	610.0082	670.9797	714.6112	719.0359	683.7426	628.3268	578.4914	529.2840	515.6095	515.4753	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	24.9701	25.0362	25.1013	25.4118	25.4708	25.7489	25.7489	25.8011	25.6411	25.4708	25.3518	25.2286	21.0000 (85)
alpha	2.6647	2.6691	2.6734	2.6941	2.6981	2.7166	2.7166	2.7201	2.7094	2.6981	2.6901	2.6819	
util living area	0.9638	0.9522	0.9341	0.8852	0.7984	0.6588	0.5286	0.5797	0.7686	0.9024	0.9493	0.9668	(86)
MIT	18.3924	18.6368	19.0461	19.6815	20.2660	20.7051	20.8839	20.8477	20.5160	19.7918	19.0144	18.3617	(87)
Th 2	20.0603	20.0626	20.0648	20.0752	20.0771	20.0862	20.0862	20.0878	20.0827	20.0771	20.0732	20.0691	(88)
util rest of house	0.9589	0.9456	0.9245	0.8672	0.7641	0.5971	0.4392	0.4918	0.7177	0.8835	0.9412	0.9622	(89)
MIT 2	17.6624	17.9053	18.3110	18.9378	19.4934	19.8897	20.0280	20.0069	19.7348	19.0543	18.2886	17.6378	(90)
Living area fraction	17.7925	18.0357	18.4420	19.0704	19.6311	20.0351	20.1806	20.1568	19.8741	19.1857	18.4180	17.7668	(91)
MIT	17.7925	18.0357	18.4420	19.0704	19.6311	20.0351	20.1806	20.1568	19.8741	19.1857	18.4180	17.7668	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7925	18.0357	18.4420	19.0704	19.6311	20.0351	20.1806	20.1568	19.8741	19.1857	18.4180	17.7668	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9425	0.9266	0.9028	0.8433	0.7450	0.5933	0.4491	0.4990	0.7044	0.8605	0.9219	0.9467	(94)
Useful gains	502.2776	540.1625	550.7092	565.8317	532.3783	426.5971	307.0716	313.5248	407.4710	455.4476	475.3583	488.0137	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1294.2554	1256.7057	1139.5391	958.6213	745.8289	505.5841	333.0794	348.7589	539.3797	807.3873	1069.3174	1288.0487	(97)
Space heating kWh	589.2315	481.5171	438.0895	282.8085	158.8072	0.0000	0.0000	0.0000	0.0000	261.8432	427.6506	595.2260	(98a)
Space heating requirement - total per year (kWh/year)												3235.1735	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	589.2315	481.5171	438.0895	282.8085	158.8072	0.0000	0.0000	0.0000	0.0000	261.8432	427.6506	595.2260	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3235.1735	
Space heating per m ²												34.6601	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	874.4121	688.3669	705.5421	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6866	0.7563	0.7160	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	600.3880	520.6447	505.1390	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	777.3301	739.0574	677.0741	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	127.3983	162.4990	127.9197	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.8496	40.6248	31.9799	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												104.4543	(107)
Energy for space heating												34.6601	(99)
Energy for space cooling												1.1191	(108)
Total												35.7792	(109)
Fabric Energy Efficiency (DFEE)												35.8	(109)

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SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	30.0000 / (5) = 0.1260 (8)
Pressure Test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

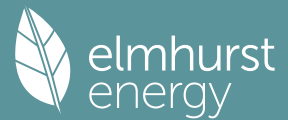
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			11.5300	1.1450	13.2023		(27)
Ground Floor			46.6700	0.1300	6.0671		(28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090		(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337		(30)
Total net area of external elements Aum (A, m ²)			191.8700				(31)
Fabric heat loss, W/K = Sum (A x U)							(32)
Party Wall 1			48.3500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							92.3808 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)				9.8400	0.0600	0.5904	
E18 Party wall between dwellings				10.2000	0.0600	0.6120	
P4 Party wall - Roof (insulation at ceiling level)				9.4800	0.1200	1.1376	
P1 Party wall - Ground floor				9.4800	0.0800	0.7584	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				9.4800	0.0000	0.0000	
E2 Other lintels (including other steel lintels)				8.8500	0.0500	0.4425	
E3 Sill				7.9200	0.0500	0.3960	
E4 Jamb				17.7000	0.0500	0.8850	
E5 Ground floor (normal)				19.3200	0.1600	3.0912	
E6 Intermediate floor within a dwelling				19.3200	0.0000	0.0000	
E16 Corner (normal)				10.2000	0.0900	0.9180	
E12 Gable (insulation at ceiling level)				9.4800	0.0600	0.5688	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3999 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 51.0620 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124 (38)
Average = Sum(39)m / 12 =	96.8574	96.6041	96.3559	95.1898	94.9716	93.9560	93.9560	93.7679	94.3472	94.9716	95.4130	95.8744 (39)
												95.1887
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0377	1.0350	1.0323	1.0198	1.0175	1.0066	1.0066	1.0046	1.0108	1.0175	1.0222	1.0272 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)											
Assumed occupancy											2.6687 (42)
Hot water usage for mixer showers											0.0000 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230 (42c)
Average daily hot water use (litres/day)	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347 (43)
Daily hot water use											71.7412 (44)
Energy content (annual)	113.6205	99.3559	103.9362	88.9136	84.2238	73.8817	72.0449	76.4153	78.8119	90.1853	98.5277 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:											0.0000 (56)
If cylinder contains dedicated solar storage											0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month											96.5775 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h											96.5775 (64)
12Total per year (kWh/year)											928.2754 (64)
Electric shower(s)											928 (64)
Heat gains from water heating, kWh/month											37.9519 (65)

5. Internal gains (see Table 5 and 5a)											
Metabolic gains (Table 5), Watts											
(66)m	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	136.3354 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)											
Water heating gains (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Total internal gains	495.4670	511.3329	488.3332	475.5386	451.3341	437.1899	420.6033	419.5594	432.1987	444.0472	469.3866 (73)

6. Solar gains											
[Jan]											
	Area	Solar flux	g	FF	Access	Gains					
	m2	Table 6a	Specific data	factor	Table 6d	W					
		W/m2	or Table 6b	or Table 6c							
North	11.5300	10.6334	0.6300	0.7000	0.7700	37.4691 (74)					
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229 (83)
Total gains	532.9361	582.9382	610.0082	670.9797	714.6112	719.0359	683.7426	628.3268	578.4914	529.2840	515.6095 (84)

7. Mean internal temperature (heating season)											
Temperature during heating periods in the living area from Table 9, Th1 (C)											21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)											
tau	24.7294	24.7943	24.8581	25.1627	25.2205	25.4931	25.4931	25.5442	25.3874	25.2205	25.1038 (86)
alpha	2.6486	2.6530	2.6572	2.6775	2.6814	2.6995	2.6995	2.7029	2.6925	2.6814	2.6736 (87)
util living area	0.9639	0.9524	0.9345	0.8862	0.8002	0.6617	0.5318	0.5829	0.7707	0.9031	0.9495 (88)
MIT	18.3652	18.6102	19.0217	19.6609	20.2510	20.6967	20.8798	20.8427	20.5052	19.7740	18.9911 (89)
Th 2	20.0520	20.0543	20.0565	20.0669	20.0688	20.0778	20.0778	20.0795	20.0744	20.0688	20.0649 (90)
util rest of house	0.9590	0.9458	0.9249	0.8681	0.7658	0.5996	0.4415	0.4942	0.7196	0.8842	0.9415 (91)
MIT 2	17.6301	17.8736	18.2816	18.9121	19.4734	19.8760	20.0178	19.9960	19.7190	19.0314	18.2602 (92)
Living area fraction	17.7612	18.0049	18.4135	19.0456	19.6120	20.0223	20.1715	20.1470	19.8592	19.1638	18.3905 (93)
Temperature adjustment	17.7612	18.0049	18.4135	19.0456	19.6120	20.0223	20.1715	20.1470	19.8592	19.1638	18.3905 (93)

8. Space heating requirement											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Full SAP Calculation Printout



Utilisation	0.9425	0.9267	0.9031	0.8440	0.7464	0.5955	0.4514	0.5012	0.7060	0.8611	0.9221	0.9467 (94)
Useful gains	502.2972	540.2364	550.8777	566.3076	533.3750	428.1540	308.6085	314.9311	408.3890	455.7432	475.4378	488.0236 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1303.8135	1265.9917	1147.9380	965.7594	751.4189	509.4569	335.5594	351.3464	543.3602	813.3187	1077.2625	1297.6810 (97)
Space heating kWh	596.3282	487.7075	444.2129	287.6053	162.2246	0.0000	0.0000	0.0000	0.0000	266.0362	433.3138	602.3851 (98a)
Space heating requirement - total per year (kWh/year)												3279.8135
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	596.3282	487.7075	444.2129	287.6053	162.2246	0.0000	0.0000	0.0000	0.0000	266.0362	433.3138	602.3851 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3279.8135
Space heating per m2												(98c) / (4) = 35.1383 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	883.1860	695.2741	712.6359	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6816	0.7516	0.7110	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	601.9893	522.5496	506.6854	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	777.3301	739.0574	677.0741	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	126.2454	161.0818	126.7692	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.5613	40.2704	31.6923	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												103.5241 (107)
Energy for space heating												35.1383 (99)
Energy for space cooling												1.1091 (108)
Total												36.2475 (109)
Fabric Energy Efficiency (TFEE)												36.2 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	238.0170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

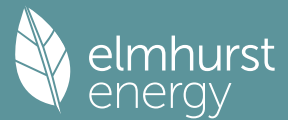
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			11.5300	1.1450	13.2023		(27)

Water heating gains (Table 5)

Full SAP Calculation Printout



Total internal gains	177.7434	174.9358	169.4261	157.2125	149.7613	141.9594	137.1072	141.0248	145.6291	154.2858	165.9864	176.1715 (72)
	687.9424	685.0915	664.3208	625.7179	587.8197	550.6715	530.6333	534.5942	554.4595	592.5056	634.6532	671.1845 (73)

6. Solar gains

[Jan]	Area m2			Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d	Gains W	
North	11.5300			10.6334		0.6300		0.7000		0.7700	37.4691 (74)	
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	725.4115	756.6968	785.9958	821.1590	851.0968	832.5175	793.7726	743.3616	700.7522	677.7424	680.8761	702.4205 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.9701	25.0362	25.1013	25.4118	25.4708	25.7489	25.7489	25.8011	25.6411	25.4708	25.3518	25.2286
alpha	2.6647	2.6691	2.6734	2.6941	2.6981	2.7166	2.7166	2.7201	2.7094	2.6981	2.6901	2.6819
util living area	0.9299	0.9176	0.8911	0.8356	0.7394	0.6001	0.4705	0.5125	0.6992	0.8463	0.9097	0.9348 (86)
MIT	18.7779	18.9710	19.3596	19.9039	20.4079	20.7678	20.9131	20.8881	20.6258	20.0234	19.3277	18.7425 (87)
Th 2	20.0603	20.0626	20.0648	20.0752	20.0771	20.0862	20.0862	20.0878	20.0827	20.0771	20.0732	20.0691 (88)
util rest of house	0.9211	0.9073	0.8768	0.8126	0.7008	0.5381	0.3865	0.4286	0.6435	0.8203	0.8968	0.9266 (89)
MIT 2	17.4666	17.7109	18.2001	18.8801	19.4843	19.8921	20.0318	20.0139	19.7474	19.0383	18.1708	17.4274 (90)
Living area fraction	17.7004	17.9355	18.4068	19.0626	19.6490	20.0482	20.1889	20.1698	19.9040	19.2139	18.3770	17.6618 (91)
MIT	17.7004	17.9355	18.4068	19.0626	19.6490	20.0482	20.1889	20.1698	19.9040	19.2139	18.3770	17.6618 (92)
Temperature adjustment	17.7004	17.9355	18.4068	19.0626	19.6490	20.0482	20.1889	20.1698	19.9040	19.2139	18.3770	17.6618 (93)
adjusted MIT	17.7004	17.9355	18.4068	19.0626	19.6490	20.0482	20.1889	20.1698	19.9040	19.2139	18.3770	17.6618 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8919	0.8766	0.8448	0.7827	0.6807	0.5353	0.3964	0.4366	0.6314	0.7909	0.8661	0.8983 (94)
Useful gains	646.9585	663.3488	664.0308	642.7571	579.3360	445.6489	314.6858	324.5615	442.4474	536.0468	589.7261	631.0031 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1285.4178	1247.1162	1136.1759	957.8911	747.5064	506.8057	333.8470	349.9648	542.1727	810.0386	1065.4483	1278.0803 (97)
Space heating kWh	475.0138	392.2917	351.2760	226.8965	125.1188	0.0000	0.0000	0.0000	0.0000	203.8499	342.5200	481.4254 (98a)
Space heating requirement - total per year (kWh/year)												2598.3921
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	475.0138	392.2917	351.2760	226.8965	125.1188	0.0000	0.0000	0.0000	0.0000	203.8499	342.5200	481.4254 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2598.3921
Space heating per m2										(98c) / (4) =		27.8379 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	475.0138	392.2917	351.2760	226.8965	125.1188	0.0000	0.0000	0.0000	0.0000	203.8499	342.5200	481.4254 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	190.0815	156.9795	140.5666	90.7949	50.0675	0.0000	0.0000	0.0000	0.0000	81.5726	137.0628	192.6472 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	177.8890	157.4333	167.2603	146.7607	142.1308	127.8975	125.9601	130.9664	132.4357	147.9126	157.6110	175.8802 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)

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Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													1039.7728	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													175.1000	
Water heating fuel used													1790.1376	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													242.5617	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													3072.4721	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1039.7728	16.4900	171.4585	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1790.1376	16.4900	295.1937	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	242.5617	16.4900	39.9984	(250)
Additional standing charges			0.0000	(251)
Total energy cost			506.6506	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		1.3184	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	78.6279	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1039.7728	0.1543	160.3911	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1790.1376	0.1409	252.2626	(264)
Space and water heating			412.6538	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	242.5617	0.1443	35.0092	(268)
Total CO2, kg/year			447.6629	(272)
CO2 emissions per m2			4.8000	(273)
EI value			95.6638	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)	
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	238.0170 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)

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Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6f)
3 * 10 = 30.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure Test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
30.0000 / (5) = 0.1260 (8)
Yes
Blower Door
5.0000 (17)
0.3760 (18)
2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3196 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate													
	0.2877	0.2637	0.2557	0.2557	0.2637	0.2317	0.2477	0.2237	0.2237	0.2397	0.2237	0.2557	(22b)
Effective ac	0.5414	0.5348	0.5327	0.5327	0.5348	0.5269	0.5307	0.5250	0.5250	0.5287	0.5250	0.5327	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Windows (Uw = 1.20)			11.5300	1.1450	13.2023			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			46.6700	0.1100	5.1337	75.0000	3500.2500	(28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090	9.0000	765.4500	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300	(30)
Total net area of external elements Aum(A, m ²)			191.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.7287			(33)
Party Wall 1			48.3500	0.0000	0.0000	20.0000	967.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			110.0000			9.0000	990.0000	(32c)
Internal Floor 1			46.6700			18.0000	840.0600	(32d)
Internal Ceiling 1			46.6700			9.0000	420.0300	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K (28)...(30) + (32) + (32a)...(32e) = 8622.8200 (34)
List of Thermal Bridges 92.3808 (35)

K1 Element	Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904	
E18 Party wall between dwellings	10.2000	0.0600	0.6120	
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376	
P1 Party wall - Ground floor	9.4800	0.0800	0.7584	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000	
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425	
E3 Sill	7.9200	0.0500	0.3960	
E4 Jamb	17.7000	0.0500	0.8850	
E5 Ground floor (normal)	19.3200	0.1600	3.0912	
E6 Intermediate floor within a dwelling	19.3200	0.0000	0.0000	
E16 Corner (normal)	10.2000	0.0900	0.9180	
E12 Gable (insulation at ceiling level)	9.4800	0.0600	0.5688	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.3999 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.1286 (37)

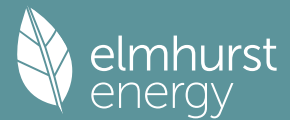
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	42.5228	42.0037	41.8407	41.8407	42.0037	41.3818	41.6827	41.2389	41.2389	41.5298	41.2389	41.8407	(38)
Heat transfer coeff	92.6514	92.1323	91.9693	91.9693	92.1323	91.5104	91.8113	91.3675	91.3675	91.6584	91.3675	91.9693	(39)
Average = Sum(39)m / 12 =												91.8255	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9926	0.9871	0.9853	0.9853	0.9871	0.9804	0.9836	0.9789	0.9789	0.9820	0.9789	0.9853	(40)
HLP (average)												0.9838	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687 (42)
Hot water usage for mixer showers													
	86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768	(42a)
Hot water usage for baths	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	(42b)
Hot water usage for other uses	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	(42c)
Average daily hot water use (litres/day)												145.2373	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173	(44)
Energy conte	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340	(45)
Energy content (annual)										Total = Sum(45)m =		2412.3938	
Distribution loss (46)m = 0.15 x (45)m	37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951	(46)
Water storage loss:													
Store volume												300.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7368	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.2281	(55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

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Total heat required for water heating calculated for each month												
	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
Total per year (kWh/year) = Sum(64)m =												3134.5309 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	126.0530	113.1930	111.4224	102.2107	102.0077	104.9224	104.8529	114.7886	119.5102	131.0716 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	177.7434	174.9358	169.4261	157.2125	149.7613	141.9594	137.1072	141.0248	145.6291	154.2858	165.9864	176.1715 (72)
Total internal gains	687.9424	685.0915	664.3208	625.7179	587.8197	550.6715	530.6333	534.5942	554.4595	592.5056	634.6532	671.1845 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					11.5300	13.0723		0.6300	0.7000	0.7700		46.0630 (74)
Solar gains	46.0630	78.1341	133.1561	221.7956	289.9619	335.2033	307.1640	247.0841	171.6243	99.6585	57.2009	37.3234 (83)
Total gains	734.0055	763.2256	797.4769	847.5135	877.7816	885.8748	837.7974	781.6784	726.0838	692.1641	691.8541	708.5078 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	25.8520	25.9977	26.0438	26.0438	25.9977	26.1744	26.0886	26.2153	26.2153	26.1321	26.2153	26.0438
alpha	2.7235	2.7332	2.7363	2.7363	2.7332	2.7450	2.7392	2.7477	2.7477	2.7421	2.7477	2.7363
util living area	0.9176	0.9070	0.8718	0.8020	0.6751	0.5018	0.3752	0.3876	0.6305	0.8004	0.8878	0.9230 (86)
MIT	19.0807	19.2094	19.6247	20.1244	20.6036	20.8790	20.9606	20.9590	20.7569	20.2947	19.6443	19.0537 (87)
Th 2	20.0895	20.0941	20.0956	20.0956	20.0941	20.0997	20.0970	20.1010	20.1010	20.0984	20.1010	20.0956 (88)
util rest of house	0.9072	0.8954	0.8550	0.7748	0.6286	0.4326	0.2881	0.2959	0.5658	0.7663	0.8714	0.9131 (89)
MIT 2	17.8657	18.0293	18.5487	19.1599	19.7185	20.0104	20.0774	20.0811	19.8993	19.3781	18.5831	17.8363 (90)
Living area fraction	18.0823	18.2397	18.7406	19.3319	19.8763	20.1652	20.2349	20.2376	20.0522	19.5415	18.7723	18.0533 (91)
MIT	18.0823	18.2397	18.7406	19.3319	19.8763	20.1652	20.2349	20.2376	20.0522	19.5415	18.7723	18.0533 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0823	18.2397	18.7406	19.3319	19.8763	20.1652	20.2349	20.2376	20.0522	19.5415	18.7723	18.0533 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8775	0.8651	0.8242	0.7483	0.6163	0.4379	0.3018	0.3103	0.5620	0.7418	0.8411	0.8842 (94)
Useful gains	644.1111	660.2506	657.2755	634.2217	541.0031	387.9353	252.8851	242.5927	408.0637	513.4521	581.9080	626.4347 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	1193.5658	1173.7356	1052.1799	885.8369	651.9544	417.7671	260.2753	250.1271	470.7444	709.5717	965.9651	1182.1136 (97)
Space heating kWh	408.7942	345.0619	293.8088	181.1629	82.5477	0.0000	0.0000	0.0000	0.0000	145.9129	276.5211	413.4251 (98a)
Space heating requirement - total per year (kWh/year)												2147.2349
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	408.7942	345.0619	293.8088	181.1629	82.5477	0.0000	0.0000	0.0000	0.0000	145.9129	276.5211	413.4251 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2147.2349
Space heating per m ²										(98c) / (4) =		23.0044 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												0.0000 (201)
Efficiency of main space heating system 1 (in %)												1.0000 (202)
Efficiency of main space heating system 2 (in %)												249.9000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (207)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												0.0000 (208)

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Space heating efficiency (main heating system 1)	408.7942	345.0619	293.8088	181.1629	82.5477	0.0000	0.0000	0.0000	0.0000	145.9129	276.5211	413.4251 (98)
Space heating fuel (main heating system)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating efficiency (main heating system 2)	163.5831	138.0800	117.5706	72.4942	33.0323	0.0000	0.0000	0.0000	0.0000	58.3885	110.6527	165.4362 (211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	177.8890	157.4333	167.2603	146.7607	142.1308	127.8975	125.9601	130.9664	132.4357	147.9126	157.6110	175.8802 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa (231)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting (232)m	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												859.2376 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1790.1376 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												242.5617 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												2891.9369 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	859.2376	26.0600	223.9173 (240)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1790.1376	26.0600	466.5099 (247)	
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)	
Energy for lighting	242.5617	26.0600	63.2116 (250)	
Additional standing charges			0.0000 (251)	
Total energy cost			753.6388 (255)	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	859.2376	0.1549	133.0876 (261)	
Total CO2 associated with community systems			0.0000 (373)	
Water heating (other fuel)	1790.1376	0.1409	252.2626 (264)	
Space and water heating			385.3502 (265)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)	
Energy for lighting	242.5617	0.1443	35.0092 (268)	
Total CO2, kg/year			420.3593 (272)	

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	859.2376	1.5735	1351.9804 (275)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1790.1376	1.5211	2722.9151 (278)	
Space and water heating			4074.8955 (279)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)	
Energy for lighting	242.5617	1.5338	372.0493 (282)	
Total Primary energy kWh/year			4446.9448 (286)	

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PLANNING

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.2	-£ 102	-49 kg (11.6%)
U Solar photovoltaic panels	+ 6.2	-£ 246	-127 kg (34.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£102	0.52 kg/m ²	B 81 A 96
Solar photovoltaic panels	£246	1.36 kg/m ²	B 87 A 97
Total Savings	£348	1.89 kg/m ²	

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£754	£652	£102
Space heating	£224	£245	-£21
Water heating	£467	£343	£123
Lighting	£63	£63	£0
Generated (PV)	-£0	-£246	£246
Total cost of fuels	£754	£406	£348
Total cost of uses	£754	£405	£348
Delivered energy	31 kWh/m ²	17 kWh/m ²	14 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m ²	5 kg/m ²	3 kg/m ²	2 kg/m ²
Primary energy	48 kWh/m ²	26 kWh/m ²	21 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

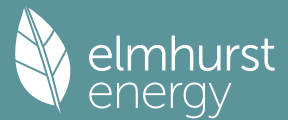
2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	= 30.0000 / (5) = 0.1260 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3760 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)]	= 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	= 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.5300	1.1450	13.2023			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			46.6700	0.1100	5.1337	75.0000	3500.2500	(28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090	9.0000	765.4500	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300	(30)
Total net area of external elements Aum(A, m2)			191.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.7287			(33)
Party Wall 1			48.3500	0.0000	0.0000	20.0000	967.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			110.0000			9.0000	990.0000	(32c)
Internal Floor 1			46.6700			18.0000	840.0600	(32d)
Internal Ceiling 1			46.6700			9.0000	420.0300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8622.8200 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 92.3808 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904	
E18 Party wall between dwellings	10.2000	0.0600	0.6120	
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376	
P1 Party wall - Ground floor	9.4800	0.0800	0.7584	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000	
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425	
E3 Sill	7.9200	0.0500	0.3960	
E4 Jamb	17.7000	0.0500	0.8850	
E5 Ground floor (normal)	19.3200	0.1600	3.0912	
E6 Intermediate floor within a dwelling	19.3200	0.0000	0.0000	
E16 Corner (normal)	10.2000	0.0900	0.9180	
E12 Gable (insulation at ceiling level)	9.4800	0.0600	0.5688	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.3999 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	50.1286 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124	(38)
Heat transfer coeff	95.9240	95.6707	95.4225	94.2564	94.0382	93.0226	93.0226	92.8345	93.4138	94.0382	94.4796	94.9410	(39)
Average = Sum(39)m / 12 =												94.2553	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0277	1.0250	1.0223	1.0098	1.0075	0.9966	0.9966	0.9946	1.0008	1.0075	1.0122	1.0172	(40)
HLP (average)												1.0098	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687 (42)
Hot water usage for mixer showers													
86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768	85.8768	(42a)
Hot water usage for baths													
29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	29.6800	(42b)
Hot water usage for other uses													
41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	41.9605	(42c)
Average daily hot water use (litres/day)												145.2373	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173	(44)
Energy conte	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340	(45)
Energy content (annual)										Total =	Sum(45)m =	2412.3938	
Distribution loss (46)m = 0.15 x (45)m													
37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951	36.9951	(46)
Water storage loss:													
Store volume												300.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7368	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.2281	(55)
Total storage loss													
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	(56)
If cylinder contains dedicated solar storage													
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
311.4837	275.6657	291.4770	250.2243	236.0767	211.3418	207.5292	217.2257	226.4921	257.5992	275.9769	307.9662	307.9662	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												641.7638	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												641.7638	
Solar input	-0.0000	-16.1808	-59.3006	-82.3728	-108.8130	-100.5524	-99.9531	-86.7035	-59.0714	-28.8162	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
311.4837	259.4849	232.1764	167.8515	127.2637	110.7894	107.5761	130.5222	167.4206	228.7830	275.9769	307.9662	307.9662	(64)
Total per year (kWh/year) = Sum(64)m =												2427.2947	(64)
Electric shower(s)													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												
Heat gains from water heating, kWh/month	132.2411	117.5568	124.9364	107.7902	101.1869	92.1254	91.5862	95.2453	100.5306	113.6720	119.5102	131.0716 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811 (69)
Pumps, fans												
	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)												
	177.7434	174.9358	167.9253	149.7085	136.0040	127.9519	123.0997	128.0178	139.6259	152.7850	165.9864	176.1715 (72)
Total internal gains	687.9424	685.0915	662.8200	618.2139	574.0623	536.6641	516.6259	521.5873	548.4563	591.0048	634.6532	671.1845 (73)

6. Solar gains

[Jan]	Area		Solar flux		g		FF		Access		Gains	
	m2		Table 6a		Specific data		Specific data		factor		W	
			W/m2		or Table 6b		or Table 6c		Table 6d			
North	11.5300		10.6334		0.6300		0.7000		0.7700		37.4691 (74)	
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	725.4115	756.6968	784.4950	813.6550	837.3394	818.5100	779.7651	730.3547	694.7490	676.2416	680.8761	702.4205 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.9701	25.0362	25.1013	25.4118	25.4708	25.7489	25.7489	25.8011	25.6411	25.4708	25.3518	25.2286
alpha	2.6647	2.6691	2.6734	2.6941	2.6981	2.7166	2.7166	2.7201	2.7094	2.6981	2.6901	2.6819
util living area	0.9299	0.9176	0.8915	0.8381	0.7452	0.6070	0.4773	0.5194	0.7025	0.8468	0.9097	0.9348 (86)
MIT	18.7779	18.9710	19.3571	19.8937	20.3951	20.7611	20.9099	20.8843	20.6211	20.0213	19.3277	18.7425 (87)
Th 2	20.0603	20.0626	20.0648	20.0752	20.0771	20.0862	20.0862	20.0878	20.0827	20.0771	20.0732	20.0691 (88)
util rest of house	0.9211	0.9073	0.8772	0.8154	0.7070	0.5449	0.3926	0.4350	0.6469	0.8209	0.8968	0.9266 (89)
MIT 2	17.4666	17.7109	18.1971	18.8681	19.4704	19.8859	20.0296	20.0112	19.7428	19.0359	18.1708	17.4274 (90)
Living area fraction									fLA = Living area / (4) =			0.1783 (91)
MIT	17.7004	17.9355	18.4039	19.0510	19.6353	20.0419	20.1866	20.1668	19.8994	19.2115	18.3770	17.6618 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7004	17.9355	18.4039	19.0510	19.6353	20.0419	20.1866	20.1668	19.8994	19.2115	18.3770	17.6618 (93)

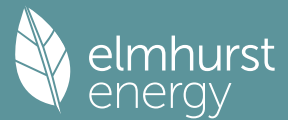
8. Space heating requirement

Utilisation	0.8919	0.8766	0.8453	0.7854	0.6863	0.5416	0.4024	0.4428	0.6345	0.7916	0.8661	0.8983 (94)
Useful gains	646.9585	663.3488	663.1090	639.0188	574.6828	443.3201	313.7669	323.4076	440.8275	535.2805	589.7261	631.0031 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1285.4178	1247.1162	1135.8974	956.7947	746.2180	506.2215	333.6321	349.6906	541.7411	809.8137	1065.4483	1278.0803 (97)
Space heating kWh	475.0138	392.2917	351.7546	228.7987	127.6222	0.0000	0.0000	0.0000	0.0000	204.2527	342.5200	481.4254 (98a)
Space heating requirement - total per year (kWh/year)												2603.6790
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	475.0138	392.2917	351.7546	228.7987	127.6222	0.0000	0.0000	0.0000	0.0000	204.2527	342.5200	481.4254 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2603.6790
Space heating per m2										(98c) / (4) =		27.8946 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	475.0138	392.2917	351.7546	228.7987	127.6222	0.0000	0.0000	0.0000	0.0000	204.2527	342.5200	481.4254 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	190.0815	156.9795	140.7581	91.5561	51.0693	0.0000	0.0000	0.0000	0.0000	81.7338	137.0628	192.6472 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	311.4837	259.4849	232.1764	167.8515	127.2637	110.7894	107.5761	130.5222	167.4206	228.7830	275.9769	307.9662	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(217)
Fuel for water heating, kWh/month	177.8890	148.1924	132.5965	95.8604	72.6806	63.2721	61.4370	74.5415	95.6143	130.6585	157.6110	175.8802	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.3162	-57.4369	-86.5394	-99.9314	-107.0203	-95.0525	-93.6728	-88.4938	-78.3914	-66.5057	-43.1279	-32.7569	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1041.8884	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1386.2334	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												242.5617	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-887.2453	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1863.4382	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1041.8884	16.4900	171.8074	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1386.2334	16.4900	228.5899	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	242.5617	16.4900	39.9984	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-887.2453	16.4900	-146.3068	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-146.3068	(252)
Total energy cost			307.2810	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.7996	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	87.0380	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1041.8884	0.1542	160.6834	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1386.2334	0.1450	200.9589	(264)
Space and water heating			361.6423	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	242.5617	0.1443	35.0092	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-887.2453	0.1344	-119.2684	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-119.2684	(269)
Total CO2, kg/year			288.4801	(272)
CO2 emissions per m2			3.0900	(273)
EI value			97.2057	
EI rating			97	(274)
EI band			A	

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SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

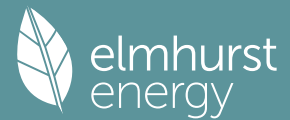
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.2877	0.2637	0.2557	0.2557	0.2637	0.2317	0.2477	0.2237	0.2237	0.2397	0.2237	0.2557 (22b)
Effective ac	0.5414	0.5348	0.5327	0.5327	0.5348	0.5269	0.5307	0.5250	0.5250	0.5287	0.5250	0.5327 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			11.5300	1.1450	13.2023		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			46.6700	0.1100	5.1337	75.0000	3500.2500 (28a)
Brick	98.5300	13.4800	85.0500	0.1800	15.3090	9.0000	765.4500 (29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300 (30)
Total net area of external elements Aum(A, m ²)			191.8700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	40.7287			(33)
Party Wall 1			48.3500	0.0000	0.0000	20.0000	967.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)
FF			110.0000			9.0000	990.0000 (32c)
Internal Floor 1			46.6700			18.0000	840.0600 (32d)
Internal Ceiling 1			46.6700			9.0000	420.0300 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	8622.8200 (34)			
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							92.3808 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)				9.8400	0.0600	0.5904	
E18 Party wall between dwellings				10.2000	0.0600	0.6120	
P4 Party wall - Roof (insulation at ceiling level)				9.4800	0.1200	1.1376	
P1 Party wall - Ground floor				9.4800	0.0800	0.7584	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				9.4800	0.0000	0.0000	
E2 Other lintels (including other steel lintels)				8.8500	0.0500	0.4425	
E3 Sill				7.9200	0.0500	0.3960	
E4 Jamb				17.7000	0.0500	0.8850	
E5 Ground floor (normal)				19.3200	0.1600	3.0912	
E6 Intermediate floor within a dwelling				19.3200	0.0000	0.0000	
E16 Corner (normal)				10.2000	0.0900	0.9180	
E12 Gable (insulation at ceiling level)				9.4800	0.0600	0.5688	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3999 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	50.1286 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	42.5228	42.0037	41.8407	41.8407	42.0037	41.3818	41.6827	41.2389	41.2389	41.5298	41.2389	41.8407 (38)
Average = Sum(39)m / 12 =	92.6514	92.1323	91.9693	91.9693	92.1323	91.5104	91.8113	91.3675	91.3675	91.6584	91.3675	91.9693 (39)
												91.8255
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9926	0.9871	0.9853	0.9853	0.9871	0.9804	0.9836	0.9789	0.9789	0.9820	0.9789	0.9853 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6687 (42)
Hot water usage for mixer showers												85.8768 (42a)
Hot water usage for baths												29.6800 (42b)
Hot water usage for other uses												41.9605 (42c)
Average daily hot water use (litres/day)												145.2373 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173 (44)
Energy content (annual)	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340 (45)
Distribution loss (46)m = 0.15 x (45)m												2412.3938
Water storage loss:												36.9951 (46)
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												0.0103 (51)
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.7368 (52)
Volume factor from Table 2a												0.5400 (53)
Temperature factor from Table 2b												1.2281 (55)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss												38.0698 (56)
If cylinder contains dedicated solar storage												38.0698 (57)
Primary loss												23.2624 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												307.9662 (62)
WWHRS												0.0000 (63a)
PV diverter												-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												761.8610 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												761.8610
Solar input	-1.8066	-20.9016	-66.2724	-94.0035	-118.5966	-119.4269	-116.0534	-103.7445	-72.6012	-40.8605	-7.5938	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	309.6771	254.7641	225.2046	156.2208	117.4800	91.9148	91.4758	113.4813	153.8909	216.7387	268.3831	307.9662 (64)
Electric shower(s)												2307.1975 (64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	124.9364	107.7902	101.1869	92.1254	91.5862	95.2453	100.5306	113.6720	119.5102	131.0716 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657 (68)
Pumps, fans	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Total internal gains	177.7434	174.9358	167.9253	149.7085	136.0040	127.9519	123.0997	128.0178	139.6259	152.7850	165.9864	176.1715 (72)
	687.9424	685.0915	662.8200	618.2139	574.0623	536.6641	516.6259	521.5873	548.4563	591.0048	634.6532	671.1845 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains	
	m2	Table 6a	Specific data	Specific data	factor	W	
		W/m2	or Table 6b	or Table 6c	Table 6d		
North	11.5300	13.0723	0.6300	0.7000	0.7700	46.0630 (74)	
Solar gains	46.0630	78.1341	133.1561	221.7956	289.9619	335.2033	307.1640
Total gains	734.0055	763.2256	795.9761	840.0095	864.0242	871.8674	823.7899

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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tau	25.8520	25.9977	26.0438	26.0438	25.9977	26.1744	26.0886	26.2153	26.2153	26.1321	26.2153	26.0438
alpha	2.7235	2.7332	2.7363	2.7363	2.7332	2.7450	2.7392	2.7477	2.7477	2.7421	2.7477	2.7363
util living area	0.9176	0.9070	0.8722	0.8048	0.6813	0.5081	0.3809	0.3934	0.6338	0.8011	0.8878	0.9230 (86)
MIT	19.0807	19.2094	19.6223	20.1154	20.5940	20.8752	20.9591	20.9575	20.7535	20.2929	19.6443	19.0537 (87)
Th 2	20.0895	20.0941	20.0956	20.0956	20.0941	20.0997	20.0970	20.1010	20.1010	20.0984	20.1010	20.0956 (88)
util rest of house	0.9072	0.8954	0.8554	0.7778	0.6349	0.4385	0.2927	0.3006	0.5692	0.7671	0.8714	0.9131 (89)
MIT 2	17.8657	18.0293	18.5459	19.1496	19.7086	20.0074	20.0767	20.0803	19.8963	19.3761	18.5831	17.8363 (90)
Living area fraction									FLA = Living area / (4) =			0.1783 (91)
MIT	18.0823	18.2397	18.7378	19.3218	19.8665	20.1621	20.2340	20.2367	20.0491	19.5395	18.7723	18.0533 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0823	18.2397	18.7378	19.3218	19.8665	20.1621	20.2340	20.2367	20.0491	19.5395	18.7723	18.0533 (93)

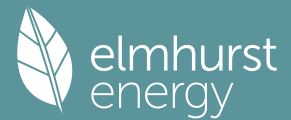
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8775	0.8651	0.8247	0.7511	0.6221	0.4435	0.3065	0.3151	0.5651	0.7425	0.8411	0.8842	(94)
Useful gains	644.1111	660.2506	656.4210	630.9487	537.5488	386.7027	252.5128	242.2166	406.9334	512.8169	581.9080	626.4347	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1193.5658	1173.7356	1051.9297	884.9098	651.0492	417.4766	260.1912	250.0420	470.4603	709.3931	965.9651	1182.1136	(97)
Space heating kWh	408.7942	345.0619	294.2585	182.8520	84.4443	0.0000	0.0000	0.0000	0.0000	146.2527	276.5211	413.4251	(98a)
Space heating requirement - total per year (kWh/year)												2151.6098	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	408.7942	345.0619	294.2585	182.8520	84.4443	0.0000	0.0000	0.0000	0.0000	146.2527	276.5211	413.4251	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2151.6098	
Space heating per m2										(98c) / (4) =		23.0513	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	408.7942	345.0619	294.2585	182.8520	84.4443	0.0000	0.0000	0.0000	0.0000	146.2527	276.5211	413.4251	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	163.5831	138.0800	117.7505	73.1701	33.7912	0.0000	0.0000	0.0000	0.0000	58.5245	110.6527	165.4362	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	309.6771	254.7641	225.2046	156.2208	117.4800	91.9148	91.4758	113.4813	153.8909	216.7387	268.3831	307.9662	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	176.8573	145.4963	128.6148	89.2181	67.0931	52.4928	52.2420	64.8094	87.8875	123.7799	153.2742	175.8802	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-45.1505	-60.2694	-89.3208	-104.1460	-108.3866	-100.7553	-98.5205	-94.1733	-84.1848	-72.2303	-50.4871	-37.8701	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												860.9883	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1317.6457	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												242.5617	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-945.4947	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1555.7010	(238)

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10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	860.9883	26.0600	224.3736 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1317.6457	26.0600	343.3785 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	242.5617	26.0600	63.2116 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-945.4947	26.0600	-246.3959
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-246.3959 (252)
Total energy cost			405.4157 (255)

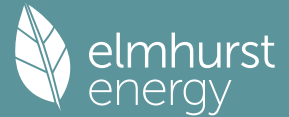
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	860.9883	0.1549	133.3304 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1317.6457	0.1458	192.1256 (264)
Space and water heating			325.4560 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	242.5617	0.1443	35.0092 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-945.4947	0.1347	-127.3327
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-127.3327 (269)
Total CO2, kg/year			244.2294 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	860.9883	1.5733	1354.6296 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1317.6457	1.5394	2028.3462 (278)
Space and water heating			3382.9758 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	242.5617	1.5338	372.0493 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-945.4947	1.4977	-1416.0994
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1416.0994 (283)
Total Primary energy kWh/year			2459.9497 (286)

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Property Reference	FURNERS LANE 17				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 17, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	79 C	DER	4.90	TER	10.87	
Environmental	96 A	% DER < TER				54.92
CO ₂ Emissions (t/year)	0.37	DFEE	31.58	TFEE	32.32	
Compliance Check	See BREL	% DFEE < TFEE				2.28
% DPER < TPER	8.59	DPER	51.87	TPER	56.74	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			40.6700	0.1000	4.0670	75.0000	3050.2500 (28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782	9.0000	278.9100 (29a)
Joists FF	40.6700		40.6700	0.1100	4.4737	9.0000	366.0300 (30)
Total net area of external elements Aum(A, m ²)			125.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.4582		(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)
FF			95.0000			9.0000	855.0000 (32c)
Internal Floor 1			40.6700			18.0000	732.0600 (32d)
Internal Ceiling 1			40.6700			9.0000	366.0300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8302.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							102.0688 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)				8.5800	0.0600	0.5148	
E18 Party wall between dwellings				20.4000	0.0600	1.2240	

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P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752	
P1 Party wall - Ground floor	18.9600	0.0800	1.5168	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000	
E2 Other lintels (including other steel lintels)	8.2600	0.0500	0.4130	
E3 Sill	7.3300	0.0500	0.3665	
E4 Jamb	15.3000	0.0500	0.7650	
E5 Ground floor (normal)	8.5800	0.1600	1.3728	
E6 Intermediate floor within a dwelling	8.5800	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				8.4481 (36)
Point Thermal bridges				0.0000
Total fabric heat loss		(33) + (36) + (36a) =		36.9063 (37)

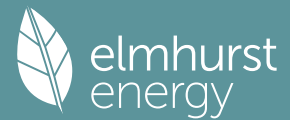
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.4839	Feb 40.2408	Mar 40.0025	Apr 38.8834	May 38.6740	Jun 37.6992	Jul 37.6992	Aug 37.5187	Sep 38.0747	Oct 38.6740	Nov 39.0976	Dec 39.5404 (38)
Heat transfer coeff	77.3902	77.1471	76.9088	75.7897	75.5803	74.6055	74.6055	74.4250	74.9810	75.5803	76.0039	76.4467 (39)
Average = Sum(39)m / 12 =												75.7887
HLP	Jan 0.9514	Feb 0.9485	Mar 0.9455	Apr 0.9318	May 0.9292	Jun 0.9172	Jul 0.9172	Aug 0.9150	Sep 0.9218	Oct 0.9292	Nov 0.9344	Dec 0.9398 (40)
HLP (average)												0.9318
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.4878 (42)
Hot water usage for mixer showers												
	82.4148	81.1763	79.3715	75.9184	73.3700	70.5282	68.9128	70.7040	72.6674	75.7187	79.2460	82.0990 (42a)
Hot water usage for baths	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798 (42b)
Hot water usage for other uses	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075 (42c)
Average daily hot water use (litres/day)												138.8469 (43)
Daily hot water use	Jan 150.9984	Feb 147.8785	Mar 144.0197	Apr 138.0100	May 133.1810	Jun 127.9690	Jul 125.8612	Aug 129.7022	Sep 133.7679	Oct 139.2533	Nov 145.3597	Dec 150.5864 (44)
Energy content	239.1445	210.5770	221.3529	188.9288	179.2873	157.3528	152.2182	160.5984	164.9492	188.9654	207.0916	235.7819 (45)
Energy content (annual)										Total = Sum(45)m =		2306.2480
Distribution loss (46)m = 0.15 x (45)m												
	35.8717	31.5866	33.2029	28.3393	26.8931	23.6029	22.8327	24.0898	24.7424	28.3448	31.0637	35.3673 (46)
Water storage loss:												
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7368 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss												
	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (56)
If cylinder contains dedicated solar storage												
	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
FV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3028.3851 (64)
Electric shower(s)												3028 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	128.5813	114.3343	122.6656	110.3018	108.6788	99.8028	99.6783	102.4647	102.3286	111.8967	116.3409	127.4632 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan 124.3897	Feb 124.3897	Mar 124.3897	Apr 124.3897	May 124.3897	Jun 124.3897	Jul 124.3897	Aug 124.3897	Sep 124.3897	Oct 124.3897	Nov 124.3897	Dec 124.3897 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	121.6009	134.6296	121.6009	125.6543	121.6009	125.6543	121.6009	121.6009	125.6543	121.6009	125.6543	121.6009 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	222.2183	224.5242	218.7134	206.3427	190.7270	176.0504	166.2455	163.9396	169.7505	182.1211	197.7369	212.4134 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118 (71)
Water heating gains (Table 5)												
	172.8243	170.1403	164.8731	153.1970	146.0736	138.6150	133.9762	137.7214	142.1231	150.3988	161.5846	171.3215 (72)
Total internal gains	579.9605	592.6111	568.5043	548.5109	521.7184	500.6366	482.1396	483.5788	497.8447	517.4378	548.2927	568.6528 (73)

6. Solar gains												
[Jan]												
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
North	10.8200				10.6334		0.6300		0.7000		0.7700	35.1618 (74)
Solar gains	35.1618	67.1960	114.1824	183.4062	247.0649	264.4903	246.9355	195.9118	137.2842	79.9880	43.3766	29.3126 (83)
Total gains	615.1223	659.8071	682.6867	731.9171	768.7833	765.1269	729.0751	679.4906	635.1290	597.4258	591.6693	597.9654 (84)

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7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7995	29.8934	29.9860	30.4288	30.5131	30.9118	30.9118	30.9867	30.7570	30.5131	30.3430	30.1673
alpha	2.9866	2.9929	2.9991	3.0286	3.0342	3.0608	3.0608	3.0658	3.0505	3.0342	3.0229	3.0112
util living area	0.9398	0.9233	0.8964	0.8291	0.7175	0.5591	0.4278	0.4713	0.6714	0.8441	0.9155	0.9439 (86)
MIT	19.1022	19.3167	19.6602	20.1699	20.5947	20.8662	20.9561	20.9404	20.7557	20.2453	19.6238	19.0793 (87)
Th 2	20.1240	20.1265	20.1290	20.1406	20.1428	20.1529	20.1529	20.1548	20.1490	20.1428	20.1384	20.1338 (88)
util rest of house	0.9320	0.9133	0.8825	0.8056	0.6783	0.5001	0.3529	0.3949	0.6159	0.8179	0.9031	0.9366 (89)
MIT 2	17.9035	18.1742	18.6061	19.2399	19.7419	20.0435	20.1261	20.1164	19.9340	19.3432	18.5718	17.8809 (90)
Living area fraction												0.2496 (91)
MIT	18.2027	18.4593	18.8692	19.4720	19.9547	20.2489	20.3333	20.3221	20.1391	19.5683	18.8343	18.1800 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2027	18.4593	18.8692	19.4720	19.9547	20.2489	20.3333	20.3221	20.1391	19.5683	18.8343	18.1800 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9096	0.8895	0.8579	0.7847	0.6690	0.5070	0.3694	0.4106	0.6152	0.7974	0.8795	0.9151 (94)
Useful gains	559.5404	586.8889	585.6863	574.3257	514.3001	387.9562	269.2856	278.9989	390.7439	476.3830	520.3865	547.1821 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1075.9301	1046.0639	951.2987	801.2510	623.8922	421.4365	278.5221	291.9011	452.8168	677.8273	891.8559	1068.7220 (97)
Space heating kWh	384.1939	308.5656	272.0156	163.3862	81.5365	0.0000	0.0000	0.0000	0.0000	149.8746	267.4580	388.0257 (98a)
Space heating requirement - total per year (kWh/year)												2015.0561
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	384.1939	308.5656	272.0156	163.3862	81.5365	0.0000	0.0000	0.0000	0.0000	149.8746	267.4580	388.0257 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2015.0561
Space heating per m2										(98c) / (4) =		24.7732 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	384.1939	308.5656	272.0156	163.3862	81.5365	0.0000	0.0000	0.0000	0.0000	149.8746	267.4580	388.0257 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	153.7391	123.4756	108.8498	65.3806	32.6277	0.0000	0.0000	0.0000	0.0000	59.9738	107.0260	155.2724 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	171.6029	151.8982	161.4421	141.7947	137.4183	123.7616	121.9591	126.7450	128.0999	142.9455	152.1675	169.6825 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	25.8516	20.7391	18.6732	13.6808	10.5675	8.6337	9.6400	12.5304	16.2758	21.3547	24.1201	26.5701 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												806.3450 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1729.5175 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												208.6369 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												

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PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2744.4993 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	806.3450	0.1547	124.7526 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1729.5175	0.1409	243.6801 (264)
Space and water heating			368.4327 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	208.6369	0.1443	30.1127 (268)
Total CO2, kg/year			398.5455 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.9000 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	806.3450	1.5728	1268.2168 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1729.5175	1.5210	2630.5580 (278)
Space and water heating			3898.7748 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	208.6369	1.5338	320.0142 (282)
Total Primary energy kWh/year			4218.7890 (286)
Dwelling Primary energy Rate (DPER)			51.8700 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.4170 (5)

2. Ventilation rate

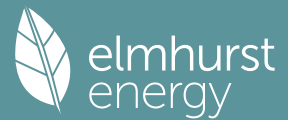
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			10.8200	1.1450	12.3893		(27)

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Ground Floor				40.6700	0.1300	5.2871	(28a)
Brick	43.7600	12.7700		30.9900	0.1800	5.5782	(29a)
Joists FF	40.6700			40.6700	0.1100	4.4737	(30)
Total net area of external elements Aum(A, m2)				125.1000			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =		29.6783	(33)
Party Wall 1				96.7000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

102.0688 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	8.5800	0.0600	0.5148
E18 Party wall between dwellings	20.4000	0.0600	1.2240
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752
P1 Party wall - Ground floor	18.9600	0.0800	1.5168
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000
E2 Other lintels (including other steel lintels)	8.2600	0.0500	0.4130
E3 Sill	7.3300	0.0500	0.3665
E4 Jamb	15.3000	0.0500	0.7650
E5 Ground floor (normal)	8.5800	0.1600	1.3728
E6 Intermediate floor within a dwelling	8.5800	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

8.4481 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 38.1264 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.4839	40.2408	40.0025	38.8834	38.6740	37.6992	37.6992	37.5187	38.0747	38.6740	39.0976	39.5404
Heat transfer coeff	78.6103	78.3672	78.1289	77.0098	76.8004	75.8256	75.8256	75.6451	76.2011	76.8004	77.2240	77.6668
Average = Sum(39)m / 12 =												77.0088

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9664	0.9635	0.9605	0.9468	0.9442	0.9322	0.9322	0.9300	0.9368	0.9442	0.9494	0.9548
HLP (average)												0.9468
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy

2.4878 (42)

Hot water usage for mixer showers

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	65.9319	64.9410	63.4972	60.7347	58.6960	56.4225	55.1303	56.5632	58.1339	60.5749	63.3968	65.6792
Hot water usage for baths	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798
Hot water usage for other uses	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075
Average daily hot water use (litres/day)												123.6501

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	134.5154	131.6432	128.1454	122.8264	118.5070	113.8634	112.0786	115.5614	119.2345	124.1095	129.5105	134.1666
Energy conte	213.0396	187.4582	196.9547	168.1432	159.5332	140.0083	135.5494	143.0891	147.0280	168.4155	184.5115	210.0724
Energy content (annual)										Total = Sum(45)m =		2053.8030
Distribution loss (46)m = 0.15 x (45)m	31.9559	28.1187	29.5432	25.2215	23.9300	21.0012	20.3324	21.4634	22.0542	25.2623	27.6767	31.5109

Water storage loss:

Store volume

300.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):

Temperature factor from Table 2b

2.1127 (48)

Enter (49) or (54) in (55)

0.5400 (49)

Total storage loss

1.1409 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month	271.6684	240.4133	255.5835	224.8807	218.1620	196.7458	194.1782	201.7179	203.7656	227.0443	241.2490	268.7012
WWHRS	-30.1413	-26.6572	-27.9139	-23.1138	-21.5412	-18.4330	-17.2780	-18.3734	-19.0715	-22.4832	-25.4707	-29.5831
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	241.5271	213.7561	227.6697	201.7669	196.6208	178.3129	176.9002	183.3445	184.6941	204.5611	215.7783	239.1181

12Total per year (kWh/year)

Total per year (kWh/year) = Sum(64)m = 2464.0498 (64)

Electric shower(s)

0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	117.7387	104.6939	112.3905	101.2976	99.9479	91.9428	91.9732	94.4802	94.2769	102.9012	106.7401	116.7521

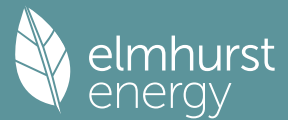
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	121.6009	134.6296	121.6009	125.6543	121.6009	125.6543	121.6009	121.6009	125.6543	121.6009	125.6543	121.6009
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.2183	224.5242	218.7134	206.3427	190.7270	176.0504	166.2455	163.9396	169.7505	182.1211	197.7369	212.4134
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000
Losses e.g. evaporation (negative values) (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118
Water heating gains (Table 5)	158.2509	155.7945	151.0625	140.6912	134.3385	127.6983	123.6199	126.9895	130.9401	138.3081	148.2502	156.9249
Total internal gains	565.3871	578.2652	554.6937	536.0051	509.9833	489.7199	471.7833	472.8469	486.6618	505.3470	534.9582	554.2562

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	10.8200				10.6334		0.6300		0.7000		0.7700		35.1618 (74)	
Solar gains	35.1618	67.1960	114.1824	183.4062	247.0649	264.4903	246.9355	195.9118	137.2842	79.9880	43.3766	29.3126	(83)	
Total gains	600.5489	645.4612	668.8761	719.4113	757.0482	754.2102	718.7188	668.7587	623.9460	585.3350	578.3348	583.5688	(84)	
7. Mean internal temperature (heating season)														
Temperature during heating periods in the living area from Table 9, Th1 (C)														
Utilisation factor for gains for living area, nil,m (see Table 9a)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	29.3370	29.4280	29.5177	29.9467	30.0283	30.4144	30.4144	30.4869	30.2645	30.0283	29.8636	29.6934		
alpha	2.9558	2.9619	2.9678	2.9964	3.0019	3.0276	3.0276	3.0325	3.0176	3.0019	2.9909	2.9796		
util living area	0.9437	0.9278	0.9022	0.8371	0.7279	0.5708	0.4387	0.4832	0.6836	0.8524	0.9207	0.9476	(86)	
MIT	19.0287	19.2468	19.5981	20.1228	20.5653	20.8533	20.9509	20.9336	20.7349	20.2014	19.5618	19.0051	(87)	
Th 2	20.1114	20.1139	20.1164	20.1279	20.1301	20.1402	20.1402	20.1421	20.1363	20.1301	20.1257	20.1211	(88)	
util rest of house	0.9362	0.9183	0.8887	0.8140	0.6888	0.5106	0.3614	0.4047	0.6279	0.8268	0.9088	0.9406	(89)	
MIT 2	17.8035	18.0790	18.5214	19.1749	19.6994	20.0202	20.1104	20.0994	19.9025	19.2825	18.4871	17.7799	(90)	
Living area fraction	fLA = Living area / (4) =													
MIT	18.1093	18.3705	18.7901	19.4115	19.9155	20.2281	20.3201	20.3076	20.1103	19.5118	18.7553	18.0857	(92)	
Temperature adjustment	0.0000													
adjusted MIT	18.1093	18.3705	18.7901	19.4115	19.9155	20.2281	20.3201	20.3076	20.1103	19.5118	18.7553	18.0857	(93)	
8. Space heating requirement														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9141	0.8945	0.8638	0.7921	0.6782	0.5171	0.3781	0.4205	0.6261	0.8054	0.8851	0.9194	(94)	
Useful gains	548.9545	577.3435	577.7754	569.8623	513.4667	390.0057	271.7471	281.1839	390.6273	471.4244	511.9025	536.5189	(95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Heat loss rate W	1085.5538	1055.6425	960.2130	809.4859	630.9545	426.7562	282.0825	295.5891	457.9893	684.4307	900.0679	1078.4575	(97)	
Space heating kWh	399.2299	321.4169	284.5335	172.5290	87.4109	0.0000	0.0000	0.0000	0.0000	158.4767	279.4791	403.2023	(98a)	
Space heating requirement - total per year (kWh/year)													2106.2784	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)	
Solar heating contribution - total per year (kWh/year)													0.0000	
Space heating kWh	399.2299	321.4169	284.5335	172.5290	87.4109	0.0000	0.0000	0.0000	0.0000	158.4767	279.4791	403.2023	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)													2106.2784	
Space heating per m2	(98c) / (4) =												25.8947 (99)	
9a. Energy requirements - Individual heating systems, including micro-CHP														
Fraction of space heat from secondary/supplementary system (Table 11)														
Fraction of space heat from main system(s)														
Efficiency of main space heating system 1 (in %)														
Efficiency of main space heating system 2 (in %)														
Efficiency of secondary/supplementary heating system, %														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	399.2299	321.4169	284.5335	172.5290	87.4109	0.0000	0.0000	0.0000	0.0000	158.4767	279.4791	403.2023	(98)	
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)	
Space heating fuel (main heating system)	432.5351	348.2307	308.2703	186.9220	94.7031	0.0000	0.0000	0.0000	0.0000	171.6974	302.7943	436.8389	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	241.5271	213.7561	227.6697	201.7669	196.6208	178.3129	176.9002	183.3445	184.6941	204.5611	215.7783	239.1181	(64)	
Efficiency of water heater	85.1789	84.9723	84.5609	83.7107	82.3692	79.8000	79.8000	79.8000	79.8000	83.4940	84.6409	79.8000	(216)	
Fuel for water heating, kWh/month	283.5528	251.5598	269.2374	241.0287	238.7068	223.4497	221.6795	229.7550	231.4462	245.0009	254.9338	280.5829	(219)	
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)	
Lighting	25.2663	20.2695	18.2505	13.3711	10.3282	8.4382	9.4217	12.2467	15.9073	20.8712	23.5740	25.9685	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-37.8975	-53.3412	-76.5404	-85.8970	-92.4781	-86.2591	-85.1957	-80.5106	-72.2039	-60.9308	-41.6351	-32.7751	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-21.6514	-45.5294	-90.4665	-135.8371	-179.5775	-180.4276	-178.3007	-150.9742	-110.6722	-65.0923	-28.9012	-17.1221	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													2281.9917 (211)	
Space heating fuel - main system 2													0.0000 (213)	

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2970.9337 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	203.9133 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2010.2166 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3532.6220 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2281.9917	0.2100	479.2183 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2970.9337	0.2100	623.8961 (264)
Space and water heating			1103.1143 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	203.9133	0.1443	29.4310 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-805.6644	0.1346	-108.4626
PV Unit electricity exported	-1204.5522	0.1259	-151.6581
Total			-260.1207 (269)
Total CO2, kg/year			884.3538 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.8700 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2281.9917	1.1300	2578.6507 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2970.9337	1.1300	3357.1550 (278)
Space and water heating			5935.8057 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	203.9133	1.5338	312.7690 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-805.6644	1.4976	-1206.5258
PV Unit electricity exported	-1204.5522	0.4622	-556.6899
Total			-1763.2157 (283)
Total Primary energy kWh/year			4615.4597 (286)
Target Primary Energy Rate (TPER)			56.7400 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

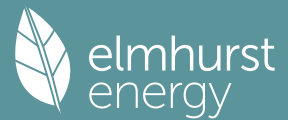
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)

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Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3354 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			10.8200	1.1450	12.3893			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			40.6700	0.1000	4.0670	75.0000	3050.2500	(28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782	9.0000	278.9100	(29a)
Joists FF	40.6700		40.6700	0.1100	4.4737	9.0000	366.0300	(30)
Total net area of external elements Aum(A, m2)			125.1000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.4582			(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			95.0000			9.0000	855.0000	(32c)
Internal Floor 1			40.6700			18.0000	732.0600	(32d)
Internal Ceiling 1			40.6700			9.0000	366.0300	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 8302.2800 (34)
List of Thermal Bridges
102.0688 (35)

K1 Element	Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)	8.5800	0.0600	0.5148	
E18 Party wall between dwellings	20.4000	0.0600	1.2240	
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752	
P1 Party wall - Ground floor	18.9600	0.0800	1.5168	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000	
E2 Other lintels (including other steel lintels)	8.2600	0.0500	0.4130	
E3 Sill	7.3300	0.0500	0.3665	
E4 Jamb	15.3000	0.0500	0.7650	
E5 Ground floor (normal)	8.5800	0.1600	1.3728	
E6 Intermediate floor within a dwelling	8.5800	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				8.4481 (36)
Point Thermal Bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	36.9063 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	40.4839	40.2408	40.0025	38.8834	38.6740	37.6992	37.6992	37.5187	38.0747	38.6740	39.0976	39.5404	(38)
Average = Sum(39)m / 12 =	77.3902	77.1471	76.9088	75.7897	75.5803	74.6055	74.6055	74.4250	74.9810	75.5803	76.0039	76.4467	(39)
													75.7887
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9514	0.9485	0.9455	0.9318	0.9292	0.9172	0.9172	0.9150	0.9218	0.9292	0.9344	0.9398	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
													0.9318
													31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4878 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Hot water usage for other uses	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798	(42b)
Average daily hot water use (litres/day)	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075	(42c)
													62.8632 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	68.5836	66.7022	64.6482	62.0917	59.8110	57.4408	56.9484	58.9982	61.1006	63.5346	66.1137	68.4873	(44)
Energy content (annual)	108.6196	94.9831	99.3619	85.0004	80.5171	70.6302	68.8741	73.0521	75.3431	86.2158	94.1911	107.2346	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
WWHRS	92.3267	80.7356	84.4576	72.2503	68.4395	60.0357	58.5430	62.0943	64.0416	73.2835	80.0625	91.1494	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
	92.3267	80.7356	84.4576	72.2503	68.4395	60.0357	58.5430	62.0943	64.0416	73.2835	80.0625	91.1494	(64)
12Total per year (kWh/year)													887.4197 (64)
Electric shower(s)													887 (64)
	52.8004	47.0456	51.3720	49.0237	49.9436	47.6413	49.2294	49.9436	49.0237	51.3720	50.4060	52.8004	(64a)
Heat gains from water heating, kWh/month													600.6017 (64a)
	36.2818	31.9453	33.9574	30.3185	29.5958	26.9193	26.9431	28.0095	28.2663	31.1639	32.6171	35.9875	(65)

5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	121.6009	134.6296	121.6009	125.6543	121.6009	125.6543	121.6009	121.6009	125.6543	121.6009	125.6543	121.6009 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.2183	224.5242	218.7134	206.3427	190.7270	176.0504	166.2455	163.9396	169.7505	182.1211	197.7369	212.4134 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118 (71)
Water heating gains (Table 5)	48.7658	47.5377	45.6417	42.1090	39.7793	37.3878	36.2138	37.6471	39.2588	41.8869	45.3016	48.3702 (72)
Total internal gains	452.9020	467.0084	446.2729	434.4229	412.4241	399.4094	384.3772	383.5046	394.9805	405.9259	429.0096	442.7015 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W		
-----				-----				-----					
North				10.8200	10.6334	0.6300	0.7000			0.7700	35.1618 (74)		
-----				-----				-----					
Solar gains	35.1618	67.1960	114.1824	183.4062	247.0649	264.4903	246.9355	195.9118	137.2842	79.9880	43.3766	29.3126 (83)	
Total gains	488.0638	534.2044	560.4552	617.8291	659.4890	663.8998	631.3127	579.4164	532.2647	485.9139	472.3862	472.0141 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7995	29.8934	29.9860	30.4288	30.5131	30.9118	30.9118	30.9867	30.7570	30.5131	30.3430	30.1673
alpha	2.9866	2.9929	2.9991	3.0286	3.0342	3.0608	3.0608	3.0658	3.0505	3.0342	3.0229	3.0112
util living area	0.9653	0.9528	0.9325	0.8761	0.7755	0.6194	0.4837	0.5363	0.7423	0.8964	0.9495	0.9684 (86)
MIT	18.8181	19.0502	19.4223	19.9944	20.4872	20.8217	20.9384	20.9148	20.6716	20.0612	19.3747	18.7929 (87)
Th 2	20.1240	20.1265	20.1290	20.1406	20.1428	20.1529	20.1529	20.1548	20.1490	20.1428	20.1384	20.1338 (88)
util rest of house	0.9604	0.9461	0.9225	0.8569	0.7396	0.5590	0.4022	0.4541	0.6900	0.8765	0.9413	0.9639 (89)
MIT 2	18.1159	18.3465	18.7147	19.2776	19.7400	20.0368	20.1230	20.1109	19.9172	19.3516	18.6778	18.0977 (90)
Living area fraction	18.2911	18.5221	18.8913	19.4565	19.9265	20.2327	20.3265	20.3115	20.1055	19.5287	18.8517	18.2712 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2911	18.5221	18.8913	19.4565	19.9265	20.2327	20.3265	20.3115	20.1055	19.5287	18.8517	18.2712 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9469	0.9304	0.9048	0.8391	0.7295	0.5651	0.4196	0.4702	0.6870	0.8592	0.9256	0.9512 (94)
Useful gains	462.1700	497.0455	507.0907	518.4081	481.1261	375.1513	264.9052	272.4170	365.6805	417.5163	437.2278	448.9927 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1082.7748	1050.9071	953.0010	800.0736	621.7610	420.2325	278.0155	291.1135	450.2962	674.8330	893.1770	1075.6997 (97)
Space heating kWh	461.7299	372.1950	331.7573	202.7992	104.6323	0.0000	0.0000	0.0000	0.0000	191.4436	328.2834	466.2700 (98a)
Space heating requirement - total per year (kWh/year)												2459.1107
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	461.7299	372.1950	331.7573	202.7992	104.6323	0.0000	0.0000	0.0000	0.0000	191.4436	328.2834	466.2700 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2459.1107
Space heating per m ²										(98c) / (4) =		30.2325 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	701.2920	552.0810	565.6302	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7647	0.8289	0.7922	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	536.2435	457.6342	448.0912	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	722.1042	686.6343	628.4349	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	133.8197	170.3761	134.1758	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	33.4549	42.5940	33.5439	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												109.5929 (107)
Energy for space heating												30.2325 (99)
Energy for space cooling												1.3473 (108)
Total												31.5798 (109)
Fabric Energy Efficiency (DFEE)												31.6 (109)

Full SAP Calculation Printout



SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Ground Floor			40.6700	0.1300	5.2871		(28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782		(29a)
Joists FF	40.6700		40.6700	0.1100	4.4737		(30)
Total net area of external elements Aum(A, m ²)			125.1000				(31)
Fabric heat loss, W/K = Sum (A x U)					29.6783		(32)
Party Wall 1			96.7000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							102.0688 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)				8.5800	0.0600	0.5148	
E18 Party wall between dwellings				20.4000	0.0600	1.2240	
P4 Party wall - Roof (insulation at ceiling level)				18.9600	0.1200	2.2752	
P1 Party wall - Ground floor				18.9600	0.0800	1.5168	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				18.9600	0.0000	0.0000	
E2 Other lintels (including other steel lintels)				8.2600	0.0500	0.4130	
E3 Sill				7.3300	0.0500	0.3665	
E4 Jamb				15.3000	0.0500	0.7650	
E5 Ground floor (normal)				8.5800	0.1600	1.3728	
E6 Intermediate floor within a dwelling				8.5800	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						8.4481	(36)
Point Thermal bridges						0.0000	(36a) =
Total fabric heat loss						38.1264	(33) + (36) + (36a) = (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	40.4839	40.2408	40.0025	38.8834	38.6740	37.6992	37.6992	37.5187	38.0747	38.6740	39.0976	39.5404 (38)
Heat transfer coeff	78.6103	78.3672	78.1289	77.0098	76.8004	75.8256	75.8256	75.6451	76.2011	76.8004	77.2240	77.6668 (39)
Average = Sum(39)m / 12 =												77.0088
HLP	0.9664	0.9635	0.9605	0.9468	0.9442	0.9322	0.9322	0.9300	0.9368	0.9442	0.9494	Dec 0.9548 (40)
HLP (average)												0.9468
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4878 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)

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Hot water usage for baths	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798 (42b)
Hot water usage for other uses	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075 (42c)
Average daily hot water use (litres/day)												62.8632 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	68.5836	66.7022	64.6482	62.0917	59.8110	57.4408	56.9484	58.9982	61.1006	63.5346	66.1137	68.4873 (44)
Energy content (annual)	108.6196	94.9831	99.3619	85.0004	80.5171	70.6302	68.8741	73.0521	75.3431	86.2158	94.1911	107.2346 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
WWHRS	92.3267	80.7356	84.4576	72.2503	68.4395	60.0357	58.5430	62.0943	64.0416	73.2835	80.0625	91.1494 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	92.3267	80.7356	84.4576	72.2503	68.4395	60.0357	58.5430	62.0943	64.0416	73.2835	80.0625	91.1494 (64)
12Total per year (kWh/year)												887.4197 (64)
Electric shower(s)	52.8004	47.0456	51.3720	49.0237	49.9436	47.6413	49.2294	49.9436	49.0237	51.3720	50.4060	52.8004 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												600.6017 (64a)
Heat gains from water heating, kWh/month	36.2818	31.9453	33.9574	30.3185	29.5958	26.9193	26.9431	28.0095	28.2663	31.1639	32.6171	35.9875 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897	124.3897 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	121.6009	134.6296	121.6009	125.6543	121.6009	125.6543	121.6009	121.6009	125.6543	121.6009	125.6543	121.6009 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.2183	224.5242	218.7134	206.3427	190.7270	176.0504	166.2455	163.9396	169.7505	182.1211	197.7369	212.4134 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390	35.4390 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118 (71)
Water heating gains (Table 5)	48.7658	47.5377	45.6417	42.1090	39.7793	37.3878	36.2138	37.6471	39.2588	41.8869	45.3016	48.3702 (72)
Total internal gains	452.9020	467.0084	446.2729	434.4229	412.4241	399.4094	384.3772	383.5046	394.9805	405.9259	429.0096	442.7015 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W		
-----				-----				-----				-----	
North				10.8200	10.6334	0.6300		0.7000		0.7700	35.1618 (74)		
-----				-----				-----				-----	
Solar gains	35.1618	67.1960	114.1824	183.4062	247.0649	264.4903	246.9355	195.9118	137.2842	79.9880	43.3766	29.3126 (83)	
Total gains	488.0638	534.2044	560.4552	617.8291	659.4890	663.8998	631.3127	579.4164	532.2647	485.9139	472.3862	472.0141 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.3370	29.4280	29.5177	29.9467	30.0283	30.4144	30.4144	30.4869	30.2645	30.0283	29.8636	29.6934
alpha	2.9558	2.9619	2.9678	2.9964	3.0019	3.0276	3.0276	3.0325	3.0176	3.0019	2.9909	2.9796
util living area	0.9656	0.9532	0.9333	0.8780	0.7792	0.6248	0.4893	0.5419	0.7465	0.8979	0.9500	0.9686 (86)
MIT	18.7765	19.0096	19.3854	19.9638	20.4662	20.8114	20.9339	20.9091	20.6569	20.0346	19.3393	18.7509 (87)
Th 2	20.1114	20.1139	20.1164	20.1279	20.1301	20.1402	20.1402	20.1421	20.1363	20.1301	20.1257	20.1211 (88)
util rest of house	0.9607	0.9466	0.9233	0.8589	0.7432	0.5637	0.4063	0.4584	0.6939	0.8781	0.9418	0.9642 (89)
MIT 2	18.0662	18.2978	18.6697	19.2391	19.7110	20.0175	20.1082	20.0953	19.8942	19.3169	18.6342	18.0476 (90)
Living area fraction									fLA = Living area / (4) =			0.2496 (91)
MIT	18.2435	18.4754	18.8483	19.4199	19.8995	20.2156	20.3143	20.2984	20.0846	19.4961	18.8102	18.2231 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2435	18.4754	18.8483	19.4199	19.8995	20.2156	20.3143	20.2984	20.0846	19.4961	18.8102	18.2231 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9471	0.9308	0.9054	0.8407	0.7325	0.5694	0.4238	0.4745	0.6904	0.8605	0.9260	0.9513 (94)
Ext temp.	462.2394	497.2216	507.4552	519.3884	483.1011	378.0235	267.5461	274.9065	367.4766	418.1338	437.4153	449.0441 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1096.1004	1063.8689	964.7602	810.1380	629.7233	425.8096	281.6362	294.8953	456.0297	683.2205	904.3055	1089.1323 (97)
Space heating requirement - total per year (kWh/year)	471.5926	380.7870	340.2349	209.3397	109.0869	0.0000	0.0000	0.0000	0.0000	197.2244	336.1610	476.2256 (98a)
												2520.6521

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Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	471.5926	380.7870	340.2349	209.3397	109.0869	0.0000	0.0000	0.0000	0.0000	197.2244	336.1610	476.2256 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2520.6521
Space heating per m2										(98c) / (4) =		30.9891 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	712.7610	561.1097	574.9030	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7566	0.8217	0.7844	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	539.2663	461.0845	450.9630	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	722.1042	686.6343	628.4349	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	131.6433	167.8091	132.0391	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	32.9108	41.9523	33.0098	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												107.8729 (107)
Energy for space heating												30.9891 (99)
Energy for space cooling												1.3262 (108)
Total												32.3153 (109)
Fabric Energy Efficiency (TFEE)												32.3 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.6700 (1b)	x	2.4000 (2b) =
First floor	40.6700 (1c)	x	2.7000 (2c) =
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.4170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			40.6700	0.1000	4.0670	75.0000	3050.2500 (28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782	9.0000	278.9100 (29a)
Joists FF	40.6700		40.6700	0.1100	4.4737	9.0000	366.0300 (30)
Total net area of external elements Aum(A, m2)			125.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.4582		(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)

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FF	95.0000	9.0000	855.0000 (32c)
Internal Floor 1	40.6700	18.0000	732.0600 (32d)
Internal Ceiling 1	40.6700	9.0000	366.0300 (32e)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 8302.2800 (34)
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 102.0688 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	8.5800	0.0600	0.5148
E10 Eaves (insulation at ceiling level)	20.4000	0.0600	1.2240
E18 Party wall between dwellings	18.9600	0.1200	2.2752
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.0800	1.5168
P1 Party wall - Ground floor	18.9600	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	8.2600	0.0500	0.4130
E2 Other lintels (including other steel lintels)	7.3300	0.0500	0.3665
E3 Sill	15.3000	0.0500	0.7650
E4 Jamb	8.5800	0.1600	1.3728
E5 Ground floor (normal)	8.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.4481 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 36.9063 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.4839	40.2408	40.0025	38.8834	38.6740	37.6992	37.6992	37.5187	38.0747	38.6740	39.0976	39.5404 (38)
Heat transfer coeff	77.3902	77.1471	76.9088	75.7897	75.5803	74.6055	74.6055	74.4250	74.9810	75.5803	76.0039	76.4467 (39)
Average = $\text{Sum}(39)\text{m} / 12 =$												75.7887
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9514	0.9485	0.9455	0.9318	0.9292	0.9172	0.9172	0.9150	0.9218	0.9292	0.9344	0.9398 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4878 (42)
Hot water usage for mixer showers	82.4148	81.1763	79.3715	75.9184	73.3700	70.5282	68.9128	70.7040	72.6674	75.7187	79.2460	82.0990 (42a)
Hot water usage for baths	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798 (42b)
Hot water usage for other uses	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075 (42c)
Average daily hot water use (litres/day)												138.8469 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	150.9984	147.8785	144.0197	138.0100	133.1810	127.9690	125.8612	129.7022	133.7679	139.2533	145.3597	150.5864 (44)
Energy content (annual)	239.1445	210.5770	221.3529	188.9288	179.2873	157.3528	152.2182	160.5984	164.9492	188.9654	207.0916	235.7819 (45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$												2306.2480
Water storage loss:	35.8717	31.5866	33.2029	28.3393	26.8931	23.6029	22.8327	24.0898	24.7424	28.3448	31.0637	35.3673 (46)
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7368 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	128.5813	114.3343	122.6656	110.3018	108.6788	99.8028	99.6783	102.4647	102.3286	111.8967	116.3409	127.4632 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.5347	26.2325	21.3337	16.1510	12.0730	10.1926	11.0134	14.3157	19.2145	24.3972	28.4751	30.3556 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.6691	335.1108	326.4378	307.9742	284.6671	262.7618	248.1277	244.6860	253.3589	271.8226	295.1296	317.0350 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118 (71)
Water heating gains (Table 5)	172.8243	170.1403	164.8731	153.1970	146.0736	138.6150	133.9762	137.7214	142.1231	150.3988	161.5846	171.3215 (72)
Total internal gains	639.1986	636.6541	617.8151	582.4926	547.9842	513.7398	495.2878	498.8935	516.8669	551.7890	590.3598	623.8825 (73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	10.8200				10.6334	0.6300		0.7000		0.7700	35.1618 (74)
Solar gains	35.1618	67.1960	114.1824	183.4062	247.0649	264.4903	246.9355	195.9118	137.2842	79.9880	29.3126 (83)
Total gains	674.3604	703.8500	731.9975	765.8988	795.0491	778.2301	742.2233	694.8053	654.1511	631.7771	653.1951 (84)
7. Mean internal temperature (heating season)											
Temperature during heating periods in the living area from Table 9, Th1 (C)											21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
tau	29.7995	29.8934	29.9860	30.4288	30.5131	30.9118	30.9118	30.9867	30.7570	30.5131	30.3430
alpha	2.9866	2.9929	2.9991	3.0286	3.0342	3.0608	3.0608	3.0658	3.0505	3.0342	3.0229
util living area	0.9259	0.9117	0.8806	0.8149	0.7040	0.5519	0.4212	0.4625	0.6591	0.8273	0.9021
											0.9313 (86)
MIT	19.2253	19.4032	19.7471	20.2160	20.6166	20.8709	20.9579	20.9434	20.7684	20.2946	19.7040
Th 2	20.1240	20.1265	20.1290	20.1406	20.1428	20.1529	20.1529	20.1548	20.1490	20.1428	20.1384
util rest of house	0.9166	0.9006	0.8651	0.7902	0.6644	0.4932	0.3471	0.3871	0.6034	0.7995	0.8882
MIT 2	18.0565	18.2809	18.7114	19.2935	19.7650	20.0477	20.1273	20.1185	19.9461	19.3998	18.6697
Living area fraction	18.3482	18.5610	18.9699	19.5237	19.9775	20.2531	20.3346	20.3244	20.1513	19.6231	18.9278
MIT	18.3482	18.5610	18.9699	19.5237	19.9775	20.2531	20.3346	20.3244	20.1513	19.6231	18.9278
Temperature adjustment											0.0000
adjusted MIT	18.3482	18.5610	18.9699	19.5237	19.9775	20.2531	20.3346	20.3244	20.1513	19.6231	18.9278
											0.0000 (93)
8. Space heating requirement											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Utilisation	0.8928	0.8760	0.8406	0.7702	0.6561	0.5004	0.3635	0.4027	0.6035	0.7801	0.8642
Useful gains	602.0920	616.6050	615.3139	589.9262	521.6515	389.4436	269.7845	279.8328	394.8004	492.8392	547.6616
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000
Heat loss rate W	1087.1902	1053.9043	959.0466	805.1703	625.6195	421.7542	278.6237	292.0725	453.7338	681.9709	898.9615
Space heating kWh	360.9131	293.8651	255.7371	154.9757	77.3522	0.0000	0.0000	0.0000	0.0000	140.7140	252.9359
Space heating requirement - total per year (kWh/year)											365.8401 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Solar heating contribution - total per year (kWh/year)											0.0000 (98b)
Space heating kWh	360.9131	293.8651	255.7371	154.9757	77.3522	0.0000	0.0000	0.0000	0.0000	140.7140	252.9359
Space heating requirement after solar contribution - total per year (kWh/year)											365.8401 (98c)
Space heating per m2										(98c) / (4) =	23.3874 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP											
Fraction of space heat from secondary/supplementary system (Table 11)											0.0000 (201)
Fraction of space heat from main system(s)											1.0000 (202)
Efficiency of main space heating system 1 (in %)											249.9000 (206)
Efficiency of main space heating system 2 (in %)											0.0000 (207)
Efficiency of secondary/supplementary heating system, %											0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Space heating requirement	360.9131	293.8651	255.7371	154.9757	77.3522	0.0000	0.0000	0.0000	0.0000	140.7140	252.9359
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000
Space heating fuel (main heating system)	144.4230	117.5931	102.3358	62.0151	30.9533	0.0000	0.0000	0.0000	0.0000	56.3081	101.2149
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating fuel (total)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water heating											
Water heating requirement	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000
Fuel for water heating, kWh/month	171.6029	151.8982	161.4421	141.7947	137.4183	123.7616	121.9591	126.7450	128.0999	142.9455	152.1675
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Lighting	25.8516	20.7391	18.6732	13.6808	10.5675	8.6337	9.6400	12.5304	16.2758	21.3547	24.1201
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Annual totals kWh/year											
Space heating fuel - main system 1											761.2378 (211)
Space heating fuel - main system 2											0.0000 (213)
Space heating fuel - secondary											0.0000 (215)

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Efficiency of water heater	175.1000	
Water heating fuel used	1729.5175	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	208.6369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2699.3922	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	761.2378	16.4900	125.5281 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1729.5175	16.4900	285.1974 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	208.6369	16.4900	34.4042 (250)
Additional standing charges			0.0000 (251)
Total energy cost			445.1298 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2684 (257)
SAP value		79.4396
SAP rating (Section 12)		79 (258)
SAP band		C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	761.2378	0.1547	117.7709 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1729.5175	0.1409	243.6801 (264)
Space and water heating			361.4510 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	208.6369	0.1443	30.1127 (268)
Total CO2, kg/year			391.5637 (272)
CO2 emissions per m2			4.8100 (273)
EI value			95.8470
EI rating			96 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

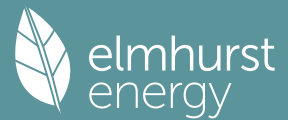
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.4170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)

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Infiltration rate		0.3946 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3354 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Adj infilt rate	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Effective ac	0.3019	0.2767	0.2684	0.2684	0.2767	0.2432	0.2600	0.2348	0.2348	0.2516	0.2348	0.2684	(22b)
	0.5456	0.5383	0.5360	0.5360	0.5383	0.5296	0.5338	0.5276	0.5276	0.5316	0.5276	0.5360	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			10.8200	1.1450	12.3893			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			40.6700	0.1000	4.0670	75.0000	3050.2500	(28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782	9.0000	278.9100	(29a)
Joists FF	40.6700		40.6700	0.1100	4.4737	9.0000	366.0300	(30)
Total net area of external elements Aum(A, m2)			125.1000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	28.4582		(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			95.0000			9.0000	855.0000	(32c)
Internal Floor 1			40.6700			18.0000	732.0600	(32d)
Internal Ceiling 1			40.6700			9.0000	366.0300	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 8302.2800 (34)
List of Thermal Bridges
102.0688 (35)

K1 Element	Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)	8.5800	0.0600	0.5148	
E18 Party wall between dwellings	20.4000	0.0600	1.2240	
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752	
P1 Party wall - Ground floor	18.9600	0.0800	1.5168	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000	
E2 Other lintels (including other steel lintels)	8.2600	0.0500	0.4130	
E3 Sill	7.3300	0.0500	0.3665	
E4 Jamb	15.3000	0.0500	0.7650	
E5 Ground floor (normal)	8.5800	0.1600	1.3728	
E6 Intermediate floor within a dwelling	8.5800	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.4481	(36)
Point Thermal Bridges			0.0000	(36a) =
Total fabric heat loss			(33) + (36) + (36a) =	36.9063 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	37.3430	36.8448	36.6884	36.6884	36.8448	36.2479	36.5367	36.1107	36.1107	36.3899	36.1107	36.6884	(38)
Average = Sum(39)m / 12 =	74.2493	73.7511	73.5947	73.5947	73.7511	73.1542	73.4431	73.0170	73.0170	73.2962	73.0170	73.5947	(39)
												73.4567	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9128	0.9067	0.9048	0.9048	0.9067	0.8994	0.9029	0.8977	0.8977	0.9011	0.8977	0.9048	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4878 (42)
Hot water usage for mixer showers	82.4148	81.1763	79.3715	75.9184	73.3700	70.5282	68.9128	70.7040	72.6674	75.7187	79.2460	82.0990	(42a)
Hot water usage for baths	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798	(42b)
Hot water usage for other uses	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075	(42c)
Average daily hot water use (litres/day)													138.8469 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	150.9984	147.8785	144.0197	138.0100	133.1810	127.9690	125.8612	129.7022	133.7679	139.2533	145.3597	150.5864	(44)
Energy content (annual)	239.1445	210.5770	221.3529	188.9288	179.2873	157.3528	152.2182	160.5984	164.9492	188.9654	207.0916	235.7819	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2306.2480
Water storage loss:	35.8717	31.5866	33.2029	28.3393	26.8931	23.6029	22.8327	24.0898	24.7424	28.3448	31.0637	35.3673	(46)
Store volume													300.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7368 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	300.4767	265.9738	282.6851	248.2826	240.6195	216.7065	213.5504	221.9306	224.3030	250.2976	266.4453	297.1140	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)

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Heat gains from water heating, kWh/month
128.5813 114.3343 122.6656 110.3018 108.6788 99.8028 99.6783 102.4647 102.3286 111.8967 116.3409 127.4632 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.5347	26.2325	21.3337	16.1510	12.0730	10.1926	11.0134	14.3157	19.2145	24.3972	28.4751	30.3556	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.6691	335.1108	326.4378	307.9742	284.6671	262.7618	248.1277	244.6860	253.3589	271.8226	295.1296	317.0350	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	(71)
Water heating gains (Table 5)	172.8243	170.1403	164.8731	153.1970	146.0736	138.6150	133.9762	137.7214	142.1231	150.3988	161.5846	171.3215	(72)
Total internal gains	639.1986	636.6541	617.8151	582.4926	547.9842	513.7398	495.2878	498.8935	516.8669	551.7890	590.3598	623.8825	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W

North					10.8200	13.0723	0.6300	0.7000			0.7700			43.2266 (74)

Solar gains	43.2266	73.3227	124.9565	208.1378	272.1065	314.5620	288.2493	231.8691	161.0559	93.5217	53.6785	35.0250	(83)	
Total gains	682.4252	709.9768	742.7716	790.6304	820.0907	828.3018	783.5371	730.7625	677.9228	645.3107	644.0384	658.9076	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.0601	31.2699	31.3364	31.3364	31.2699	31.5250	31.4010	31.5843	31.5843	31.4639	31.5843	31.3364	
alpha	3.0707	3.0847	3.0891	3.0891	3.0847	3.1017	3.0934	3.1056	3.1056	3.0976	3.1056	3.0891	
util living area	0.9109	0.8983	0.8564	0.7742	0.6311	0.4506	0.3296	0.3409	0.5826	0.7723	0.8751	0.9169	(86)
MIT	19.5138	19.6349	19.9941	20.4066	20.7645	20.9409	20.9834	20.9825	20.8633	20.5238	19.9945	19.4899	(87)
Th 2	20.1566	20.1618	20.1634	20.1634	20.1618	20.1680	20.1650	20.1695	20.1695	20.1666	20.1695	20.1634	(88)
util rest of house	0.8998	0.8857	0.8382	0.7454	0.5851	0.3887	0.2562	0.2635	0.5207	0.7364	0.8573	0.9063	(89)
MIT 2	18.4397	18.5934	19.0392	19.5366	19.9430	20.1255	20.1570	20.1612	20.0590	19.6870	19.0502	18.4152	(90)
Living area fraction	18.7077	18.8533	19.2775	19.7537	20.1480	20.3290	20.3632	20.3662	20.2598	19.8959	19.2859	18.6834	(91)
MIT	18.7077	18.8533	19.2775	19.7537	20.1480	20.3290	20.3632	20.3662	20.2598	19.8959	19.2859	18.6834	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7077	18.8533	19.2775	19.7537	20.1480	20.3290	20.3632	20.3662	20.2598	19.8959	19.2859	18.6834	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8762	0.8620	0.8158	0.7298	0.5843	0.4010	0.2739	0.2822	0.5278	0.7234	0.8350	0.8833	(94)
Useful gains	597.9454	612.0331	605.9753	577.0413	479.1553	332.1315	214.6237	206.1895	357.8057	466.8076	537.7500	581.9975	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1002.9389	984.8236	881.4832	739.9014	541.9248	345.9469	217.6277	209.2818	391.3534	593.3960	809.4589	992.3072	(97)
Space heating kWh	301.3152	250.5152	204.9779	117.2593	46.7005	0.0000	0.0000	0.0000	0.0000	94.1817	195.6304	305.2704	(98a)
Space heating requirement - total per year (kWh/year)												1515.8506	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	301.3152	250.5152	204.9779	117.2593	46.7005	0.0000	0.0000	0.0000	0.0000	94.1817	195.6304	305.2704	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1515.8506	
Space heating per m2										(98c) / (4) =		18.6360	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	301.3152	250.5152	204.9779	117.2593	46.7005	0.0000	0.0000	0.0000	0.0000	94.1817	195.6304	305.2704	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	120.5743	100.2462	82.0240	46.9225	18.6877	0.0000	0.0000	0.0000	0.0000	37.6878	78.2835	122.1570	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

N	Solar water heating	Recommended
U	Solar photovoltaic panels	Recommended

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V2 Wind turbine

Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.4	-£ 101	-48 kg (13.2%)
U Solar photovoltaic panels	+ 6.5	-£ 237	-123 kg (38.4%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£101	0.60 kg/m ²	B 82	A 96
Solar photovoltaic panels	£237	1.51 kg/m ²	B 88	A 97
Total Savings	£338	2.10 kg/m ²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £663	Potential £562	Saving £101
Electricity			
Space heating	£158	£179	-£21
Water heating	£451	£328	£122
Lighting	£54	£54	£0
Generated (PV)	-£0	-£237	£237
Total cost of fuels	£663	£325	£338
Total cost of uses	£663	£324	£338
Delivered energy	31 kWh/m ²	15 kWh/m ²	16 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m ²	5 kg/m ²	2 kg/m ²	2 kg/m ²
Primary energy	48 kWh/m ²	24 kWh/m ²	24 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4170 (5)

2. Ventilation rate

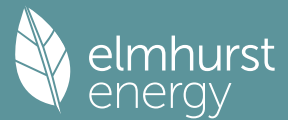
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			40.6700	0.1000	4.0670	75.0000	3050.2500 (28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782	9.0000	278.9100 (29a)
Joists FF	40.6700		40.6700	0.1100	4.4737	9.0000	366.0300 (30)
Total net area of external elements Aum(A, m ²)			125.1000				(31)

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Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	28.4582				(33)
Party Wall 1	96.7000	0.0000	0.0000	20.0000	1934.0000	(32)
GF	80.0000			9.0000	720.0000	(32c)
FF	95.0000			9.0000	855.0000	(32c)
Internal Floor 1	40.6700			18.0000	732.0600	(32d)
Internal Ceiling 1	40.6700			9.0000	366.0300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8302.2800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		102.0688	(35)

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	8.5800	0.0600	0.5148	
E10 Eaves (insulation at ceiling level)	20.4000	0.0600	1.2240	
E18 Party wall between dwellings	18.9600	0.1200	2.2752	
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.0800	1.5168	
P1 Party wall - Ground floor	18.9600	0.0000	0.0000	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	8.2600	0.0500	0.4130	
E2 Other lintels (including other steel lintels)	7.3300	0.0500	0.3665	
E3 Sill	15.3000	0.0500	0.7650	
E4 Jamb	8.5800	0.1600	1.3728	
E5 Ground floor (normal)	8.5800	0.0000	0.0000	
E6 Intermediate floor within a dwelling				8.4481 (36)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				0.0000
Point Thermal bridges				(36a) =
Total fabric heat loss				(33) + (36) + (36a) = 36.9063 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.4839	40.2408	40.0025	38.8834	38.6740	37.6992	37.6992	37.5187	38.0747	38.6740	39.0976	39.5404	(38)
Heat transfer coeff	77.3902	77.1471	76.9088	75.7897	75.5803	74.6055	74.6055	74.4250	74.9810	75.5803	76.0039	76.4467	(39)
Average = Sum(39)m / 12 =												75.7887	
HLP	0.9514	0.9485	0.9455	0.9318	0.9292	0.9172	0.9172	0.9150	0.9218	0.9292	0.9344	0.9398	(40)
HLP (average)												0.9318	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4878	(42)
Hot water usage for mixer showers	82.4148	81.1763	79.3715	75.9184	73.3700	70.5282	68.9128	70.7040	72.6674	75.7187	79.2460	82.0990	(42a)	
Hot water usage for baths	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798	(42b)	
Hot water usage for other uses	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075	(42c)	
Average daily hot water use (litres/day)												138.8469	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	150.9984	147.8785	144.0197	138.0100	133.1810	127.9690	125.8612	129.7022	133.7679	139.2533	145.3597	150.5864	(44)	
Energy conte	239.1445	210.5770	221.3529	188.9288	179.2873	157.3528	152.2182	160.5984	164.9492	188.9654	207.0916	235.7819	(45)	
Energy content (annual)										Total = Sum(45)m =			2306.2480	
Distribution loss (46)m = 0.15 x (45)m	35.8717	31.5866	33.2029	28.3393	26.8931	23.6029	22.8327	24.0898	24.7424	28.3448	31.0637	35.3673	(46)	
Water storage loss:														
Store volume												300.0000	(47)	
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)	
Volume factor from Table 2a												0.7368	(52)	
Temperature factor from Table 2b												0.5400	(53)	
Enter (49) or (54) in (55)												1.2281	(55)	
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)	
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	300.4767	265.9738	281.2894	241.5290	227.8251	204.0998	200.5235	209.8341	218.9001	248.9018	266.4453	297.1140	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Aperture area of solar collector													3.0000 (H1)	
Zero-loss collector efficiency													0.8000 (H2)	
Collector linear heat loss coefficient													1.8000 (H3)	
Collector 2nd order heat loss coefficient													0.0000 (H4)	
Collector loop efficiency													0.9000 (H5)	
Incidence angle modifier													1.0000 (H6)	
Overshading factor													0.8000 (H8)	
Overall heat loss coefficient of system													6.5000 (H10)	
Heat loss coefficient of collector loop													3.9667 (H11)	
Dedicated solar storage volume													75.0000 (H12)	
Effective solar volume													75.0000 (H14)	
Reference volume													225.0000 (H15)	
Storage tank correction coefficient													1.3161 (H16)	
Heat delivered to hot water													637.2916 (H24)	
Heat delivered to space heating													0.0000 (H29)	
Solar input													637.2916	
Solar input	-0.0000	-16.1873	-59.0716	-81.8647	-107.8735	-99.6484	-99.0362	-86.0462	-58.7811	-28.7826	-0.0000	-0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h	300.4767	249.7866	222.2177	159.6643	119.9516	104.4514	101.4873	123.7879	160.1190	220.1192	266.4453	297.1140	(64)	
	Total per year (kWh/year) = Sum(64)m =												2325.6211 (64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)	
Heat gains from water heating, kWh/month	128.5813	114.3343	121.5490	104.8989	98.4433	89.7174	89.2568	92.7876	98.0063	110.7801	116.3409	127.4632	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	29.5347	26.2325	21.3337	16.1510	12.0730	10.1926	11.0134	14.3157	19.2145	24.3972	28.4751	30.3556 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	331.6691	335.1108	326.4378	307.9742	284.6671	262.7618	248.1277	244.6860	253.3589	271.8226	295.1296	317.0350 (68)
Pumps, fans	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118 (71)
Total internal gains	172.8243	170.1403	163.3723	145.6930	132.3163	124.6075	119.9688	124.7144	136.1199	148.8980	161.5846	171.3215 (72)
	639.1986	636.6541	616.3143	574.9886	534.2269	499.7323	481.2803	485.8865	510.8637	550.2882	590.3598	623.8825 (73)

6. Solar gains

[Jan]													
				Area m2	Solar flux Table 6a W/m2			g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				10.8200	10.6334			0.6300	0.7000	0.7700		35.1618 (74)	
Solar gains	35.1618	67.1960	114.1824	183.4062	247.0649	264.4903	246.9355	195.9118	137.2842	79.9880	43.3766	29.3126 (83)	
Total gains	674.3604	703.8500	730.4967	758.3948	781.2918	764.2226	728.2158	681.7984	648.1479	630.2763	633.7364	653.1951 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	29.7995	29.8934	29.9860	30.4288	30.5131	30.9118	30.9118	30.9867	30.7570	30.5131	30.3430	30.1673
alpha	2.9866	2.9929	2.9991	3.0286	3.0342	3.0608	3.0608	3.0658	3.0505	3.0342	3.0229	3.0112
util living area	0.9259	0.9117	0.8811	0.8180	0.7110	0.5596	0.4283	0.4699	0.6629	0.8281	0.9021	0.9313 (86)
MIT	19.2253	19.4032	19.7445	20.2061	20.6053	20.8659	20.9559	20.9409	20.7645	20.2925	19.7040	19.1963 (87)
Th 2	20.1240	20.1265	20.1290	20.1406	20.1428	20.1529	20.1529	20.1548	20.1490	20.1428	20.1384	20.1338 (88)
util rest of house	0.9166	0.9006	0.8657	0.7936	0.6716	0.5005	0.3533	0.3937	0.6073	0.8003	0.8882	0.9226 (89)
MIT 2	18.0565	18.2809	18.7083	19.2820	19.7531	20.0433	20.1261	20.1168	19.9424	19.3974	18.6697	18.0267 (90)
Living area fraction	18.3482	18.5610	18.9669	19.5126	19.9658	20.2486	20.3332	20.3224	20.1475	19.6208	18.9278	18.3186 (92)
MIT	18.3482	18.5610	18.9669	19.5126	19.9658	20.2486	20.3332	20.3224	20.1475	19.6208	18.9278	18.3186 (93)
Temperature adjustment												0.0000
adjusted MIT	18.3482	18.5610	18.9669	19.5126	19.9658	20.2486	20.3332	20.3224	20.1475	19.6208	18.9278	18.3186 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8928	0.8760	0.8411	0.7734	0.6628	0.5075	0.3697	0.4094	0.6072	0.7808	0.8642	0.8996 (94)
Ext temp.	602.0920	616.6050	614.4385	586.5564	517.8570	387.8511	269.2520	279.1281	393.5471	492.1428	547.6616	587.6031 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1087.1902	1053.9043	958.8182	804.3261	624.7295	421.4140	278.5152	291.9277	453.4511	681.7962	898.9615	1079.3237 (97)
Space heating requirement - total per year (kWh/year)	360.9131	293.8651	256.2185	156.7941	79.5132	0.0000	0.0000	0.0000	0.0000	141.1021	252.9359	365.8401 (98a)
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	360.9131	293.8651	256.2185	156.7941	79.5132	0.0000	0.0000	0.0000	0.0000	141.1021	252.9359	365.8401 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1907.1822
Space heating per m2										(98c) / (4) =		23.4470 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	360.9131	293.8651	256.2185	156.7941	79.5132	0.0000	0.0000	0.0000	0.0000	141.1021	252.9359	365.8401 (98)
Fuel for water heating, kWh/month	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating efficiency (main heating system 2)	144.4230	117.5931	102.5284	62.7428	31.8180	0.0000	0.0000	0.0000	0.0000	56.4634	101.2149	146.3946 (211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Water heating requirement	300.4767	249.7866	222.2177	159.6643	119.9516	104.4514	101.4873	123.7879	160.1190	220.1192	266.4453	297.1140 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	171.6029	142.6537	126.9091	91.1846	68.5046	59.6525	57.9596	70.6956	91.4443	125.7106	152.1675	169.6825 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	25.8516	20.7391	18.6732	13.6808	10.5675	8.6337	9.6400	12.5304	16.2758	21.3547	24.1201	26.5701 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233a)m	-37.6424	-56.0040	-83.5993	-95.4744	-101.4618	-91.3699	-90.0440	-85.4287	-76.1734	-64.5384	-42.2376	-32.2211	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												763.1781	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1328.1674	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												208.6369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-856.1950	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1523.7874	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	763.1781	16.4900	125.8481	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1328.1674	16.4900	219.0148	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	208.6369	16.4900	34.4042	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.1950	16.4900	-141.1866	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-141.1866	(252)
Total energy cost			251.2725	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.3600	(256)
Energy cost factor (ECF)			0.7160	(257)
SAP value			88.3938	
SAP rating (Section 12)			88	(258)
SAP band			B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	763.1781	0.1547	118.0397	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1328.1674	0.1451	192.6931	(264)
Space and water heating			310.7327	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	208.6369	0.1443	30.1127	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.1950	0.1345	-115.1604	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-115.1604	(269)
Total CO2, kg/year			236.7820	(272)
CO2 emissions per m2			2.9100	(273)
EI value			97.4886	
EI rating			97	(274)
EI band			A	

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	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.6700 (1b)	x 2.4000 (2b)	= 97.6080 (1b) - (3b)
First floor	40.6700 (1c)	x 2.7000 (2c)	= 109.8090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3354 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3019	0.2767	0.2684	0.2684	0.2767	0.2432	0.2600	0.2348	0.2348	0.2516	0.2348	0.2684 (22b)
Effective ac	0.5456	0.5383	0.5360	0.5360	0.5383	0.5296	0.5338	0.5276	0.5276	0.5316	0.5276	0.5360 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			10.8200	1.1450	12.3893		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			40.6700	0.1000	4.0670	75.0000	3050.2500 (28a)
Brick	43.7600	12.7700	30.9900	0.1800	5.5782	9.0000	278.9100 (29a)
Joists FF	40.6700		40.6700	0.1100	4.4737	9.0000	366.0300 (30)
Total net area of external elements Aum(A, m ²)			125.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.4582		(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)
FF			95.0000			9.0000	855.0000 (32c)
Internal Floor 1			40.6700			18.0000	732.0600 (32d)
Internal Ceiling 1			40.6700			9.0000	366.0300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8302.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							102.0688 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)				8.5800	0.0600	0.5148	
E18 Party wall between dwellings				20.4000	0.0600	1.2240	
P4 Party wall - Roof (insulation at ceiling level)				18.9600	0.1200	2.2752	
P1 Party wall - Ground floor				18.9600	0.0800	1.5168	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				18.9600	0.0000	0.0000	
E2 Other lintels (including other steel lintels)				8.2600	0.0500	0.4130	
E3 Sill				7.3300	0.0500	0.3665	
E4 Jamb				15.3000	0.0500	0.7650	
E5 Ground floor (normal)				8.5800	0.1600	1.3728	
E6 Intermediate floor within a dwelling				8.5800	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4481 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	36.9063 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	37.3430	36.8448	36.6884	36.6884	36.8448	36.2479	36.5367	36.1107	36.1107	36.3899	36.1107	36.6884 (38)
Average = Sum(39)m / 12 =	74.2493	73.7511	73.5947	73.5947	73.7511	73.1542	73.4431	73.0170	73.0170	73.2962	73.0170	73.5947 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9128	0.9067	0.9048	0.9048	0.9067	0.8994	0.9029	0.8977	0.8977	0.9011	0.8977	0.9048 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4878 (42)
Hot water usage for mixer showers												
	82.4148	81.1763	79.3715	75.9184	73.3700	70.5282	68.9128	70.7040	72.6674	75.7187	79.2460	82.0990 (42a)
Hot water usage for baths												
	28.4761	28.0532	27.4576	26.3595	25.5373	24.6256	24.1331	24.7245	25.3684	26.3440	27.4647	28.3798 (42b)
Hot water usage for other uses												
	40.1075	38.6490	37.1906	35.7321	34.2737	32.8152	32.8152	34.2737	35.7321	37.1906	38.6490	40.1075 (42c)
Average daily hot water use (litres/day)												138.8469 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Daily hot water use	150.9984	147.8785	144.0197	138.0100	133.1810	127.9690	125.8612	129.7022	133.7679	139.2533	145.3597	150.5864	(44)
Energy content (annual)	239.1445	210.5770	221.3529	188.9288	179.2873	157.3528	152.2182	160.5984	164.9492	188.9654	207.0916	235.7819	(45)
Distribution loss (46)m = 0.15 x (45)m	35.8717	31.5866	33.2029	28.3393	26.8931	23.6029	22.8327	24.0898	24.7424	28.3448	31.0637	35.3673	(46)
Water storage loss:													
Store volume												300.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7368	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.2281	(55)
Total storage loss													
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	(56)
If cylinder contains dedicated solar storage													
38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
300.4767	265.9738	281.2894	241.5290	227.8251	204.0998	200.5235	209.8341	218.9001	248.9018	266.4453	297.1140	297.1140	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector													
Zero-loss collector efficiency												3.0000	(H1)
Collector linear heat loss coefficient												0.8000	(H2)
Collector 2nd order heat loss coefficient												1.8000	(H3)
Collector loop efficiency												0.0000	(H4)
Incidence angle modifier												0.9000	(H5)
Overshading factor												1.0000	(H6)
Overall heat loss coefficient of system												0.8000	(H8)
Heat loss coefficient of collector loop												6.5000	(H10)
Dedicated solar storage volume												3.9667	(H11)
Effective solar volume												75.0000	(H12)
Reference volume												75.0000	(H14)
Storage tank correction coefficient												225.0000	(H15)
Heat delivered to hot water												1.3161	(H16)
Heat delivered to space heating												755.9954	(H24)
Solar input												0.0000	(H29)
Solar input	-1.8659	-20.8871	-65.9918	-93.3576	-117.5003	-118.1747	-114.8330	-102.8256	-72.1672	-40.7470	-7.6452	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	298.6109	245.0867	215.2976	148.1713	110.3248	85.9251	85.6904	107.0085	146.7329	208.1548	258.8001	297.1140	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	128.5813	114.3343	121.5490	104.8989	98.4433	89.7174	89.2568	92.7876	98.0063	110.7801	116.3409	127.4632	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	149.2677	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.5347	26.2325	21.3337	16.1510	12.0730	10.1926	11.0134	14.3157	19.2145	24.3972	28.4751	30.3556	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.6691	335.1108	326.4378	307.9742	284.6671	262.7618	248.1277	244.6860	253.3589	271.8226	295.1296	317.0350	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	52.4146	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	-99.5118	(71)
Water heating gains (Table 5)	172.8243	170.1403	163.3723	145.6930	132.3163	124.6075	119.9688	124.7144	136.1199	148.8980	161.5846	171.3215	(72)
Total internal gains	639.1986	636.6541	616.3143	574.9886	534.2269	499.7323	481.2803	485.8865	510.8637	550.2882	590.3598	623.8825	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				10.8200	13.0723	0.6300	0.7000	0.7700	43.2266 (74)			
Solar gains	43.2266	73.3227	124.9565	208.1378	272.1065	314.5620	288.2493	231.8691	161.0559	93.5217	53.6785	35.0250 (83)
Total gains	682.4252	709.9768	741.2708	783.1264	806.3334	814.2943	769.5296	717.7556	671.9196	643.8099	644.0384	658.9076 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
tau	31.0601	31.2699	31.3364	31.3364	31.2699	31.5250	31.4010	31.5843	31.5843	31.4639	31.5843	31.3364		
alpha	3.0707	3.0847	3.0891	3.0891	3.0847	3.1017	3.0934	3.1056	3.1056	3.0976	3.1056	3.0891		
util living area	0.9109	0.8983	0.8570	0.7776	0.6383	0.4572	0.3352	0.3466	0.5864	0.7732	0.8751	0.9169	(86)	
MIT	19.5138	19.6349	19.9917	20.3982	20.7567	20.9384	20.9825	20.9817	20.8608	20.5221	19.9945	19.4899	(87)	
Th 2	20.1566	20.1618	20.1634	20.1634	20.1618	20.1680	20.1650	20.1695	20.1695	20.1666	20.1695	20.1634	(88)	
util rest of house	0.8998	0.8857	0.8388	0.7491	0.5923	0.3947	0.2607	0.2681	0.5244	0.7373	0.8573	0.9063	(89)	
MIT 2	18.4397	18.5934	19.0364	19.5271	19.9353	20.1237	20.1566	20.1608	20.0568	19.6852	19.0502	18.4152	(90)	
Living area fraction	18.7077	18.8533	19.2749	19.7445	20.1403	20.3270	20.3627	20.3657	20.2575	19.8941	19.2859	18.6834	(92)	
MIT	18.7077	18.8533	19.2749	19.7445	20.1403	20.3270	20.3627	20.3657	20.2575	19.8941	19.2859	18.6834	(93)	
Temperature adjustment												0.0000		
adjusted MIT	18.7077	18.8533	19.2749	19.7445	20.1403	20.3270	20.3627	20.3657	20.2575	19.8941	19.2859	18.6834		

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8762	0.8620	0.8164	0.7332	0.5910	0.4070	0.2787	0.2870	0.5313	0.7242	0.8350	0.8833	(94)
Useful gains	597.9454	612.0331	605.1842	574.2168	476.5795	331.4048	214.4369	205.9984	357.0171	466.2623	537.7500	581.9975	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1002.9389	984.8236	881.2853	739.2242	541.3551	345.7995	217.5903	209.2435	391.1856	593.2664	809.4589	992.3072	(97)
Space heating kWh	301.3152	250.5152	205.4192	118.8053	48.1931	0.0000	0.0000	0.0000	0.0000	94.4911	195.6304	305.2704	(98a)
Space heating requirement - total per year (kWh/year)												1519.6398	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	301.3152	250.5152	205.4192	118.8053	48.1931	0.0000	0.0000	0.0000	0.0000	94.4911	195.6304	305.2704	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1519.6398	
Space heating per m2										(98c) / (4) =		18.6826	(99)

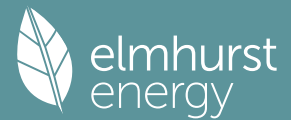
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	301.3152	250.5152	205.4192	118.8053	48.1931	0.0000	0.0000	0.0000	0.0000	94.4911	195.6304	305.2704	(98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating fuel (main heating system)	120.5743	100.2462	82.2006	47.5411	19.2849	0.0000	0.0000	0.0000	0.0000	37.8115	78.2835	122.1570	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	298.6109	245.0867	215.2976	148.1713	110.3248	85.9251	85.6904	107.0085	146.7329	208.1548	258.8001	297.1140	(64)	
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
Fuel for water heating, kWh/month	170.5373	139.9696	122.9569	84.6210	63.0068	49.0720	48.9380	61.1128	83.7995	118.8777	147.8013	169.6825	(219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)	
Lighting	25.8516	20.7391	18.6732	13.6808	10.5675	8.6337	9.6400	12.5304	16.2758	21.3547	24.1201	26.5701	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-44.2464	-58.6582	-86.0886	-99.1637	-102.6981	-96.3579	-94.2916	-90.5339	-81.5635	-69.9302	-49.2980	-37.1771	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													608.0992	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													175.1000	
Water heating fuel used													1260.3754	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													80.0000	(231)
Electricity for lighting (calculated in Appendix L)													208.6369	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-910.0071	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													1247.1043	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	608.0992	26.0600	158.4706	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1260.3754	26.0600	328.4538	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	208.6369	26.0600	54.3708	(250)
Additional standing charges			0.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-910.0071	26.0600	-237.1479
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-237.1479 (252)
Total energy cost			324.9954 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	608.0992	0.1554	94.4885 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1260.3754	0.1460	183.9554 (264)
Space and water heating			278.4438 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	208.6369	0.1443	30.1127 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-910.0071	0.1348	-122.6398
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-122.6398 (269)
Total CO2, kg/year			197.0137 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	608.0992	1.5753	957.9314 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1260.3754	1.5399	1940.8603 (278)
Space and water heating			2898.7918 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	208.6369	1.5338	320.0142 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-910.0071	1.4981	-1363.2708
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1363.2708 (283)
Total Primary energy kWh/year			1976.5591 (286)

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Property Reference	FURNERS LANE 18				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 18, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	4.59	TER	10.00	
Environmental	96 A	% DER < TER				54.10
CO ₂ Emissions (t/year)	0.4	DFEE	30.89	TFEE	31.62	
Compliance Check	See BREL	% DFEE < TFEE				2.31
% DPER < TPER	6.77	DPER	48.58	TPER	52.11	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

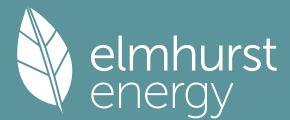
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			11.5300	1.1450	13.2023		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			46.6700	0.1000	4.6670	75.0000	3500.2500 (28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060	9.0000	330.3000 (29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300 (30)
Total net area of external elements Aum(A, m ²)			143.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5590		(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)
FF			110.0000			9.0000	990.0000 (32c)
Internal Floor 1			46.6700			18.0000	840.0600 (32d)
Internal Ceiling 1			46.6700			9.0000	420.0300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9154.6700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							98.0787 (35)
List of Thermal Bridges							
K1 Element					Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)					9.8400	0.0600	0.5904
E2 Other lintels (including other steel lintels)					8.8500	0.0500	0.4425

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E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	17.7000	0.0500	0.8850
E5 Ground floor (normal)	9.8400	0.1600	1.5744
E6 Intermediate floor within a dwelling	9.8400	0.0000	0.0000
E18 Party wall between dwellings	15.3000	0.0600	0.9180
E25 Staggered party wall between dwellings	5.1000	0.0600	0.3060
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752
P1 Party wall - Ground floor	18.9600	0.0800	1.5168
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.9043 (36)
Point Thermal Bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =		40.4633 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124 (38)
Average = Sum(39)m / 12 =	86.2587	86.0054	85.7572	84.5911	84.3729	83.3573	83.3573	83.1692	83.7485	84.3729	84.8143	85.2757 (39)
												84.5900
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9241	0.9214	0.9188	0.9063	0.9039	0.8930	0.8930	0.8910	0.8972	0.9039	0.9087	0.9136 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.9063 (40)
												31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.6687 (42)
Hot water usage for mixer showers	86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768 (42a)
Hot water usage for baths	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800 (42b)
Hot water usage for other uses	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605 (42c)
Average daily hot water use (litres/day)	37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173 (44)
Energy content (annual)	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340 (45)
Distribution loss (46)m = 0.15 x (45)m	37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951 (46)
Water storage loss:												
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7368 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
Total per year (kWh/year)												3134.5309 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	126.0530	113.1930	111.4224	102.2107	102.0077	104.9224	104.8529	114.7886	119.5102	131.0716 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760 (68)
Pumps, fans	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Total internal gains	177.7434	174.9358	169.4261	157.2125	149.7613	141.9594	137.1072	141.0248	145.6291	154.2858	165.9864	176.1715 (72)
	625.1999	639.5429	613.0168	591.7039	562.4852	540.0406	519.8299	521.2042	536.7620	557.5181	590.9862	612.8139 (73)

6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
North	11.5300	10.6334	0.6300	0.7000	0.7700	37.4691 (74)						
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)

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Total gains 662.6690 711.1482 734.6918 787.1451 825.7623 821.8866 782.9691 729.9716 683.0547 642.7548 637.2091 644.0500 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	29.4807	29.5675	29.6531	30.0618	30.1396	30.5068	30.5068	30.5758	30.3643	30.1396	29.9827	29.8205	21.0000 (85)
alpha	2.9654	2.9712	2.9769	3.0041	3.0093	3.0338	3.0338	3.0384	3.0243	3.0093	2.9988	2.9880	
util living area	0.9434	0.9277	0.9026	0.8387	0.7311	0.5747	0.4423	0.4863	0.6856	0.8530	0.9206	0.9473	(86)
MIT	19.0429	19.2581	19.6041	20.1218	20.5623	20.8515	20.9502	20.9329	20.7343	20.2036	19.5699	19.0178	(87)
Th 2	20.1470	20.1493	20.1516	20.1622	20.1642	20.1734	20.1751	20.1751	20.1698	20.1642	20.1601	20.1560	(88)
util rest of house	0.9362	0.9186	0.8897	0.8167	0.6937	0.5169	0.3676	0.4106	0.6322	0.8285	0.9091	0.9406	(89)
MIT 2	17.8476	18.1197	18.5556	19.2014	19.7256	20.0495	20.1421	20.1307	19.9317	19.3124	18.5231	17.8217	(90)
Living area fraction	fLA = Living area / (4) =												0.1783 (91)
MIT	18.0607	18.3226	18.7425	19.3655	19.8748	20.1924	20.2862	20.2737	20.0748	19.4712	18.7097	18.0349	(92)
Temperature adjustment	0.0000												0.0000
adjusted MIT	18.0607	18.3226	18.7425	19.3655	19.8748	20.1924	20.2862	20.2737	20.0748	19.4712	18.7097	18.0349	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9129	0.8934	0.8632	0.7925	0.6796	0.5183	0.3782	0.4200	0.6255	0.8045	0.8840	0.9183	(94)
Useful gains	604.9788	635.3457	634.1776	623.7841	561.1472	425.9717	296.0807	306.6036	427.2724	517.1087	563.2690	591.4161	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1186.9797	1154.4169	1049.8850	885.2889	689.7306	466.1704	307.2702	322.1704	500.3813	748.4922	984.6673	1179.7806	(97)
Space heating kWh	433.0087	348.8158	309.2863	188.2834	95.6661	0.0000	0.0000	0.0000	0.0000	172.1494	303.4068	437.7432	(98a)
Space heating requirement - total per year (kWh/year)	2288.3597												
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)	0.0000												
Space heating kWh	433.0087	348.8158	309.2863	188.2834	95.6661	0.0000	0.0000	0.0000	0.0000	172.1494	303.4068	437.7432	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2288.3597												
Space heating per m2	(98c) / (4) = 24.5164 (99)												

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)

Fraction of space heat from main system(s)

Efficiency of main space heating system 1 (in %)

Efficiency of main space heating system 2 (in %)

Efficiency of secondary/supplementary heating system, %

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	433.0087	348.8158	309.2863	188.2834	95.6661	0.0000	0.0000	0.0000	0.0000	172.1494	303.4068	437.7432	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	173.2728	139.5822	123.7640	75.3435	38.2817	0.0000	0.0000	0.0000	0.0000	68.8873	121.4113	175.1674	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	177.8890	157.4333	167.2603	146.7607	142.1308	127.8975	125.9601	130.9664	132.4357	147.9126	157.6110	175.8802	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1	915.7102 (211)												
Space heating fuel - main system 2	0.0000 (213)												
Space heating fuel - secondary	0.0000 (215)												
Efficiency of water heater	175.1000												
Water heating fuel used	1790.1376 (219)												
Space cooling fuel	0.0000 (221)												

Electricity for pumps and fans:

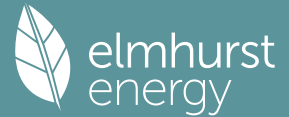
Total electricity for the above, kWh/year

Electricity for lighting (calculated in Appendix L)

0.0000 (231)

242.5617 (232)

Full SAP Calculation Printout



Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2948.4095 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	915.7102	0.1546	141.5939 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1790.1376	0.1409	252.2626 (264)
Space and water heating			393.8565 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	242.5617	0.1443	35.0092 (268)
Total CO2, kg/year			428.8656 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.5900 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	915.7102	1.5725	1439.9336 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1790.1376	1.5211	2722.9151 (278)
Space and water heating			4162.8488 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	242.5617	1.5338	372.0493 (282)
Total Primary energy kWh/year			4534.8980 (286)
Dwelling Primary energy Rate (DPER)			48.5800 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)

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TER Opening Type (Uw = 1.20)			11.5300	1.1450	13.2023	(27)
Ground Floor			46.6700	0.1300	6.0671	(28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	(30)
Total net area of external elements Aum(A, m2)			143.5200			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.9591	(33)
Party Wall 1			96.7000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 98.0787 (35)

List of Thermal Bridges						
K1 Element				Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)				9.8400	0.0600	0.5904
E2 Other lintels (including other steel lintels)				8.8500	0.0500	0.4425
E3 Sill				7.9200	0.0500	0.3960
E4 Jamb				17.7000	0.0500	0.8850
E5 Ground floor (normal)				9.8400	0.1600	1.5744
E6 Intermediate floor within a dwelling				9.8400	0.0000	0.0000
E18 Party wall between dwellings				15.3000	0.0600	0.9180
E25 Staggered party wall between dwellings				5.1000	0.0600	0.3060
P4 Party wall - Roof (insulation at ceiling level)				18.9600	0.1200	2.2752
P1 Party wall - Ground floor				18.9600	0.0800	1.5168
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				18.9600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9043 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 41.8634 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124
Average = Sum(39)m / 12 =	87.6588	87.4055	87.1573	85.9912	85.7730	84.7574	84.7574	84.5693	85.1486	85.7730	86.2144	86.6758

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9391	0.9364	0.9338	0.9213	0.9189	0.9080	0.9080	0.9060	0.9122	0.9189	0.9237	0.9286
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687 (42)
Hot water usage for mixer showers													
Hot water usage for baths													
Hot water usage for other uses													
Average daily hot water use (litres/day)													129.3413 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	140.7069	137.7023	134.0434	128.4795	123.9613	119.1039	117.2372	120.8803	124.7225	129.8220	135.4716	140.3420	(44)
Energy content (annual)	222.8453	196.0863	206.0197	175.8821	166.8758	146.4521	141.7882	149.6751	153.7954	176.1673	193.0041	219.7416	(45)
Distribution loss (46)m = 0.15 x (45)m													2148.3328
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1127 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1409 (55)
Total storage loss													
If cylinder contains dedicated solar storage													
Primary loss													
Combi loss													
Total heat required for water heating calculated for each month													
WWHRS													
PV diverter													
Solar input													
FGHRS													
Output from w/h													
12Total per year (kWh/year)													
Electric shower(s)													
Heat gains from water heating, kWh/month													

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760	(68)
Pumps, fans	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	(71)
Total internal gains	162.6332	160.0636	155.1137	144.2651	137.6200	130.6741	126.4081	129.9328	134.0653	141.7724	152.1721	161.2461	(72)
	610.0897	624.6707	598.7045	578.7564	550.3438	528.7554	509.1308	510.1122	525.1982	545.0047	577.1719	597.8886	(73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North				11.5300	10.6334		0.6300		0.7000	0.7700	37.4691 (74)
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	31.2361 (83)
Total gains	647.5587	696.2760	720.3794	774.1976	813.6210	810.6013	772.2700	718.8796	671.4909	630.2415	629.1246 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)											21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
tau	29.0098	29.0939	29.1767	29.5724	29.6476	30.0029	30.0029	30.0696	29.8650	29.6476	29.4958
alpha	2.9340	2.9396	2.9451	2.9715	2.9765	3.0002	3.0002	3.0046	2.9910	2.9765	2.9664
util living area	0.9469	0.9319	0.9078	0.8461	0.7411	0.5862	0.4532	0.4982	0.6974	0.8606	0.9254
											0.9507 (86)
MIT	18.9696	19.1881	19.5416	20.0738	20.5316	20.8376	20.9445	20.9255	20.7125	20.1591	19.5079
Th 2	20.1344	20.1367	20.1389	20.1495	20.1514	20.1607	20.1607	20.1624	20.1571	20.1514	20.1474
util rest of house											
	0.9400	0.9231	0.8954	0.8246	0.7038	0.5274	0.3762	0.4204	0.6438	0.8368	0.9144
MIT 2	17.7478	18.0243	18.4703	19.1351	19.6815	20.0250	20.1259	20.1130	19.8990	19.2507	18.4381
Living area fraction										fLA = Living area / (4) =	0.1783 (91)
MIT	17.9656	18.2318	18.6613	19.3024	19.8331	20.1699	20.2718	20.2578	20.0440	19.4126	18.6288
Temperature adjustment											0.0000
adjusted MIT	17.9656	18.2318	18.6613	19.3024	19.8331	20.1699	20.2718	20.2578	20.0440	19.4126	18.6288
											17.9389 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9170	0.8980	0.8686	0.7994	0.6884	0.5281	0.3868	0.4297	0.6359	0.8120	0.8891	0.9222 (94)
Useful gains	593.8376	625.2647	625.7569	618.9137	560.0870	428.0859	298.7261	308.9252	427.0187	511.7491	554.2876	580.1986 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1197.9084	1165.2705	1059.9459	894.5152	697.5992	472.0869	311.2125	326.2527	506.1221	755.8869	993.9502	1190.8320 (97)
Space heating kWh	449.4287	362.8839	323.0366	198.4331	102.3091	0.0000	0.0000	0.0000	0.0000	181.6385	316.5571	454.3113 (98a)
Space heating requirement - total per year (kWh/year)												2388.5982
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	449.4287	362.8839	323.0366	198.4331	102.3091	0.0000	0.0000	0.0000	0.0000	181.6385	316.5571	454.3113 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2388.5982
Space heating per m2										(98c) / (4) =		25.5903 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	449.4287	362.8839	323.0366	198.4331	102.3091	0.0000	0.0000	0.0000	0.0000	181.6385	316.5571	454.3113 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	486.9217	393.1570	349.9855	214.9871	110.8441	0.0000	0.0000	0.0000	0.0000	196.7915	342.9654	492.2116 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	249.9459	221.1575	235.4502	208.4423	202.9722	183.9085	182.3440	189.0850	190.5839	211.2784	223.0989	247.4260 (64)
Efficiency of water heater	85.3595	85.1630	84.7694	83.9495	82.6058	79.8000	79.8000	79.8000	79.8000	83.7227	84.8441	79.8000 (216)
Fuel for water heating, kWh/month	292.8157	259.6875	277.7536	248.2947	245.7118	230.4618	228.5012	236.9487	238.8269	252.3551	262.9515	85.4038 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	28.3278	22.7256	20.4619	14.9913	11.5797	9.4607	10.5634	13.7307	17.8348	23.4002	26.4305	29.1151 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-43.0360	-60.3393	-86.2393	-96.3687	-103.3845	-96.2774	-95.0720	-90.0173	-81.0086	-68.7195	-47.1904	-37.2451 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-25.2980	-53.1175	-105.4060	-158.0775	-208.8072	-209.7533	-207.2977	-175.6182	-128.8470	-75.8957	-33.7521	-20.0133 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	2587.8637	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3064.0215	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	228.6216	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2306.7817	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3659.7251	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2587.8637	0.2100	543.4514 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3064.0215	0.2100	643.4445 (264)
Space and water heating			1186.8959 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	228.6216	0.1443	32.9972 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-904.8983	0.1347	-121.9051
PV Unit electricity exported	-1401.8834	0.1259	-176.5500
Total			-298.4551 (269)
Total CO2, kg/year			933.3672 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.0000 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2587.8637	1.1300	2924.2860 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3064.0215	1.1300	3462.3443 (278)
Space and water heating			6386.6303 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	228.6216	1.5338	350.6674 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-904.8983	1.4979	-1355.4456
PV Unit electricity exported	-1401.8834	0.4623	-648.0622
Total			-2003.5078 (283)
Total Primary energy kWh/year			4863.8907 (286)
Target Primary Energy Rate (TPER)			52.1100 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 238.0170 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)

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Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3196 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													(23c)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.5300	1.1450	13.2023			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			46.6700	0.1000	4.6670	75.0000	3500.2500	(28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060	9.0000	330.3000	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300	(30)
Total net area of external elements Aum(A, m2)			143.5200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5590			(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			110.0000			9.0000	990.0000	(32c)
Internal Floor 1			46.6700			18.0000	840.0600	(32d)
Internal Ceiling 1			46.6700			9.0000	420.0300	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 9154.6700 (34)
List of Thermal Bridges 98.0787 (35)

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425
E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	17.7000	0.0500	0.8850
E5 Ground floor (normal)	9.8400	0.1600	1.5744
E6 Intermediate floor within a dwelling	9.8400	0.0000	0.0000
E18 Party wall between dwellings	15.3000	0.0600	0.9180
E25 Staggered party wall between dwellings	5.1000	0.0600	0.3060
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752
P1 Party wall - Ground floor	18.9600	0.0800	1.5168
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9043 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 40.4633 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124	(38)
Heat transfer coeff	86.2587	86.0054	85.7572	84.5911	84.3729	83.3573	83.3573	83.1692	83.7485	84.3729	84.8143	85.2757	(39)
Average = Sum(39)m / 12 =												84.5900	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9241	0.9214	0.9188	0.9063	0.9039	0.8930	0.8930	0.8910	0.8972	0.9039	0.9087	0.9136	(40)
HLP (average)												0.9063	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687 (42)
Hot water usage for mixer showers													(42a)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Hot water usage for baths													(42b)
	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	
Hot water usage for other uses													(42c)
	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	
Average daily hot water use (litres/day)												65.7573	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	71.7412	69.7731	67.6244	64.9502	62.5645	60.0851	59.5701	61.7144	63.9137	66.4598	69.1576	71.6405	(44)
Energy conte	113.6205	99.3559	103.9362	88.9136	84.2238	73.8817	72.0449	76.4153	78.8119	90.1853	98.5277	112.1718	(45)
Energy content (annual)										Total = Sum(45)m =		1092.0887	
Distribution loss (46)m = 0.15 x (45)m													(46)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

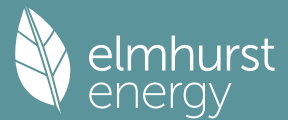
Water storage loss:													
Total storage loss													(56)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
If cylinder contains dedicated solar storage													(57)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	96.5775	84.4526	88.3458	75.5765	71.5902	62.7994	61.2381	64.9530	66.9901	76.6575	83.7486	95.3460	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h 96.5775 84.4526 88.3458 75.5765 71.5902 62.7994 61.2381 64.9530 66.9901 76.6575 83.7486 95.3460 (64)
Total per year (kWh/year) = Sum(64)m = 928.2754 (64)
12Total per year (kWh/year) 928 (64)

Electric shower(s) 55.2300 49.2104 53.7359 51.2795 52.2417 49.8335 51.4946 52.2417 51.2795 53.7359 52.7254 55.2300 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 628.2380 (64a)

Heat gains from water heating, kWh/month 37.9519 33.4157 35.5204 31.7140 30.9580 28.1582 28.1832 29.2987 29.5674 32.5983 34.1185 37.6440 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	51.0106	49.7258	47.7425	44.0472	41.6102	39.1087	37.8806	39.3800	41.0658	43.8150	47.3868	50.5968 (72)
Total internal gains	495.4670	511.3329	488.3332	475.5386	451.3341	437.1899	420.6033	419.5594	432.1987	444.0472	469.3866	484.2392 (73)

6. Solar gains

[Jan]	Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	11.5300		10.6334		0.6300		0.7000		0.7700		37.4691 (74)	
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	532.9361	582.9382	610.0082	670.9797	714.6112	719.0359	683.7426	628.3268	578.4914	529.2840	515.6095	515.4753 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.4807	29.5675	29.6531	30.0618	30.1396	30.5068	30.5068	30.5758	30.3643	30.1396	29.9827	29.8205
alpha	2.9654	2.9712	2.9769	3.0041	3.0093	3.0338	3.0338	3.0384	3.0243	3.0093	2.9988	2.9880
util living area	0.9663	0.9542	0.9350	0.8812	0.7845	0.6314	0.4955	0.5479	0.7511	0.9002	0.9511	0.9693 (86)
MIT	18.7784	19.0095	19.3810	19.9553	20.4580	20.8068	20.9321	20.9069	20.6523	20.0299	19.3375	18.7515 (87)
Th 2	20.1470	20.1493	20.1516	20.1622	20.1642	20.1734	20.1734	20.1751	20.1698	20.1642	20.1601	20.1560 (88)
util rest of house	0.9617	0.9480	0.9257	0.8632	0.7503	0.5727	0.4152	0.4674	0.7010	0.8814	0.9434	0.9651 (89)
MIT 2	18.0962	18.3258	18.6939	19.2596	19.7337	20.0453	20.1394	20.1257	19.9205	19.3407	18.6601	18.0757 (90)
Living area fraction	18.2178	18.4477	18.8164	19.3836	19.8628	20.1810	20.2807	20.2650	20.0510	19.4636	18.7808	18.1962 (91)
MIT	18.2178	18.4477	18.8164	19.3836	19.8628	20.1810	20.2807	20.2650	20.0510	19.4636	18.7808	18.1962 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2178	18.4477	18.8164	19.3836	19.8628	20.1810	20.2807	20.2650	20.0510	19.4636	18.7808	18.1962 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9479	0.9318	0.9071	0.8435	0.7366	0.5733	0.4261	0.4767	0.6930	0.8623	0.9270	0.9521 (94)
Useful gains	505.1626	543.1842	553.3448	565.9458	526.3583	412.2426	291.3285	299.4948	400.9090	456.3918	477.9621	490.7775 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1200.5336	1165.1763	1056.2163	886.8222	688.7230	465.2195	306.8136	321.4482	498.3874	747.8442	990.7018	1193.5369 (97)
Space heating kWh	517.3561	417.9787	374.1364	231.0310	120.7994	0.0000	0.0000	0.0000	0.0000	216.8406	369.1726	522.8530 (98a)
Space heating requirement - total per year (kWh/year)												2770.1677
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	517.3561	417.9787	374.1364	231.0310	120.7994	0.0000	0.0000	0.0000	0.0000	216.8406	369.1726	522.8530 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2770.1677
Space heating per m ²												29.6782 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	783.5582	616.8437	632.0858	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7491	0.8154	0.7776	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	586.9517	502.9777	491.5146	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	777.3301	739.0574	677.0741	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	137.0724	175.6433	138.0562	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	34.2681	43.9108	34.5141	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												112.6930 (107)
Energy for space heating												29.6782 (99)
Energy for space cooling												1.2073 (108)
Total												30.8856 (109)
Fabric Energy Efficiency (DFEE)												30.9 (109)

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SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			11.5300	1.1450	13.2023		(27)
Ground Floor			46.6700	0.1300	6.0671		(28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060		(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337		(30)
Total net area of external elements Aum(A, m ²)			143.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.9591		(33)
Party Wall 1			96.7000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 98.0787 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425
E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	17.7000	0.0500	0.8850
E5 Ground floor (normal)	9.8400	0.1600	1.5744
E6 Intermediate floor within a dwelling	9.8400	0.0000	0.0000
E18 Party wall between dwellings	15.3000	0.0600	0.9180
E25 Staggered party wall between dwellings	5.1000	0.0600	0.3060
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752
P1 Party wall - Ground floor	18.9600	0.0800	1.5168
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.9043 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	41.8634 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124 (38)
Heat transfer coeff	87.6588	87.4055	87.1573	85.9912	85.7730	84.7574	84.7574	84.5693	85.1486	85.7730	86.2144	86.6758 (39)
Average = Sum(39)m / 12 =												85.9901

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9391	0.9364	0.9338	0.9213	0.9189	0.9080	0.9080	0.9060	0.9122	0.9189	0.9237	0.9286 (40)
HLP (average)												0.9213
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

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Assumed occupancy											2.6687 (42)	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)	
Hot water usage for baths	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230 (42b)	
Hot water usage for other uses	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347 (42c)	
Average daily hot water use (litres/day)											65.7573 (43)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	71.7412	69.7731	67.6244	64.9502	62.5645	60.0851	59.5701	61.7144	63.9137	66.4598	69.1576	71.6405 (44)
Energy content (annual)	113.6205	99.3559	103.9362	88.9136	84.2238	73.8817	72.0449	76.4153	78.8119	90.1853	98.5277	112.1718 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												Total = Sum(45)m = 1092.0887
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	96.5775	84.4526	88.3458	75.5765	71.5902	62.7994	61.2381	64.9530	66.9901	76.6575	83.7486	95.3460 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	96.5775	84.4526	88.3458	75.5765	71.5902	62.7994	61.2381	64.9530	66.9901	76.6575	83.7486	95.3460 (64)
Total per year (kWh/year) = Sum(64)m = 928.2754 (64)												
12Total per year (kWh/year)												928 (64)
Electric shower(s)	55.2300	49.2104	53.7359	51.2795	52.2417	49.8335	51.4946	52.2417	51.2795	53.7359	52.7254	55.2300 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 628.2380 (64a)												
Heat gains from water heating, kWh/month	37.9519	33.4157	35.5204	31.7140	30.9580	28.1582	28.1832	29.2987	29.5674	32.5983	34.1185	37.6440 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367	133.4367 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.3354	150.9427	136.3354	140.8799	136.3354	140.8799	136.3354	136.3354	140.8799	136.3354	140.8799	136.3354 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0901	247.6333	241.2244	227.5805	210.3575	194.1703	183.3563	180.8130	187.2220	200.8659	218.0889	234.2760 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437	36.3437 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	51.0106	49.7258	47.7425	44.0472	41.6102	39.1087	37.8806	39.3800	41.0658	43.8150	47.3868	50.5968 (72)
Total internal gains	495.4670	511.3329	488.3332	475.5386	451.3341	437.1899	420.6033	419.5594	432.1987	444.0472	469.3866	484.2392 (73)

6. Solar gains

[Jan]				Area	Solar flux		g		FF		Access	Gains
				m2	Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	

North				11.5300	10.6334		0.6300		0.7000		0.7700	37.4691 (74)

Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	532.9361	582.9382	610.0082	670.9797	714.6112	719.0359	683.7426	628.3268	578.4914	529.2840	515.6095	515.4753 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.0098	29.0939	29.1767	29.5724	29.6476	30.0029	30.0029	30.0696	29.8650	29.6476	29.4958	29.3388
alpha	2.9340	2.9396	2.9451	2.9715	2.9765	3.0002	3.0002	3.0046	2.9910	2.9765	2.9664	2.9559
util living area	0.9666	0.9547	0.9358	0.8831	0.7881	0.6368	0.5013	0.5537	0.7552	0.9017	0.9516	0.9695 (86)
MIT	18.7356	18.9675	19.3429	19.9236	20.4360	20.7957	20.9271	20.9006	20.6368	20.0024	19.3009	18.7082 (87)
Th 2	20.1344	20.1367	20.1389	20.1495	20.1514	20.1607	20.1607	20.1624	20.1571	20.1514	20.1474	20.1433 (88)
util rest of house	0.9620	0.9484	0.9265	0.8651	0.7539	0.5775	0.4193	0.4718	0.7049	0.8830	0.9439	0.9653 (89)
MIT 2	18.0452	18.2758	18.6476	19.2199	19.7036	20.0252	20.1243	20.1098	19.8968	19.3051	18.6153	18.0243 (90)
Living area fraction	18.1683	18.3991	18.7715	19.3453	19.8342	20.1626	20.2674	20.2508	fLA = Living area / (4) =			0.1783 (91)
MIT	18.1683	18.3991	18.7715	19.3453	19.8342	20.1626	20.2674	20.2508	20.0287	19.4294	18.7375	18.1462 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1683	18.3991	18.7715	19.3453	19.8342	20.1626	20.2674	20.2508	20.0287	19.4294	18.7375	18.1462 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9480	0.9321	0.9077	0.8450	0.7395	0.5776	0.4303	0.4810	0.6963	0.8635	0.9274	0.9522 (94)
Useful gains	505.2281	543.3619	553.7186	566.9669	528.4453	415.3365	294.2030	302.1949	402.8253	457.0366	478.1520	490.8239 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												

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Space heating kWh	1215.6749	1179.8968	1069.5534	898.2051	697.6930	471.4702	310.8394	325.6572	504.8217	757.3221	1003.3231	1208.7976	(97)
Space heating requirement - total per year (kWh/year)	528.5724	427.7514	383.7811	238.4915	125.9203	0.0000	0.0000	0.0000	0.0000	223.4124	378.1232	534.1724	(98a)
Solar heating kWh												2840.2248	
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating kWh	528.5724	427.7514	383.7811	238.4915	125.9203	0.0000	0.0000	0.0000	0.0000	223.4124	378.1232	534.1724	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2840.2248	
Space heating per m2										(98c) / (4) =		30.4288	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	796.7192	627.2045	642.7265	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7407	0.8078	0.7695	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	590.1286	506.6633	494.5572	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	777.3301	739.0574	677.0741	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	134.7851	172.9012	135.7925	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	33.6963	43.2253	33.9481	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement													(107)
Energy for space heating													110.8697
Energy for space cooling													30.4288
Total													1.1878
Fabric Energy Efficiency (TFEE)													31.6166
													31.6

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080	(1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	238.0170 (5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1260 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3760	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756	(22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.5300	1.1450	13.2023			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			46.6700	0.1000	4.6670	75.0000	3500.2500	(28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060	9.0000	330.3000	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300	(30)

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Total net area of external elements Aum(A, m2)	143.5200				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	31.5590			(33)
Party Wall 1	96.7000	0.0000	0.0000	20.0000	1934.0000 (32)
GF	80.0000			9.0000	720.0000 (32c)
FF	110.0000			9.0000	990.0000 (32c)
Internal Floor 1	46.6700			18.0000	840.0600 (32d)
Internal Ceiling 1	46.6700			9.0000	420.0300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9154.6700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 98.0787 (35)

List of Thermal Bridges					
K1 Element	Length	Psi-value	Total		
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904		
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425		
E3 Sill	7.9200	0.0500	0.3960		
E4 Jamb	17.7000	0.0500	0.8850		
E5 Ground floor (normal)	9.8400	0.1600	1.5744		
E6 Intermediate floor within a dwelling	9.8400	0.0000	0.0000		
E18 Party wall between dwellings	15.3000	0.0600	0.9180		
E25 Staggered party wall between dwellings	5.1000	0.0600	0.3060		
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752		
P1 Party wall - Ground floor	18.9600	0.0800	1.5168		
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000		

Thermal bridges (Sum(L x Psi) calculated using Appendix K) (36a) = 8.9043 (36)
Point Thermal Bridges 0.0000
Total fabric heat loss (33) + (36) + (36a) = 40.4633 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	45.7954	45.5421	45.2939	44.1278	43.9096	42.8940	42.8940	42.7059	43.2852	43.9096	44.3510	44.8124	(39)
Average = Sum(39)m / 12 =	86.2587	86.0054	85.7572	84.5911	84.3729	83.3573	83.3573	83.1692	83.7485	84.3729	84.8143	85.2757	(39)
												84.5900	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.9241	0.9214	0.9188	0.9063	0.9039	0.8930	0.8930	0.8910	0.8972	0.9039	0.9087	0.9136	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

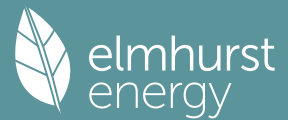
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687 (42)
Hot water usage for mixer showers													
86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768	(42a)	
Hot water usage for baths													
29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	(42b)	
Hot water usage for other uses													
41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	(42c)	
Average daily hot water use (litres/day)												145.2373 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173	(44)
Energy conte	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340	(45)
Energy content (annual)										Total = Sum(45)m =		2412.3938	
Distribution loss (46)m = 0.15 x (45)m	37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951	(46)
Water storage loss:													
Store volume												300.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7368	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.2281	(55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	126.0530	113.1930	111.4224	102.2107	102.0077	104.9224	104.8529	114.7886	119.5102	131.0716	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	(71)
Water heating gains (Table 5)	177.7434	174.9358	169.4261	157.2125	149.7613	141.9594	137.1072	141.0248	145.6291	154.2858	165.9864	176.1715	(72)
Total internal gains	687.9424	685.0915	664.3208	625.7179	587.8197	550.6715	530.6333	534.5942	554.4595	592.5056	634.6532	671.1845	(73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	

North				11.5300	10.6334	0.6300	0.7000			0.7700	37.4691 (74)	

Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	725.4115	756.6968	785.9958	821.1590	851.0968	832.5175	793.7726	743.3616	700.7522	677.7424	680.8761	702.4205 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.4807	29.5675	29.6531	30.0618	30.1396	30.5068	30.5068	30.5758	30.3643	30.1396	29.9827	29.8205
alpha	2.9654	2.9712	2.9769	3.0041	3.0093	3.0338	3.0338	3.0384	3.0243	3.0093	2.9988	2.9880
util living area	0.9305	0.9172	0.8880	0.8260	0.7193	0.5693	0.4371	0.4790	0.6751	0.8378	0.9084	0.9357 (86)
MIT	19.1625	19.3405	19.6880	20.1655	20.5828	20.8553	20.9518	20.9356	20.7459	20.2509	19.6468	19.1313 (87)
Th 2	20.1470	20.1493	20.1516	20.1622	20.1642	20.1734	20.1734	20.1751	20.1698	20.1642	20.1601	20.1560 (88)
util rest of house	0.9220	0.9070	0.8737	0.8029	0.6814	0.5116	0.3630	0.4040	0.6214	0.8118	0.8955	0.9277 (89)
MIT 2	17.9968	18.2216	18.6579	19.2525	19.7476	20.0529	20.1432	20.1326	19.9430	19.3672	18.6174	17.9634 (90)
Living area fraction									fLA = Living area / (4) =			0.1783 (91)
MIT	18.2046	18.4211	18.8415	19.4153	19.8965	20.1960	20.2873	20.2757	20.0861	19.5247	18.8009	18.1716 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2046	18.4211	18.8415	19.4153	19.8965	20.1960	20.2873	20.2757	20.0861	19.5247	18.8009	18.1716 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8970	0.8810	0.8470	0.7794	0.6682	0.5133	0.3736	0.4135	0.6155	0.7886	0.8697	0.9036 (94)
Useful gains	650.7009	666.6149	665.7422	640.0101	568.6958	427.2994	296.5398	307.4149	431.3201	534.4697	592.1524	634.7395 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1199.3913	1162.8880	1058.3745	889.4968	691.5655	466.4632	307.3661	322.3418	501.3280	753.0044	992.4041	1191.4413 (97)
Space heating kWh	408.2257	333.4955	292.1185	179.6304	91.4151	0.0000	0.0000	0.0000	0.0000	162.5898	288.1812	414.1861 (98a)
Space heating requirement - total per year (kWh/year)												2169.8422
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	408.2257	333.4955	292.1185	179.6304	91.4151	0.0000	0.0000	0.0000	0.0000	162.5898	288.1812	414.1861 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2169.8422
Space heating per m2										(98c) / (4) =		23.2466 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	408.2257	333.4955	292.1185	179.6304	91.4151	0.0000	0.0000	0.0000	0.0000	162.5898	288.1812	414.1861 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	163.3556	133.4516	116.8941	71.8809	36.5807	0.0000	0.0000	0.0000	0.0000	65.0619	115.3186	165.7407 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	177.8890	157.4333	167.2603	146.7607	142.1308	127.8975	125.9601	130.9664	132.4357	147.9126	157.6110	175.8802 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												868.2842	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1790.1376	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												242.5617	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2900.9835	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	868.2842	16.4900	143.1801	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1790.1376	16.4900	295.1937	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	242.5617	16.4900	39.9984	(250)
Additional standing charges			0.0000	(251)
Total energy cost			478.3722	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2449	(257)
SAP value		79.8208	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	868.2842	0.1546	134.2489	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1790.1376	0.1409	252.2626	(264)
Space and water heating			386.5115	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	242.5617	0.1443	35.0092	(268)
Total CO2, kg/year			421.5207	(272)
CO2 emissions per m2			4.5200	(273)
EI value			95.9170	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080	(1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	238.0170	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1260 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3760 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3196 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Adj infilt rate	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Effective ac	0.2877	0.2637	0.2557	0.2557	0.2637	0.2317	0.2477	0.2237	0.2237	0.2397	0.2237	0.2557	(22b)
	0.5414	0.5348	0.5327	0.5327	0.5348	0.5269	0.5307	0.5250	0.5250	0.5287	0.5250	0.5327	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.5300	1.1450	13.2023			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			46.6700	0.1000	4.6670	75.0000	3500.2500	(28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060	9.0000	330.3000	(29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300	(30)
Total net area of external elements Aum(A, m2)			143.5200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 31.5590			(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000	(32)
GF			80.0000			9.0000	720.0000	(32c)
FF			110.0000			9.0000	990.0000	(32c)
Internal Floor 1			46.6700			18.0000	840.0600	(32d)
Internal Ceiling 1			46.6700			9.0000	420.0300	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 9154.6700 (34)
List of Thermal Bridges 98.0787 (35)

K1 Element	Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904	
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425	
E3 Sill	7.9200	0.0500	0.3960	
E4 Jamb	17.7000	0.0500	0.8850	
E5 Ground floor (normal)	9.8400	0.1600	1.5744	
E6 Intermediate floor within a dwelling	9.8400	0.0000	0.0000	
E18 Party wall between dwellings	15.3000	0.0600	0.9180	
E25 Staggered party wall between dwellings	5.1000	0.0600	0.3060	
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752	
P1 Party wall - Ground floor	18.9600	0.0800	1.5168	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.9043	(36)
Point Thermal bridges			0.0000	(36a) =
Total fabric heat loss			40.4633	(33) + (36) + (36a) =

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	42.5228	42.0037	41.8407	41.8407	42.0037	41.3818	41.6827	41.2389	41.2389	41.5298	41.2389	41.8407	(38)
Average = Sum(39)m / 12 =	82.9861	82.4670	82.3040	82.3040	82.4670	81.8451	82.1460	81.7022	81.7022	81.9931	81.7022	82.3040	(39)
												82.1602	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.8891	0.8835	0.8818	0.8818	0.8835	0.8768	0.8801	0.8753	0.8753	0.8784	0.8753	0.8818	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6687	(42)
Hot water usage for mixer showers														
86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768	(42a)		
Hot water usage for baths														
29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800	(42b)		
Hot water usage for other uses														
41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605	(42c)		
Average daily hot water use (litres/day)													145.2373	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173	(44)	
Energy content (annual)	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340	(45)	
Distribution loss (46)m = 0.15 x (45)m	37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951	(46)	
Water storage loss:														
Store volume													300.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.7368	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													1.2281	(55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)	
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	

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Output from w/h	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
	Total per year (kWh/year) = Sum(64)m = 3134.5309 (64)											
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)											
Heat gains from water heating, kWh/month	132.2411	117.5568	126.0530	113.1930	111.4224	102.2107	102.0077	104.9224	104.8529	114.7886	119.5102	131.0716 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	(71)
Water heating gains (Table 5)	177.7434	174.9358	169.4261	157.2125	149.7613	141.9594	137.1072	141.0248	145.6291	154.2858	165.9864	176.1715	(72)
Total internal gains	687.9424	685.0915	664.3208	625.7179	587.8197	550.6715	530.6333	534.5942	554.4595	592.5056	634.6532	671.1845	(73)

6. Solar gains

[Jan]		Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North		11.5300		13.0723		0.6300		0.7000		0.7700		46.0630	(74)
Solar gains	46.0630	78.1341	133.1561	221.7956	289.9619	335.2033	307.1640	247.0841	171.6243	99.6585	57.2009	37.3234	(83)
Total gains	734.0055	763.2256	797.4769	847.5135	877.7816	885.8748	837.7974	781.6784	726.0838	692.1641	691.8541	708.5078	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	30.6432	30.8361	30.8972	30.8972	30.8361	31.0704	30.9566	31.1248	31.1248	31.0144	31.1248	30.8972	
alpha	3.0429	3.0557	3.0598	3.0598	3.0557	3.0714	3.0638	3.0750	3.0750	3.0676	3.0750	3.0598	
util living area	0.9167	0.9049	0.8656	0.7875	0.6483	0.4675	0.3434	0.3551	0.6001	0.7856	0.8833	0.9224	(86)
MIT	19.4471	19.5675	19.9333	20.3593	20.7387	20.9320	20.9805	20.9795	20.8467	20.4856	19.9369	19.4219	(87)
Th 2	20.1768	20.1815	20.1830	20.1830	20.1815	20.1872	20.1845	20.1885	20.1885	20.1859	20.1885	20.1830	(88)
util rest of house	0.9064	0.8933	0.8487	0.7604	0.6037	0.4058	0.2693	0.2769	0.5395	0.7516	0.8669	0.9127	(89)
MIT 2	18.3739	18.5269	18.9825	19.4994	19.9349	20.1371	20.1747	20.1785	20.0620	19.6614	18.9968	18.3470	(90)
Living area fraction										FLA = Living area / (4) =		0.1783	(91)
MIT	18.5652	18.7124	19.1520	19.6527	20.0782	20.2788	20.3183	20.3213	20.2019	19.8083	19.1644	18.5386	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5652	18.7124	19.1520	19.6527	20.0782	20.2788	20.3183	20.3213	20.2019	19.8083	19.1644	18.5386	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8813	0.8679	0.8237	0.7407	0.5977	0.4130	0.2817	0.2900	0.5406	0.7339	0.8420	0.8883	(94)
Useful gains	646.9012	662.4018	656.8567	627.7610	524.6263	365.8365	236.0035	226.6752	392.5251	508.0034	582.5325	629.3361	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1109.1251	1089.5852	975.4690	819.1487	600.2110	382.9395	239.7284	230.5046	433.1746	656.6266	895.8167	1097.8243	(97)
Space heating kWh	343.8945	287.0672	237.0475	137.7992	56.2350	0.0000	0.0000	0.0000	0.0000	110.5756	225.5646	348.5552	(98a)
Space heating requirement - total per year (kWh/year)												1746.7389	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	343.8945	287.0672	237.0475	137.7992	56.2350	0.0000	0.0000	0.0000	0.0000	110.5756	225.5646	348.5552	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1746.7389	
Space heating per m2										(98c) / (4) =		18.7137	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	343.8945	287.0672	237.0475	137.7992	56.2350	0.0000	0.0000	0.0000	0.0000	110.5756	225.5646	348.5552	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	137.6129	114.8728	94.8570	55.1417	22.5030	0.0000	0.0000	0.0000	0.0000	44.2479	90.2620	139.4779	(211)
Space heating efficiency (main heating system 2)													

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	311.4837	275.6657	292.8728	256.9779	248.8710	223.9485	220.5562	229.3222	231.8950	258.9949	275.9769	307.9662 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	177.8890	157.4333	167.2603	146.7607	142.1308	127.8975	125.9601	130.9664	132.4357	147.9126	157.6110	175.8802 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												698.9751 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1790.1376 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												242.5617 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												2731.6745 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	698.9751	26.0600	182.1529	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1790.1376	26.0600	466.5099	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	242.5617	26.0600	63.2116	(250)
Additional standing charges			0.0000	(251)
Total energy cost			711.8744	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	698.9751	0.1553	108.5615	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1790.1376	0.1409	252.2626	(264)
Space and water heating			360.8241	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	242.5617	0.1443	35.0092	(268)
Total CO2, kg/year			395.8333	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	698.9751	1.5750	1100.9123	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1790.1376	1.5211	2722.9151	(278)
Space and water heating			3823.8274	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	242.5617	1.5338	372.0493	(282)
Total Primary energy kWh/year			4195.8767	(286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:

C 80

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Current environmental impact rating:

A 96

N Solar water heating
U Solar photovoltaic panels
V2 Wind turbine

Recommended
Recommended
Not applicable

Recommended measures:

N Solar water heating	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 2.2	-£ 102	-49 kg (12.3%)
	+ 6.1	-£ 245	-126 kg (36.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£102	0.52 kg/m ²	B 82 A 96
Solar photovoltaic panels	£245	1.36 kg/m ²	B 88 A 97
Total Savings	£347	1.88 kg/m ²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£712	£610	£102
Space heating	£182	£203	-£21
Water heating	£467	£343	£123
Lighting	£63	£63	£0
Generated (PV)	-£0	-£245	£245
Total cost of fuels	£712	£365	£347
Total cost of uses	£712	£364	£347
Delivered energy	29 kWh/m ²	15 kWh/m ²	14 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m ²	4 kg/m ²	2 kg/m ²	2 kg/m ²
Primary energy	45 kWh/m ²	24 kWh/m ²	21 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1260 (8)

Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
Yes
Blower Door
5.0000 (17)
0.3760 (18)
2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4075	0.3995	0.3916	0.3516	0.3436	0.3037	0.3037	0.2957	0.3196	0.3436	0.3596	0.3756 (22b)
Effective ac	0.5830	0.5798	0.5767	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5647	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K

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Windows (Uw = 1.20)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													

Full SAP Calculation Printout



5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	177.7434	174.9358	167.9253	149.7085	136.0040	127.9519	123.0997	128.0178	139.6259	152.7850	165.9864	176.1715 (72)
Total internal gains	687.9424	685.0915	662.8200	618.2139	574.0623	536.6641	516.6259	521.5873	548.4563	591.0048	634.6532	671.1845 (73)

6. Solar gains

[Jan]	Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	11.5300		10.6334		0.6300		0.7000		0.7700		37.4691 (74)	
Solar gains	37.4691	71.6053	121.6749	195.4412	263.2771	281.8460	263.1392	208.7674	146.2927	85.2368	46.2229	31.2361 (83)
Total gains	725.4115	756.6968	784.4950	813.6550	837.3394	818.5100	779.7651	730.3547	694.7490	676.2416	680.8761	702.4205 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.4807	29.5675	29.6531	30.0618	30.1396	30.5068	30.5068	30.5758	30.3643	30.1396	29.9827	29.8205
alpha	2.9654	2.9712	2.9769	3.0041	3.0093	3.0338	3.0338	3.0384	3.0243	3.0093	2.9988	2.9880
util living area	0.9305	0.9172	0.8885	0.8288	0.7257	0.5764	0.4438	0.4861	0.6786	0.8384	0.9084	0.9357 (86)
MIT	19.1625	19.3405	19.6856	20.1560	20.5718	20.8502	20.9497	20.9330	20.7420	20.2489	19.6468	19.1313 (87)
Th 2	20.1470	20.1493	20.1516	20.1622	20.1642	20.1734	20.1734	20.1751	20.1698	20.1642	20.1601	20.1560 (88)
util rest of house	0.9220	0.9070	0.8742	0.8060	0.6881	0.5186	0.3690	0.4104	0.6250	0.8125	0.8955	0.9277 (89)
MIT 2	17.9968	18.2216	18.6550	19.2415	19.7359	20.0483	20.1418	20.1307	19.9392	19.3649	18.6174	17.9634 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2046	18.4211	18.8387	19.4045	19.8849	20.1913	20.2858	20.2737	20.0824	19.5225	18.8009	18.1716 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.2046	18.4211	18.8387	19.4045	19.8849	20.1913	20.2858	20.2737	20.0824	19.5225	18.8009	18.1716 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8970	0.8810	0.8475	0.7823	0.6743	0.5199	0.3795	0.4198	0.6189	0.7893	0.8697	0.9036 (94)
Useful gains	650.7009	666.6149	664.8438	636.4996	564.6458	425.5409	295.9408	306.6274	429.9703	533.7462	592.1524	634.7395 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1199.3913	1162.8880	1058.1334	888.5886	690.5825	466.0753	307.2409	322.1755	501.0129	752.8170	992.4041	1191.4413 (97)
Space heating kWh	408.2257	333.4955	292.6074	181.5041	93.6969	0.0000	0.0000	0.0000	0.0000	162.9887	288.1812	414.1861 (98a)
Space heating requirement - total per year (kWh/year)	2174.8856											
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	408.2257	333.4955	292.6074	181.5041	93.6969	0.0000	0.0000	0.0000	0.0000	162.9887	288.1812	414.1861 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2174.8856											
Space heating per m ²	(98c) / (4) = 23.3007 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	408.2257	333.4955	292.6074	181.5041	93.6969	0.0000	0.0000	0.0000	0.0000	162.9887	288.1812	414.1861 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	163.3556	133.4516	117.0898	72.6307	37.4938	0.0000	0.0000	0.0000	0.0000	65.2216	115.3186	165.7407 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	311.4837	259.4849	232.1764	167.8515	127.2637	110.7894	107.5761	130.5222	167.4206	228.7830	275.9769	307.9662 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (217)

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Fuel for water heating, kWh/month	177.8890	148.1924	132.5965	95.8604	72.6806	63.2721	61.4370	74.5415	95.6143	130.6585	157.6110	175.8802	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.1091	-56.9938	-85.6302	-98.5751	-105.5056	-95.0525	-93.6728	-88.4938	-78.3914	-65.9452	-42.8569	-32.5902	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												870.3024	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1386.2334	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												242.5617	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-881.8165	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1697.2810	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	870.3024	16.4900	143.5129	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1386.2334	16.4900	228.5899	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	242.5617	16.4900	39.9984	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-881.8165	16.4900	-145.4115	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-145.4115	(252)
Total energy cost			279.8816	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.7283	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	88.1937	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	870.3024	0.1546	134.5283	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1386.2334	0.1450	200.9589	(264)
Space and water heating			335.4872	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	242.5617	0.1443	35.0092	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-881.8165	0.1344	-118.4864	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-118.4864	(269)
Total CO2, kg/year			263.1070	(272)
CO2 emissions per m2			2.8200	(273)
EI value			97.4515	
EI rating			97	(274)
EI band			A	

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6700 (1b)	x 2.4000 (2b)	= 112.0080 (1b) - (3b)
First floor	46.6700 (1c)	x 2.7000 (2c)	= 126.0090 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3400		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.0170 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.2877	0.2637	0.2557	0.2557	0.2637	0.2317	0.2477	0.2237	0.2237	0.2397	0.2237	0.2557 (22b)
Effective ac	0.5414	0.5348	0.5327	0.5327	0.5348	0.5269	0.5307	0.5250	0.5250	0.5287	0.5250	0.5327 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			11.5300	1.1450	13.2023		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			46.6700	0.1000	4.6670	75.0000	3500.2500 (28a)
Brick	50.1800	13.4800	36.7000	0.1800	6.6060	9.0000	330.3000 (29a)
Joists FF	46.6700		46.6700	0.1100	5.1337	9.0000	420.0300 (30)
Total net area of external elements Aum(A, m ²)			143.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5590		(33)
Party Wall 1			96.7000	0.0000	0.0000	20.0000	1934.0000 (32)
GF			80.0000			9.0000	720.0000 (32c)
FF			110.0000			9.0000	990.0000 (32c)
Internal Floor 1			46.6700			18.0000	840.0600 (32d)
Internal Ceiling 1			46.6700			9.0000	420.0300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 9154.6700 (34)
98.0787 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.8400	0.0600	0.5904
E2 Other lintels (including other steel lintels)	8.8500	0.0500	0.4425
E3 Sill	7.9200	0.0500	0.3960
E4 Jamb	17.7000	0.0500	0.8850
E5 Ground floor (normal)	9.8400	0.1600	1.5744
E6 Intermediate floor within a dwelling	9.8400	0.0000	0.0000
E18 Party wall between dwellings	15.3000	0.0600	0.9180
E25 Staggered party wall between dwellings	5.1000	0.0600	0.3060
P4 Party wall - Roof (insulation at ceiling level)	18.9600	0.1200	2.2752
P1 Party wall - Ground floor	18.9600	0.0800	1.5168
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 40.4633 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

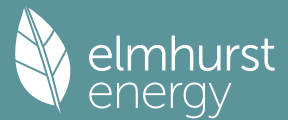
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.5228	42.0037	41.8407	41.8407	42.0037	41.3818	41.6827	41.2389	41.2389	41.5298	41.2389	41.8407 (38)
Heat transfer coeff	82.9861	82.4670	82.3040	82.3040	82.4670	81.8451	82.1460	81.7022	81.7022	81.9931	81.7022	82.3040 (39)
Average = Sum(39)m / 12 =												82.1602

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8891	0.8835	0.8818	0.8818	0.8835	0.8768	0.8801	0.8753	0.8753	0.8784	0.8753	0.8818 (40)
HLP (average)												0.8802
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Hot water usage for mixer showers
2.6687 (42)

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Hot water usage for baths	86.2071	84.9115	83.0237	79.4117	76.7461	73.7735	72.0838	73.9574	76.0111	79.2028	82.8924	85.8768 (42a)
Hot water usage for other uses	29.7807	29.3384	28.7156	27.5672	26.7073	25.7538	25.2388	25.8573	26.5307	27.5509	28.7230	29.6800 (42b)
Average daily hot water use (litres/day)	41.9605	40.4347	38.9088	37.3830	35.8572	34.3313	34.3313	35.8572	37.3830	38.9088	40.4347	41.9605 (42c)
												145.2373 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	157.9483	154.6846	150.6481	144.3619	139.3106	133.8586	131.6539	135.6718	139.9248	145.6626	152.0501	157.5173 (44)
Distribution loss (46)m = 0.15 x (45)m	250.1515	220.2689	231.5406	197.6242	187.5388	164.5948	159.2240	167.9900	172.5412	197.6627	216.6232	246.6340 (45)
										Total = Sum(45)m =		2412.3938
Water storage loss:	37.5227	33.0403	34.7311	29.6436	28.1308	24.6892	23.8836	25.1985	25.8812	29.6494	32.4935	36.9951 (46)
Store volume												300.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7368 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.2281 (55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	311.4837	275.6657	291.4770	250.2243	236.0767	211.3418	207.5292	217.2257	226.4921	257.5992	275.9769	307.9662 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												761.8610 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												761.8610
Solar input	-1.8066	-20.9016	-66.2724	-94.0035	-118.5966	-119.4269	-116.0534	-103.7445	-72.6012	-40.8605	-7.5938	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	309.6771	254.7641	225.2046	156.2208	117.4800	91.9148	91.4758	113.4813	153.8909	216.7387	268.3831	307.9662 (64)
												2307.1975 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	132.2411	117.5568	124.9364	107.7902	101.1869	92.1254	91.5862	95.2453	100.5306	113.6720	119.5102	131.0716 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240	160.1240 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.3371	30.4979	24.8026	18.7771	14.0361	11.8499	12.8042	16.6434	22.3388	28.3642	33.1052	35.2915 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.8061	369.6020	360.0364	339.6724	313.9664	289.8065	273.6661	269.8702	279.4358	299.7998	325.5058	349.6657 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811	53.6811 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493	-106.7493 (71)
Water heating gains (Table 5)	177.7434	174.9358	167.9253	149.7085	136.0040	127.9519	123.0997	128.0178	139.6259	152.7850	165.9864	176.1715 (72)
Total internal gains	687.9424	685.0915	662.8200	618.2139	574.0623	536.6641	516.6259	521.5873	548.4563	591.0048	634.6532	671.1845 (73)

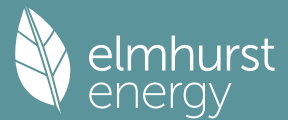
6. Solar gains

[Jan]													
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North	11.5300				13.0723		0.6300		0.7000		0.7700		46.0630 (74)
Solar gains	46.0630	78.1341	133.1561	221.7956	289.9619	335.2033	307.1640	247.0841	171.6243	99.6585	57.2009	37.3234	(83)
Total gains	734.0055	763.2256	795.9761	840.0095	864.0242	871.8674	823.7899	768.6714	720.0806	690.6633	691.8541	708.5078	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.6432	30.8361	30.8972	30.8972	30.8361	31.0704	30.9566	31.1248	31.1248	31.0144	31.1248	30.8972
alpha	3.0429	3.0557	3.0598	3.0598	3.0557	3.0714	3.0638	3.0750	3.0750	3.0676	3.0750	3.0598
util living area	0.9167	0.9049	0.8661	0.7906	0.6549	0.4738	0.3489	0.3606	0.6036	0.7863	0.8833	0.9224 (86)
MIT	19.4471	19.5675	19.9311	20.3513	20.7310	20.9295	20.9796	20.9786	20.8442	20.4840	19.9369	19.4219 (87)
Th 2	20.1768	20.1815	20.1830	20.1830	20.1815	20.1872	20.1845	20.1885	20.1885	20.1859	20.1885	20.1830 (88)
util rest of house												

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MIT 2	0.9064	0.8933	0.8493	0.7637	0.6104	0.4116	0.2737	0.2814	0.5430	0.7525	0.8669	0.9127 (89)
Living area fraction	18.3739	18.5269	18.9799	19.4902	19.9271	20.1351	20.1742	20.1780	20.0597	19.6596	18.9968	18.3470 (90)
MIT	18.5652	18.7124	19.1495	19.6437	20.0704	20.2767	20.3178	20.3207	fLA = Living area / (4) =			0.1783 (91)
Temperature adjustment									20.1995	19.8066	19.1644	18.5386 (92)
adjusted MIT	18.5652	18.7124	19.1495	19.6437	20.0704	20.2767	20.3178	20.3207	20.1995	19.8066	19.1644	18.5386 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8813	0.8679	0.8242	0.7438	0.6039	0.4187	0.2862	0.2946	0.5439	0.7347	0.8420	0.8883	(94)
Useful gains	646.9012	662.4018	656.0382	624.7824	521.8200	365.0130	235.7901	226.4574	391.6568	507.4281	582.5325	629.3361	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1109.1251	1089.5852	975.2575	818.4092	599.5682	382.7675	239.6849	230.4602	432.9835	656.4849	895.8167	1097.8243	(97)
Space heating kWh	343.8945	287.0672	237.4992	139.4113	57.8447	0.0000	0.0000	0.0000	0.0000	110.8982	225.5646	348.5552	(98a)
Space heating requirement - total per year (kWh/year)												1750.7350	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	343.8945	287.0672	237.4992	139.4113	57.8447	0.0000	0.0000	0.0000	0.0000	110.8982	225.5646	348.5552	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1750.7350	
Space heating per m2												(98c) / (4) =	18.7565 (99)

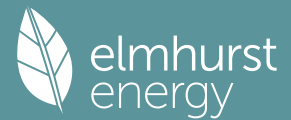
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	343.8945	287.0672	237.4992	139.4113	57.8447	0.0000	0.0000	0.0000	0.0000	110.8982	225.5646	348.5552	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	137.6129	114.8728	95.0377	55.7868	23.1471	0.0000	0.0000	0.0000	0.0000	44.3770	90.2620	139.4779	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	309.6771	254.7641	225.2046	156.2208	117.4800	91.9148	91.4758	113.4813	153.8909	216.7387	268.3831	307.9662	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	176.8573	145.4963	128.6148	89.2181	67.0931	52.4928	52.2420	64.8094	87.8875	123.7799	153.2742	175.8802	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	30.0551	24.1113	21.7096	15.9054	12.2858	10.0376	11.2075	14.5679	18.9223	24.8270	28.0421	30.8904	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-44.8714	-59.7671	-88.3242	-102.6708	-107.0312	-100.7553	-98.5205	-94.1733	-84.1848	-71.6168	-50.1292	-37.6541	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												700.5742	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1317.6457	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												242.5617	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-939.6986	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1401.0830	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year

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Space heating - main system 1	700.5742	26.0600	182.5696 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1317.6457	26.0600	343.3785 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	242.5617	26.0600	63.2116 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-939.6986	26.0600	-244.8855
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-244.8855 (252)
Total energy cost			365.1222 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	700.5742	0.1553	108.7840 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1317.6457	0.1458	192.1256 (264)
Space and water heating			300.9095 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	242.5617	0.1443	35.0092 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-939.6986	0.1346	-126.4918
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-126.4918 (269)
Total CO2, kg/year			220.5239 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	700.5742	1.5749	1103.3347 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1317.6457	1.5394	2028.3462 (278)
Space and water heating			3131.6809 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	242.5617	1.5338	372.0493 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-939.6986	1.4975	-1407.1900
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1407.1900 (283)
Total Primary energy kWh/year			2217.5642 (286)

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Property Reference	FURNERS LANE 19				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 19, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	5.14	TER	11.27	
Environmental	96 A	% DER < TER				54.39
CO ₂ Emissions (t/year)	0.33	DFEE	31.33	TFEE	31.65	
Compliance Check	See BREL	% DFEE < TFEE				1.01
% DPER < TPER	7.54	DPER	54.43	TPER	58.87	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.0560 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1204 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3704 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3149 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4015	0.3936	0.3857	0.3464	0.3385	0.2991	0.2991	0.2913	0.3149	0.3385	0.3542	0.3700 (22b)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			8.6400	1.1450	9.8931		(27)
Solid Doors			2.1200	1.0000	2.1200		(26)
Rooflight West			0.7600	1.1450	0.8702		(27a)
Ground Floor			4.1700	0.0900	0.3753	75.0000	312.7500 (28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632	9.0000	308.1600 (29a)
Ashlar	3.0100		3.0100	0.1800	0.5418	9.0000	27.0900 (29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036	9.0000	45.1800 (29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404	9.0000	7.0200 (29a)
Joists	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000 (30)
Rafters	14.0000	0.7600	13.2400	0.1300	1.7212	9.0000	119.1600 (30)
D Flat	4.8200		4.8200	0.1300	0.6266	9.0000	43.3800 (30)
Total net area of external elements Aum(A, m ²)			126.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.8555		(33)
Party Wall 1			44.7000	0.0000	0.0000	20.0000	894.0000 (32)
Party Floor 1			56.4100			30.0000	1692.3000 (32d)
GF			80.0000			9.0000	720.0000 (32c)
Heat capacity Cm = Sum (A x k)				(28)...(30) + (32) + (32a)...(32e) =			4619.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							66.7588 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E12 Gable (insulation at ceiling level)	9.9600	0.0600	0.5976
E10 Eaves (insulation at ceiling level)	3.8400	0.0600	0.2304
E16 Corner (normal)	9.6000	0.0900	0.8640
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
P1 Party wall - Ground floor	7.9600	0.0800	0.6368
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	23.1700	0.0700	1.6219
E14 Flat roof	12.4000	0.0400	0.4960
E11 Eaves (insulation at rafter level)	3.4100	0.0400	0.1364
R6 Flat ceiling	3.4100	0.0600	0.2046
E13 Gable (insulation at rafter level)	3.4000	0.0800	0.2720
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105
E3 Sill	7.2000	0.0500	0.3600
E4 Jamb	13.8000	0.0500	0.6900
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.9600	0.0800	0.1568
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.9958 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	36.8513 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	31.8153	31.6438	31.4757	30.6862	30.5385	29.8509	29.8509	29.7236	30.1158	30.5385	30.8374	31.1498	(38)
Average = Sum(39)m / 12 =	68.6666	68.4951	68.3270	67.5375	67.3898	66.7022	66.7022	66.5748	66.9670	67.3898	67.6886	68.0010	(39)
												67.5368	
HLP	0.9924	0.9900	0.9875	0.9761	0.9740	0.9640	0.9640	0.9622	0.9679	0.9740	0.9783	0.9828	(40)
HLP (average)												0.9761	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2263 (42)
Hot water usage for mixer showers													
76.9342	75.7780	74.0933	70.8698	68.4909	65.8380	64.3301	66.0021	67.8350	70.6834	73.9761	76.6394	(42a)	
Hot water usage for baths													
26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007	(42b)	
Hot water usage for other uses													
37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295	(42c)	
Average daily hot water use (litres/day)													129.6113 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.9544	138.0422	134.4403	128.8303	124.3226	119.4573	117.4895	121.0748	124.8700	129.9905	135.6908	140.5697	(44)
Energy content (annual)	223.2373	196.5703	206.6297	176.3623	167.3621	146.8867	142.0934	149.9159	153.9772	176.3958	193.3164	220.0982	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2152.8451	
33.4856	29.4855	30.9944	26.4543	25.1043	22.0330	21.3140	22.4874	23.0966	26.4594	28.9975	33.0147	(46)	
Water storage loss:													
Store volume													180.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.8736 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													0.8736 (55)
Total storage loss													
27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2745.6102	(64)
Electric shower(s)												2746	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
114.5019	101.7375	108.9799	97.6168	95.9234	87.8161	87.5216	90.1226	90.1738	98.9272	103.2540	113.4582	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.0472	117.4095	106.0472	109.5822	106.0472	109.5822	106.0472	106.0472	109.5822	106.0472	109.5822	106.0472	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	195.3992	197.4269	192.3173	181.4396	167.7085	154.8032	146.1817	144.1541	149.2636	160.1413	173.8724	186.7777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	(71)
Water heating gains (Table 5)	153.9005	151.3951	146.4784	135.5789	128.9294	121.9669	117.6366	121.1325	125.2413	132.9666	143.4084	152.4976	(72)
Total internal gains	514.7414	525.6260	504.2374	485.9952	462.0796	442.7468	426.2600	427.7283	440.4816	458.5497	486.2574	504.7170	(73)

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6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	2.1600		10.6334		0.6300		0.7000		0.7700		7.0194 (74)	
South	2.1600		46.7521		0.6300		0.7000		0.7700		30.8622 (78)	
West	4.3200		19.6403		0.6300		0.7000		0.7700		25.9300 (80)	
West	0.7600		25.9287		0.6300		0.7000		1.0000		7.8212 (82)	
Solar gains	71.6328	130.3314	197.3747	271.5296	325.1671	331.1084	315.8434	275.1934	223.2888	149.4734	87.3872	60.2356 (83)
Total gains	586.3742	655.9574	701.6122	757.5247	787.2467	773.8552	742.1034	702.9217	663.7704	608.0230	573.6447	564.9526 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.6855	18.7322	18.7783	18.9978	19.0395	19.2358	19.2358	19.2725	19.1597	19.0395	18.9554	18.8683
alpha	2.2457	2.2488	2.2519	2.2665	2.2693	2.2824	2.2824	2.2848	2.2773	2.2693	2.2637	2.2579
util living area	0.8778	0.8454	0.8011	0.7197	0.6120	0.4775	0.3653	0.3963	0.5627	0.7418	0.8410	0.8853 (86)
MIT	18.5012	18.8301	19.3011	19.9164	20.4220	20.7701	20.9102	20.8889	20.6458	20.0037	19.1756	18.4494 (87)
Th 2	20.0896	20.0917	20.0937	20.1033	20.1051	20.1134	20.1134	20.1149	20.1102	20.1051	20.1015	20.0977 (88)
util rest of house	0.8663	0.8314	0.7827	0.6935	0.5744	0.4252	0.2999	0.3302	0.5116	0.7120	0.8244	0.8746 (89)
MIT 2	17.1685	17.5782	18.1642	18.9212	19.5209	19.9145	20.0527	20.0366	19.7874	19.0430	18.0233	17.1081 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.6384	18.0197	18.5652	19.2722	19.8387	20.2162	20.3551	20.3372	20.0901	19.3818	18.4296	17.5811 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6384	18.0197	18.5652	19.2722	19.8387	20.2162	20.3551	20.3372	20.0901	19.3818	18.4296	17.5811 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8272	0.7922	0.7462	0.6663	0.5625	0.4315	0.3182	0.3473	0.5103	0.6847	0.7867	0.8361 (94)
Useful gains	485.0483	519.6676	523.5302	504.7397	442.7877	333.9566	236.1564	244.1558	338.7551	416.3054	451.2910	472.3322 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	915.9050	898.6357	824.3762	700.5102	548.4652	374.6159	250.4711	262.1166	401.1413	591.8021	766.8875	909.9271 (97)
Space heating kWh	320.5574	254.6666	223.8294	140.9547	78.6241	0.0000	0.0000	0.0000	0.0000	130.5695	227.2295	325.5706 (98a)
Space heating requirement - total per year (kWh/year)	1702.0019											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	320.5574	254.6666	223.8294	140.9547	78.6241	0.0000	0.0000	0.0000	0.0000	130.5695	227.2295	325.5706 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1702.0019											
Space heating per m2	(98c) / (4) = 24.5990 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	320.5574	254.6666	223.8294	140.9547	78.6241	0.0000	0.0000	0.0000	0.0000	130.5695	227.2295	325.5706 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	128.2743	101.9074	89.5676	56.4045	31.4622	0.0000	0.0000	0.0000	0.0000	52.2487	90.9282	130.2804 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	156.2431	138.2311	146.7585	128.5452	124.3327	111.7116	109.9017	114.3691	115.7611	129.4919	138.2277	154.4504 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	25.0461	20.0929	18.0914	13.2545	10.2382	8.3647	9.3396	12.1400	15.7686	20.6893	23.3685	25.7422 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												

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(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												681.0732	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1568.0241	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												202.1361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2451.2333	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	681.0732	0.1545	105.2083	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1568.0241	0.1410	221.0279	(264)
Space and water heating			326.2362	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	202.1361	0.1443	29.1745	(268)
Total CO2, kg/year			355.4106	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.1400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	681.0732	1.5719	1070.5768	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1568.0241	1.5212	2385.3100	(278)
Space and water heating			3455.8868	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	202.1361	1.5338	310.0430	(282)
Total Primary energy kWh/year			3765.9299	(286)
Dwelling Primary energy Rate (DPER)			54.4300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080	(1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.0560	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1204 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3704	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3149 (21)

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Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4015	0.3936	0.3857	0.3464	0.3385	0.2991	0.2991	0.2913	0.3149	0.3385	0.3542	0.3700 (22b)
	0.5806	0.5775	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.20)			8.6400	1.1450	9.8931			(27)
Rooflight West			0.7600	1.4151	1.0755			(27a)
Ground floor			4.1700	0.1300	0.5421			(28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632			(29a)
Ashlar	3.0100		3.0100	0.1800	0.5418			(29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036			(29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404			(29a)
Joists	50.0000		50.0000	0.1100	5.5000			(30)
Rafters	14.0000	0.7600	13.2400	0.1100	1.4564			(30)
D Flat	4.8200		4.8200	0.1100	0.5302			(30)
Total net area of external elements Aum(A, m2)			126.8000					(31)
Fabric heat loss, W/K = Sum (A x U)						28.8663		(33)
Party Wall 1			44.7000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

66.7588 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	9.9600	0.0600	0.5976	
E10 Eaves (insulation at ceiling level)	3.8400	0.0600	0.2304	
E16 Corner (normal)	9.6000	0.0900	0.8640	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160	
P1 Party wall - Ground floor	7.9600	0.0800	0.6368	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000	
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880	
E7 Party floor between dwellings (in blocks of flats)	23.1700	0.0700	1.6219	
E14 Flat roof	12.4000	0.0800	0.9920	
E11 Eaves (insulation at rafter level)	3.4100	0.0400	0.1364	
R6 Flat ceiling	3.4100	0.0600	0.2046	
E13 Gable (insulation at rafter level)	3.4000	0.0800	0.2720	
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376	
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105	
E3 Sill	7.2000	0.0500	0.3600	
E4 Jamb	13.8000	0.0500	0.6900	
R1 Head of roof window	0.7800	0.0800	0.0624	
R2 Sill of roof window	0.7800	0.0600	0.0468	
R3 Jamb of roof window	1.9600	0.0800	0.1568	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =		37.3581	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.8153	31.6438	31.4757	30.6862	30.5385	29.8509	29.8509	29.7236	30.1158	30.5385	30.8374	31.1498	(38)
Heat transfer coeff	69.1734	69.0019	68.8338	68.0443	67.8966	67.2090	67.2090	67.0817	67.4739	67.8966	68.1955	68.5079	(39)
Average = Sum(39)m / 12 =												68.0436	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9998	0.9973	0.9949	0.9834	0.9813	0.9714	0.9714	0.9695	0.9752	0.9813	0.9856	0.9901	(40)
HLP (average)												0.9834	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2263 (42)
Hot water usage for mixer showers	61.5474	60.6224	59.2746	56.6958	54.7927	52.6704	51.4641	52.8017	54.2680	56.5467	59.1809	61.3116	(42a)
Hot water usage for baths	26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007	(42b)
Hot water usage for other uses	37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295	(42c)
Average daily hot water use (litres/day)												115.4252	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.5675	122.8866	119.6216	114.6564	110.6244	106.2897	104.6235	107.8744	111.3030	115.8538	120.8955	125.2418	(44)
Energy conte	198.8683	174.9889	183.8539	156.9588	148.9217	130.6955	126.5330	133.5710	137.2477	157.2125	172.2379	196.0984	(45)
Energy content (annual)										Total = Sum(45)m =		1917.1877	
Distribution loss (46)m = 0.15 x (45)m	29.8302	26.2483	27.5781	23.5438	22.3383	19.6043	18.9800	20.0357	20.5872	23.5819	25.8357	29.4148	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	248.1109	219.4661	233.0966	204.6130	198.1644	178.3497	175.7757	182.8137	184.9019	206.4552	219.8921	245.3411	(62)
WWHRS	-28.1369	-24.8845	-26.0576	-21.5767	-20.1087	-17.2072	-16.1290	-17.1516	-17.8032	-20.9880	-23.7769	-27.6158	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.9740	194.5816	207.0390	183.0363	178.0556	161.1426	159.6467	165.6621	167.0987	185.4671	196.1152	217.7252	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2235.5443	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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Heat gains from water heating, kWh/month
 105.5178 93.7656 100.5256 90.3122 88.9106 81.5796 81.4664 83.8065 83.7582 91.6673 95.3924 104.5969 (65)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.0472	117.4095	106.0472	109.5822	106.0472	109.5822	106.0472	106.0472	109.5822	106.0472	109.5822	106.0472	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	195.3992	197.4269	192.3173	181.4396	167.7085	154.8032	146.1817	144.1541	149.2636	160.1413	173.8724	186.7777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	(71)
Water heating gains (Table 5)	141.8250	139.5321	135.1150	125.4336	119.5035	113.3050	109.4978	112.6432	116.3309	123.2087	132.4895	140.5872	(72)
Total internal gains	502.6660	513.7630	492.8741	475.8498	452.6538	434.0849	418.1213	419.2390	431.5712	448.7918	475.3386	492.8066	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.1600	10.6334		0.6300		0.7000		0.7700		7.0194 (74)
South				2.1600	46.7521		0.6300		0.7000		0.7700		30.8622 (78)
West				4.3200	19.6403		0.6300		0.7000		0.7700		25.9300 (80)
West				0.7600	25.9287		0.6300		0.7000		1.0000		7.8212 (82)
Solar gains	71.6328	130.3314	197.3747	271.5296	325.1671	331.1084	315.8434	275.1934	223.2888	149.4734	87.3872		60.2356 (83)
Total gains	574.2988	644.0944	690.2488	747.3794	777.8208	765.1934	733.9647	694.4324	654.8600	598.2652	562.7258		553.0422 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.5486	18.5947	18.6401	18.8563	18.8974	19.0907	19.0907	19.1269	19.0158	18.8974	18.8145	18.7288	
alpha	2.2366	2.2396	2.2427	2.2571	2.2598	2.2727	2.2727	2.2751	2.2677	2.2598	2.2543	2.2486	
util living area	0.8824	0.8505	0.8066	0.7258	0.6184	0.4838	0.3708	0.4024	0.5699	0.7484	0.8464	0.8898	(86)
MIT	18.4450	18.7785	19.2571	19.8847	20.4022	20.7606	20.9059	20.8836	20.6318	19.9731	19.1295	18.3925	(87)
Th 2	20.0835	20.0856	20.0876	20.0972	20.0989	20.1073	20.1073	20.1088	20.1041	20.0989	20.0953	20.0916	(88)
util rest of house	0.8712	0.8367	0.7885	0.6996	0.5807	0.4309	0.3043	0.3352	0.5184	0.7188	0.8301	0.8793	(89)
MIT 2	17.0958	17.5116	18.1075	18.8801	19.4946	19.9002	20.0437	20.0268	19.7684	19.0036	17.9637	17.0343	(90)
Living area fraction	17.5716	17.9584	18.5129	19.2344	19.8147	20.2036	20.3477	20.3289	20.0729	19.3455	18.3748	17.5133	(91)
MIT	17.5716	17.9584	18.5129	19.2344	19.8147	20.2036	20.3477	20.3289	20.0729	19.3455	18.3748	17.5133	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5716	17.9584	18.5129	19.2344	19.8147	20.2036	20.3477	20.3289	20.0729	19.3455	18.3748	17.5133	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	477.8570	513.4710	518.6396	501.9468	441.7585	334.2662	236.8741	244.7260	338.1992	413.1797	445.7010	465.0333	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	918.0432	901.0529	826.8944	703.1966	550.9612	376.6120	251.8825	263.5586	403.0118	593.7925	768.8924	912.0649	(97)
Space heating kWh	327.4986	260.4550	229.3415	144.8999	81.2468	0.0000	0.0000	0.0000	0.0000	134.3759	232.6978	332.5915	(98a)
Space heating requirement - total per year (kWh/year)												1743.1071	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	327.4986	260.4550	229.3415	144.8999	81.2468	0.0000	0.0000	0.0000	0.0000	134.3759	232.6978	332.5915	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1743.1071	
Space heating per m ²										(98c) / (4) =		25.1930	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
327.4986	260.4550	229.3415	144.8999	81.2468	0.0000	0.0000	0.0000	0.0000	0.0000	134.3759	232.6978	332.5915	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	354.8197	282.1831	248.4740	156.9880	88.0247	0.0000	0.0000	0.0000	0.0000	145.5860	252.1103	360.3375	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	219.9740	194.5816	207.0390	183.0363	178.0556	161.1426	159.6467	165.6621	167.0987	185.4671	196.1152	217.7252 (64)
Efficiency of water heater	84.9504	84.7144	84.2897	83.5412	82.4173	79.8000	79.8000	79.8000	79.8000	83.3491	84.4443	79.8000 (216)
Fuel for water heating, kWh/month	258.9441	229.6913	245.6278	219.0971	216.0417	201.9330	200.0585	207.5967	209.3969	222.5185	232.2419	256.1264 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685 (216)
Lighting	22.0345	17.6769	15.9161	11.6608	9.0072	7.3589	8.2166	10.6803	13.8726	18.2016	20.5587	22.6469 (217)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-32.5444	-45.9671	-66.1974	-74.5820	-80.5640	-75.2661	-74.3600	-70.1495	-62.7104	-52.6617	-35.8191	-28.1284 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-18.1095	-38.1349	-75.8632	-114.0310	-150.8539	-151.5848	-149.7772	-126.7576	-92.8489	-54.5371	-24.1809	-14.3155 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1888.5234 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												2699.2738 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												177.8312 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1709.9446 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3141.6839 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1888.5234	0.2100	396.5899 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2699.2738	0.2100	566.8475 (264)
Space and water heating			963.4374 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	177.8312	0.1443	25.6665 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-698.9500	0.1345	-94.0362
PV Unit electricity exported	-1010.9945	0.1259	-127.2602
Total			-221.2965 (269)
Total CO2, kg/year			779.7367 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.2700 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1888.5234	1.1300	2134.0314 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2699.2738	1.1300	3050.1794 (278)
Space and water heating			5184.2108 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	177.8312	1.5338	272.7635 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-698.9500	1.4972	-1046.4902
PV Unit electricity exported	-1010.9945	0.4621	-467.1319
Total			-1513.6221 (283)
Total Primary energy kWh/year			4073.4530 (286)
Target Primary Energy Rate (TPER)			58.8700 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

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	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.0560 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1204 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3704 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3149 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4015	0.3936	0.3857	0.3464	0.3385	0.2991	0.2991	0.2913	0.3149	0.3385	0.3542	0.3700 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			8.6400	1.1450	9.8931		(27)
Solid Doors			2.1200	1.0000	2.1200		(26)
Rooflight West			0.7600	1.1450	0.8702		(27a)
Ground Floor			4.1700	0.0900	0.3753	75.0000	312.7500 (28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632	9.0000	308.1600 (29a)
Ashlar	3.0100		3.0100	0.1800	0.5418	9.0000	27.0900 (29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036	9.0000	45.1800 (29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404	9.0000	7.0200 (29a)
Joists	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000 (30)
Rafters	14.0000	0.7600	13.2400	0.1300	1.7212	9.0000	119.1600 (30)
D Flat	4.8200		4.8200	0.1300	0.6266	9.0000	43.3800 (30)
Total net area of external elements Aum(A, m ²)			126.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.8555		(33)
Party Wall 1			44.7000	0.0000	0.0000	20.0000	894.0000 (32)
Party Floor 1			56.4100			30.0000	1692.3000 (32d)
GF			80.0000			9.0000	720.0000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4619.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		66.7588 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	9.9600	0.0600	0.5976
E10 Eaves (insulation at ceiling level)	3.8400	0.0600	0.2304
E16 Corner (normal)	9.6000	0.0900	0.8640
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
P1 Party wall - Ground floor	7.9600	0.0800	0.6368
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	23.1700	0.0700	1.6219
E14 Flat roof	12.4000	0.0400	0.4960
E11 Eaves (insulation at rafter level)	3.4100	0.0400	0.1364
R6 Flat ceiling	3.4100	0.0600	0.2046
E13 Gable (insulation at rafter level)	3.4000	0.0800	0.2720
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105
E3 Sill	7.2000	0.0500	0.3600
E4 Jamb	13.8000	0.0500	0.6900
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.9600	0.0800	0.1568

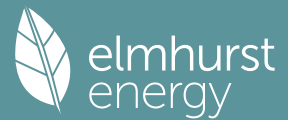
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.9958 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	36.8513 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	31.8153	31.6438	31.4757	30.6862	30.5385	29.8509	29.8509	29.7236	30.1158	30.5385	30.8374	31.1498 (38)
Heat transfer coeff	68.6666	68.4951	68.3270	67.5375	67.3898	66.7022	66.7022	66.5748	66.9670	67.3898	67.6886	68.0010 (39)
Average = Sum(39)m / 12 =												67.5368

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9924	0.9900	0.9875	0.9761	0.9740	0.9640	0.9640	0.9622	0.9679	0.9740	0.9783	0.9828 (40)
HLP (average)												0.9761
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2263 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007 (42b)
Hot water usage for other uses	37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295 (42c)
Average daily hot water use (litres/day)												58.6805 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	64.0201	62.2642	60.3470	57.9605	55.8317	53.6192	53.1594	55.0727	57.0350	59.3071	61.7146	63.9303 (44)
Energy content (annual)	101.3923	88.6633	92.7511	79.3451	75.1602	65.9311	64.2917	68.1915	70.3299	80.4791	87.9238	100.0993 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											974.5584
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	86.1834	75.3638	78.8384	67.4433	63.8861	56.0414	54.6479	57.9628	59.7804	68.4073	74.7352	85.0844 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	86.1834	75.3638	78.8384	67.4433	63.8861	56.0414	54.6479	57.9628	59.7804	68.4073	74.7352	85.0844 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											828.3746 (64)
Electric shower(s)	49.2892	43.9171	47.9558	45.7636	46.6223	44.4732	45.9556	46.6223	45.7636	47.9558	47.0540	49.2892 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											560.6616 (64a)
Heat gains from water heating, kWh/month	33.8682	29.8202	31.6985	28.3017	27.6271	25.1287	25.1509	26.1463	26.3860	29.0908	30.4473	33.5934 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472	106.0472 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	195.3992	197.4269	192.3173	181.4396	167.7085	154.8032	146.1817	144.1541	149.2636	160.1413	173.8724	186.7777 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520 (71)
Water heating gains (Table 5)	45.5217	44.3753	42.6056	39.3080	37.1332	34.9009	33.8050	35.1428	36.6472	39.1005	42.2879	45.1524 (72)
Total internal gains	403.3627	415.6062	397.3646	386.7242	367.2835	355.6808	342.4284	341.7387	351.8875	361.6835	382.1370	394.3719 (73)

6. Solar gains

[Jan]				Area	Solar flux	g	FF	Access	Gains			
				m2	Table 6a	Specific data	Specific data	factor	W			
					W/m2	or Table 6b	or Table 6c	Table 6d				

North				2.1600	10.6334	0.6300	0.7000	0.7700	7.0194 (74)			
South				2.1600	46.7521	0.6300	0.7000	0.7700	30.8622 (78)			
West				4.3200	19.6403	0.6300	0.7000	0.7700	25.9300 (80)			
West				0.7600	25.9287	0.6300	0.7000	1.0000	7.8212 (82)			

Solar gains	71.6328	130.3314	197.3747	271.5296	325.1671	331.1084	315.8434	275.1934	223.2888	149.4734	87.3872	60.2356 (83)
Total gains	474.9955	545.9376	594.7393	658.2538	692.4506	686.7892	658.2718	616.9320	575.1763	511.1569	469.5242	454.6075 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.6855	18.7322	18.7783	18.9978	19.0395	19.2358	19.2358	19.2725	19.1597	19.0395	18.9554	18.8683
alpha	2.2457	2.2488	2.2519	2.2665	2.2693	2.2824	2.2824	2.2848	2.2773	2.2693	2.2637	2.2579
util living area	0.9141	0.8843	0.8436	0.7649	0.6588	0.5210	0.4038	0.4403	0.6160	0.7945	0.8842	0.9209 (86)
MIT	18.1829	18.5459	19.0621	19.7501	20.3200	20.7232	20.8891	20.8613	20.5690	19.8247	18.9076	18.1256 (87)
Th 2	20.0896	20.0917	20.0937	20.1033	20.1051	20.1134	20.1134	20.1149	20.1102	20.1051	20.1015	20.0977 (88)
util rest of house	0.9055	0.8729	0.8278	0.7406	0.6220	0.4669	0.3335	0.3696	0.5646	0.7680	0.8709	0.9129 (89)
MIT 2	17.5034	17.8593	18.3640	19.0311	19.5638	19.9246	20.0542	20.0375	19.7994	19.1162	18.2263	17.4524 (90)
Living area fraction	17.7430	18.1014	18.6102	19.2846	19.8305	20.2062	20.3486	20.3280	20.0708	19.3660	18.4666	17.6898 (92)
MIT	17.7430	18.1014	18.6102	19.2846	19.8305	20.2062	20.3486	20.3280	20.0708	19.3660	18.4666	17.6898 (93)
Temperature adjustment												0.0000
adjusted MIT	17.7430	18.1014	18.6102	19.2846	19.8305	20.2062	20.3486	20.3280	20.0708	19.3660	18.4666	17.6898 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8765	0.8419	0.7969	0.7156	0.6097	0.4728	0.3529	0.3873	0.5622	0.7426	0.8408	0.8849	(94)
Useful gains	416.3513	459.6333	473.9542	471.0174	422.2150	324.7211	232.2767	238.9630	323.3633	379.5947	394.7849	402.3026	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	923.0870	904.2326	827.4518	701.3530	547.9142	373.9476	250.0389	261.5062	399.8461	590.7416	769.3890	917.3208	(97)
Space heating kWh	377.0114	298.7707	263.0022	165.8417	93.5202	0.0000	0.0000	0.0000	0.0000	157.0933	269.7149	383.1735	(98a)
Space heating requirement - total per year (kWh/year)												2008.1280	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	377.0114	298.7707	263.0022	165.8417	93.5202	0.0000	0.0000	0.0000	0.0000	157.0933	269.7149	383.1735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2008.1280	
Space heating per m2												29.0234	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	627.0004	493.5961	505.9687	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7542	0.8122	0.7874	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	472.9117	400.9051	398.3857	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	748.4877	717.8942	673.0304	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	198.4147	235.8399	204.3357	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	49.6037	58.9600	51.0839	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												159.6476	(107)
Energy for space heating												29.0234	(99)
Energy for space cooling												2.3074	(108)
Total												31.3308	(109)
Fabric Energy Efficiency (DFEE)												31.3	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	166.0560 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1204 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3704 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3149 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4015	0.3936	0.3857	0.3464	0.3385	0.2991	0.2991	0.2913	0.3149	0.3385	0.3542	0.3700	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684	(25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.20)			8.6400	1.1450	9.8931			(27)
Rooflight West			0.7600	1.4151	1.0755			(27a)
Ground Floor			4.1700	0.1300	0.5421			(28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632			(29a)
Ashlar	3.0100		3.0100	0.1800	0.5418			(29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036			(29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404			(29a)
Joists	50.0000		50.0000	0.1100	5.5000			(30)
Rafters	14.0000	0.7600	13.2400	0.1100	1.4564			(30)
D Flat	4.8200		4.8200	0.1100	0.5302			(30)
Total net area of external elements Aum(A, m2)			126.8000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.8663			(33)
Party Wall 1			44.7000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 66.7588 (35)

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element				
E12 Gable (insulation at ceiling level)	9.9600	0.0600	0.5976	
E10 Eaves (insulation at ceiling level)	3.8400	0.0600	0.2304	
E16 Corner (normal)	9.6000	0.0900	0.8640	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160	
P1 Party wall - Ground floor	7.9600	0.0800	0.6368	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000	
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880	
E7 Party floor between dwellings (in blocks of flats)	23.1700	0.0700	1.6219	
E14 Flat roof	12.4000	0.0800	0.9920	
E11 Eaves (insulation at rafter level)	3.4100	0.0400	0.1364	
R6 Flat ceiling	3.4100	0.0600	0.2046	
E13 Gable (insulation at rafter level)	3.4000	0.0800	0.2720	
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376	
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105	
E3 Sill	7.2000	0.0500	0.3600	
E4 Jamb	13.8000	0.0500	0.6900	
R1 Head of roof window	0.7800	0.0800	0.0624	
R2 Sill of roof window	0.7800	0.0600	0.0468	
R3 Jamb of roof window	1.9600	0.0800	0.1568	

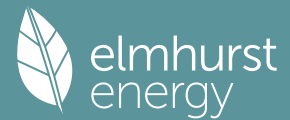
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.4918 (36)
Point Thermal bridges 0.0000
Total fabric heat loss (33) + (36) + (36a) = 37.3581 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	31.8153	31.6438	31.4757	30.6862	30.5385	29.8509	29.8509	29.7236	30.1158	30.5385	30.8374	31.1498	(38)
Average = Sum(39)m / 12 =	69.1734	69.0019	68.8338	68.0443	67.8966	67.2090	67.2090	67.0817	67.4739	67.8966	68.1955	68.5079	(39)
	68.0436												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9998	0.9973	0.9949	0.9834	0.9813	0.9714	0.9714	0.9695	0.9752	0.9813	0.9856	0.9901	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													
Assumed occupancy													2.2263 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	26.5007 (42b)
Hot water usage for other uses	26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007	37.4295 (42c)
Average daily hot water use (litres/day)	37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295	58.6805 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	64.0201	62.2642	60.3470	57.9605	55.8317	53.6192	53.1594	55.0727	57.0350	59.3071	61.7146	63.9303	(44)
Energy content (annual)	101.3923	88.6633	92.7511	79.3451	75.1602	65.9311	64.2917	68.1915	70.3299	80.4791	87.9238	100.0993	(45)
Distribution loss (46)m = 0.15 x (45)m													974.5584
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	86.1834	75.3638	78.8384	67.4433	63.8861	56.0414	54.6479	57.9628	59.7804	68.4073	74.7352	85.0844	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	86.1834	75.3638	78.8384	67.4433	63.8861	56.0414	54.6479	57.9628	59.7804	68.4073	74.7352	85.0844	(64)
12Total per year (kWh/year)													828.3746 (64)
Electric shower(s)	49.2892	43.9171	47.9558	45.7636	46.6223	44.4732	45.9556	46.6223	45.7636	47.9558	47.0540	49.2892	(64a)
Heat gains from water heating, kWh/month	33.8682	29.8202	31.6985	28.3017	27.6271	25.1287	25.1509	26.1463	26.3860	29.0908	30.4473	33.5934	(65)

5. Internal gains (see Table 5 and 5a)													
Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	111.3150	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	106.0472	117.4095	106.0472	109.5822	106.0472	109.5822	106.0472	106.0472	109.5822	106.0472	109.5822	106.0472	(67)

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Cooking gains	195.3992	197.4269	192.3173	181.4396	167.7085	154.8032	146.1817	144.1541	149.2636	160.1413	173.8724	186.7777 (68)
Pumps, fans	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315	34.1315 (69)
Losses e.g. evaporation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520 (71)
Total internal gains	45.5217	44.3753	42.6056	39.3080	37.1332	34.9009	33.8050	35.1428	36.6472	39.1005	42.2879	45.1524 (72)
	403.3627	415.6062	397.3646	386.7242	367.2835	355.6808	342.4284	341.7387	351.8875	361.6835	382.1370	394.3719 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d		Gains W
North				2.1600	10.6334	0.6300	0.7000			0.7700		7.0194 (74)
South				2.1600	46.7521	0.6300	0.7000			0.7700		30.8622 (78)
West				4.3200	19.6403	0.6300	0.7000			0.7700		25.9300 (80)
West				0.7600	25.9287	0.6300	0.7000			1.0000		7.8212 (82)
Solar gains	71.6328	130.3314	197.3747	271.5296	325.1671	331.1084	315.8434	275.1934	223.2888	149.4734	87.3872	60.2356 (83)
Total gains	474.9955	545.9376	594.7393	658.2538	692.4506	686.7892	658.2718	616.9320	575.1763	511.1569	469.5242	454.6075 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.5486	18.5947	18.6401	18.8563	18.8974	19.0907	19.0907	19.1269	19.0158	18.8974	18.8145	18.7288
alpha	2.2366	2.2396	2.2427	2.2571	2.2598	2.2727	2.2727	2.2751	2.2677	2.2598	2.2543	2.2486
util living area	0.9145	0.8849	0.8444	0.7662	0.6607	0.5232	0.4059	0.4425	0.6180	0.7957	0.8847	0.9212 (86)
MIT	18.1598	18.5233	19.0416	19.7336	20.3087	20.7173	20.8862	20.8579	20.5611	19.8101	18.8879	18.1022 (87)
Th 2	20.0835	20.0856	20.0876	20.0972	20.0989	20.1073	20.1073	20.1088	20.1041	20.0989	20.0953	20.0916 (88)
util rest of house	0.9058	0.8735	0.8286	0.7419	0.6237	0.4687	0.3350	0.3711	0.5664	0.7691	0.8714	0.9132 (89)
MIT 2	17.4769	17.8332	18.3401	19.0111	19.5490	19.9146	20.0466	20.0296	19.7878	19.0982	18.2032	17.4257 (90)
Living area fraction	17.7177	18.0766	18.5875	19.2659	19.8169	20.1976	20.3427	20.3217	20.0605	19.3493	18.4447	17.6643 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7177	18.0766	18.5875	19.2659	19.8169	20.1976	20.3427	20.3217	20.0605	19.3493	18.4447	17.6643 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8768	0.8423	0.7975	0.7165	0.6111	0.4745	0.3544	0.3889	0.5637	0.7435	0.8412	0.8851 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	928.1480	909.2091	832.0302	705.3393	551.1110	376.2119	251.5426	263.0736	402.1811	594.0474	773.6536	922.4072 (97)
Space heating kWh	380.6934	301.9701	266.1406	168.2415	95.1817	0.0000	0.0000	0.0000	0.0000	159.2283	272.6496	386.8886 (98a)
Space heating requirement - total per year (kWh/year)												2030.9937
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	380.6934	301.9701	266.1406	168.2415	95.1817	0.0000	0.0000	0.0000	0.0000	159.2283	272.6496	386.8886 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2030.9937
Space heating per m2										(98c) / (4) =		29.3539 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	631.7647	497.3467	509.8207	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7509	0.8092	0.7842	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	474.3876	402.4509	399.7925	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	748.4877	717.8942	673.0304	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	197.3521	234.6898	203.2890	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	49.3380	58.6724	50.8222	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												158.8327 (107)
Energy for space heating												29.3539 (99)
Energy for space cooling												2.2956 (108)
Total												31.6495 (109)
Fabric Energy Efficiency (TFEE)												31.6 (109)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.0560 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1204 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3704 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3149 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infilt rate	0.4015 0.3936 0.3857 0.3464 0.3385 0.2991 0.2991 0.2913 0.3149 0.3385 0.3542 0.3700 (22b)
Effective ac	0.5806 0.5775 0.5744 0.5600 0.5573 0.5447 0.5447 0.5424 0.5496 0.5573 0.5627 0.5684 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			8.6400	1.1450	9.8931		(27)
Solid Doors			2.1200	1.0000	2.1200		(26)
Rooflight West			0.7600	1.1450	0.8702		(27a)
Ground Floor			4.1700	0.0900	0.3753	75.0000	312.7500 (28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632	9.0000	308.1600 (29a)
Ashlar	3.0100		3.0100	0.1800	0.5418	9.0000	27.0900 (29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036	9.0000	45.1800 (29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404	9.0000	7.0200 (29a)
Joists	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000 (30)
Rafters	14.0000	0.7600	13.2400	0.1300	1.7212	9.0000	119.1600 (30)
D Flat	4.8200		4.8200	0.1300	0.6266	9.0000	43.3800 (30)
Total net area of external elements Aum(A, m ²)			126.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.8555		(33)
Party Wall 1			44.7000	0.0000	0.0000	20.0000	894.0000 (32)
Party Floor 1			56.4100			30.0000	1692.3000 (32d)
GF			80.0000			9.0000	720.0000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 4619.0400 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 66.7588 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	9.9600	0.0600	0.5976
E10 Eaves (insulation at ceiling level)	3.8400	0.0600	0.2304
E16 Corner (normal)	9.6000	0.0900	0.8640
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
P1 Party wall - Ground floor	7.9600	0.0800	0.6368
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	23.1700	0.0700	1.6219
E14 Flat roof	12.4000	0.0400	0.4960
E11 Eaves (insulation at rafter level)	3.4100	0.0400	0.1364
R6 Flat ceiling	3.4100	0.0600	0.2046
E13 Gable (insulation at rafter level)	3.4000	0.0800	0.2720
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105
E3 Sill	7.2000	0.0500	0.3600
E4 Jamb	13.8000	0.0500	0.6900
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.9600	0.0800	0.1568

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9958 (36)

Point Thermal bridges (36a) = 0.0000

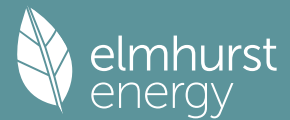
Total fabric heat loss (33) + (36) + (36a) = 36.8513 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 31.8153	Feb 31.6438	Mar 31.4757	Apr 30.6862	May 30.5385	Jun 29.8509	Jul 29.8509	Aug 29.7236	Sep 30.1158	Oct 30.5385	Nov 30.8374	Dec 31.1498 (38)
Heat transfer coeff	68.6666	68.4951	68.3270	67.5375	67.3898	66.7022	66.7022	66.5748	66.9670	67.3898	67.6886	68.0010 (39)
Average = Sum(39)m / 12 =												67.5368

HLP	Jan 0.9924	Feb 0.9900	Mar 0.9875	Apr 0.9761	May 0.9740	Jun 0.9640	Jul 0.9640	Aug 0.9622	Sep 0.9679	Oct 0.9740	Nov 0.9783	Dec 0.9828 (40)

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HLP (average)	31	28	31	30	31	30	31	31	30	31	30	0.9761
Days in mont												31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.2263 (42)
Hot water usage for mixer showers												
76.9342	75.7780	74.0933	70.8698	68.4909	65.8380	64.3301	66.0021	67.8350	70.6834	73.9761	76.6394	(42a)
Hot water usage for baths												
26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007	(42b)
Hot water usage for other uses												
37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295	(42c)
Average daily hot water use (litres/day)												129.6113 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	140.9544	138.0422	134.4403	128.8303	124.3226	119.4573	117.4895	121.0748	124.8700	129.9905	135.6908	140.5697 (44)
Energy conte	223.2373	196.5703	206.6297	176.3623	167.3621	146.8867	142.0934	149.9159	153.9772	176.3958	193.3164	220.0982 (45)
Energy content (annual)												
Distribution loss	(46)m = 0.15 x (45)m											
33.4856	29.4855	30.9944	26.4543	25.1043	22.0330	21.3140	22.4874	23.0966	26.4594	28.9975	33.0147	(46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.8736 (55)
Total storage loss												
27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage												
27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426 (64)
												2745.6102 (64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												
Heat gains from water heating, kWh/month												
114.5019	101.7375	108.9799	97.6168	95.9234	87.8161	87.5216	90.1226	90.1738	98.9272	103.2540	113.4582	(65)

5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts												
(66)m	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
28.6145	25.4151	20.6690	15.6477	11.6969	9.8750	10.6703	13.8696	18.6158	23.6370	27.5879	29.4097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
291.6406	294.6670	287.0407	270.8054	250.3112	231.0496	218.1816	215.1553	222.7815	239.0169	259.5110	278.7727	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	(71)
Water heating gains (Table 5)												
153.9005	151.3951	146.4784	135.5789	128.9294	121.9669	117.6366	121.1325	125.2413	132.9666	143.4084	152.4976	(72)
Total internal gains												
572.2657	569.5873	552.2982	520.1421	489.0476	458.0016	441.5986	445.2676	461.7487	493.7306	528.6174	558.7901	(73)

6. Solar gains												

[Jan]												
			Area	Solar flux	g	FF	Access	Gains				
		m2	Table 6a	Specific data	Specific data	factor	W					
			W/m2	or Table 6b	or Table 6c	Table 6d						
North		2.1600	10.6334	0.6300	0.7000	0.7700	7.0194	(74)				
South		2.1600	46.7521	0.6300	0.7000	0.7700	30.8622	(78)				
West		4.3200	19.6403	0.6300	0.7000	0.7700	25.9300	(80)				
West		0.7600	25.9287	0.6300	0.7000	1.0000	7.8212	(82)				

Solar gains	71.6328	130.3314	197.3747	271.5296	325.1671	331.1084	315.8434	275.1934	223.2888	149.4734	87.3872	60.2356 (83)
Total gains	643.8984	699.9187	749.6729	791.6717	814.2146	789.1100	757.4420	720.4609	685.0376	643.2040	616.0046	619.0257 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.6855	18.7322	18.7783	18.9978	19.0395	19.2358	19.2358	19.2725	19.1597	19.0395	18.9554	18.8683
alpha	2.2457	2.2488	2.2519	2.2665	2.2693	2.2824	2.2824	2.2848	2.2773	2.2693	2.2637	2.2579
util living area	0.8582	0.8297	0.7822	0.7048	0.5995	0.4705	0.3589	0.3882	0.5510	0.7233	0.8233	0.8671 (86)
MIT	18.6511	18.9336	19.3975	19.9672	20.4473	20.7772	20.9134	20.8936	20.6615	20.0604	19.2738	18.5946 (87)
Th 2	20.0896	20.0917	20.0937	20.1033	20.1051	20.1134	20.1134	20.1149	20.1102	20.1051	20.1015	20.0977 (88)
util rest of house	0.8455	0.8147	0.7628	0.6780	0.5619	0.4186	0.2944	0.3231	0.5000	0.6927	0.8055	0.8551 (89)
MIT 2	17.3531	17.7045	18.2796	18.9798	19.5480	19.9210	20.0550	20.0401	19.8027	19.1076	18.1420	17.2874 (90)

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Living area fraction									fLA = Living area / (4) =		0.3527 (91)	
MIT	17.8108	18.1379	18.6739	19.3280	19.8651	20.2229	20.3577	20.3411	20.1056	19.4436	18.5411	17.7484 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8108	18.1379	18.6739	19.3280	19.8651	20.2229	20.3577	20.3411	20.1056	19.4436	18.5411	17.7484 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8060	0.7760	0.7276	0.6524	0.5511	0.4253	0.3127	0.3403	0.4998	0.6673	0.7684	0.8159	(94)
Useful gains	518.9616	543.1033	545.4849	516.4786	448.7439	335.5915	236.8430	245.1605	342.3535	429.1810	473.3566	505.0768	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	927.7420	906.7337	831.8037	704.2805	550.2471	375.0619	250.6474	262.3778	402.1741	595.9685	774.4333	921.3067	(97)
Space heating kWh	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	309.6751	(98a)
Space heating requirement - total per year (kWh/year)												1622.7893	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	309.6751	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1622.7893	
Space heating per m2										(98c) / (4) =		23.4541	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	309.6751	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	121.7017	97.7830	85.2426	54.1086	30.2194	0.0000	0.0000	0.0000	0.0000	49.6558	86.7448	123.9196	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	156.2431	138.2311	146.7585	128.5452	124.3327	111.7116	109.9017	114.3691	115.7611	129.4919	138.2277	154.4504	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	25.0461	20.0929	18.0914	13.2545	10.2382	8.3647	9.3396	12.1400	15.7686	20.6893	23.3685	25.7422	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												649.3755	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1568.0241	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												202.1361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2419.5356	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	649.3755	16.4900	107.0820 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1568.0241	16.4900	258.5672 (247)

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Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	202.1361	16.4900	33.3322 (250)
Additional standing charges			0.0000 (251)
Total energy cost			398.9814 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2578 (257)
SAP value		79.6103
SAP rating (Section 12)		80 (258)
SAP band		C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	649.3755	0.1545	100.3018 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1568.0241	0.1410	221.0279 (264)
Space and water heating			321.3297 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	202.1361	0.1443	29.1745 (268)
Total CO2, kg/year			350.5042 (272)
CO2 emissions per m2			5.0700 (273)
EI value			95.8869
EI rating			96 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	166.0560 (5)

2. Ventilation rate

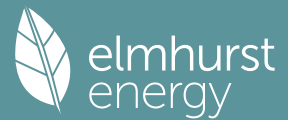
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.1204 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3704 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3149 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.2834	0.2598	0.2519	0.2519	0.2598	0.2283	0.2440	0.2204	0.2204	0.2362	0.2204	0.2519 (22b)
Effective ac	0.5402	0.5337	0.5317	0.5317	0.5337	0.5261	0.5298	0.5243	0.5243	0.5279	0.5243	0.5317 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			8.6400	1.1450	9.8931		(27)
Solid Doors			2.1200	1.0000	2.1200		(26)
Rooflight West			0.7600	1.1450	0.8702		(27a)
Ground Floor			4.1700	0.0900	0.3753	75.0000	312.7500 (28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632	9.0000	308.1600 (29a)
Ashlar	3.0100		3.0100	0.1800	0.5418	9.0000	27.0900 (29a)

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Dormers	9.3400	4.3200	5.0200	0.1800	0.9036	9.0000	45.1800 (29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404	9.0000	7.0200 (29a)
Joists	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000 (30)
Rafters	14.0000	0.7600	13.2400	0.1300	1.7212	9.0000	119.1600 (30)
D Flat	4.8200		4.8200	0.1300	0.6266	9.0000	43.3800 (30)
Total net area of external elements Aum(A, m2)			126.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	28.8555			(33)
Party Wall 1			44.7000	0.0000	0.0000	20.0000	894.0000 (32)
Party Floor 1			56.4100			30.0000	1692.3000 (32d)
GF			80.0000			9.0000	720.0000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 4619.0400 (34)
66.7588 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	9.9600	0.0600	0.5976
E12 Gable (insulation at ceiling level)	3.8400	0.0600	0.2304
E10 Eaves (insulation at ceiling level)	9.6000	0.0900	0.8640
E16 Corner (normal)	2.4000	-0.0900	-0.2160
E17 Corner (inverted - internal area greater than external area)	7.9600	0.0800	0.6368
P1 Party wall - Ground floor	9.4800	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.8000	0.0600	0.2880
E25 Staggered party wall between dwellings	23.1700	0.0700	1.6219
E7 Party floor between dwellings (in blocks of flats)	12.4000	0.0400	0.4960
E14 Flat roof	3.4100	0.0400	0.1364
E11 Eaves (insulation at rafter level)	3.4100	0.0600	0.2046
R6 Flat ceiling	3.4000	0.0800	0.2720
E13 Gable (insulation at rafter level)	9.4800	0.1200	1.1376
P4 Party wall - Roof (insulation at ceiling level)	8.2100	0.0500	0.4105
E2 Other lintels (including other steel lintels)	7.2000	0.0500	0.3600
E3 Sill	13.8000	0.0500	0.6900
E4 Jamb	0.7800	0.0800	0.0624
R1 Head of roof window	0.7800	0.0600	0.0468
R2 Sill of roof window	1.9600	0.0800	0.1568
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 36.8513 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.5996	29.2482	29.1378	29.1378	29.2482	28.8271	29.0309	28.7303	28.7303	28.9273	28.7303	29.1378	(38)
Heat transfer coeff	66.4509	66.0994	65.9891	65.9891	66.0994	65.6784	65.8821	65.5816	65.5816	65.7785	65.5816	65.9891	(39)
Average = Sum(39)m / 12 =												65.8917	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9604	0.9553	0.9537	0.9537	0.9553	0.9492	0.9522	0.9478	0.9478	0.9507	0.9478	0.9537	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2263 (42)
Hot water usage for mixer showers	76.9342	75.7780	74.0933	70.8698	68.4909	65.8380	64.3301	66.0021	67.8350	70.6834	73.9761	76.6394	(42a)
Hot water usage for baths	26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007	(42b)
Hot water usage for other uses	37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295	(42c)
Average daily hot water use (litres/day)												129.6113	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	140.9544	138.0422	134.4403	128.8303	124.3226	119.4573	117.4895	121.0748	124.8700	129.9905	135.6908	140.5697	(44)
Energy content (annual)	223.2373	196.5703	206.6297	176.3623	167.3621	146.8867	142.0934	149.9159	153.9772	176.3958	193.3164	220.0982	(45)
Distribution loss (46)m = 0.15 x (45)m	33.4856	29.4855	30.9944	26.4543	25.1043	22.0330	21.3140	22.4874	23.0966	26.4594	28.9975	33.0147	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	114.5019	101.7375	108.9799	97.6168	95.9234	87.8161	87.5216	90.1226	90.1738	98.9272	103.2540	113.4582	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6145	25.4151	20.6690	15.6477	11.6969	9.8750	10.6703	13.8696	18.6158	23.6370	27.5879	29.4097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6406	294.6670	287.0407	270.8054	250.3112	231.0496	218.1816	215.1553	222.7815	239.0169	259.5110	278.7727	(68)

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520 (71)
Water heating gains (Table 5)	153.9005	151.3951	146.4784	135.5789	128.9294	121.9669	117.6366	121.1325	125.2413	132.9666	143.4084 (72)
Total internal gains	572.2657	569.5873	552.2982	520.1421	489.0476	458.0016	441.5986	445.2676	461.7487	493.7306	528.6174 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				2.1600	13.0723	0.6300	0.7000		0.7700		8.6293 (74)	
South				2.1600	54.9219	0.6300	0.7000		0.7700		36.2553 (78)	
West				4.3200	24.4329	0.6300	0.7000		0.7700		32.2574 (80)	
West				0.7600	32.4879	0.6300	0.7000		1.0000		9.7998 (82)	
Solar gains	86.9418	139.0188	208.9593	297.4787	347.2353	383.0715	358.1052	252.8976	170.0485	106.4548	71.2607 (83)	
Total gains	659.2075	708.6061	761.2575	817.6208	836.2829	841.0730	799.7037	760.1267	714.6463	663.7790	635.0722	630.0508 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	19.3085	19.4112	19.4436	19.4436	19.4112	19.5356	19.4752	19.5644	19.5644	19.5059	19.5644	19.4436
alpha	2.2872	2.2941	2.2962	2.2962	2.2941	2.3024	2.2983	2.3043	2.3043	2.3004	2.3043	2.2962
util living area	0.8362	0.8118	0.7540	0.6640	0.5372	0.3862	0.2836	0.2884	0.4839	0.6642	0.7875	0.8463 (86)
MIT	18.9985	19.1924	19.6710	20.1835	20.6269	20.8797	20.9581	20.9582	20.7811	20.3376	19.6299	18.9491 (87)
Th 2	20.1165	20.1207	20.1221	20.1221	20.1207	20.1258	20.1234	20.1270	20.1270	20.1246	20.1270	20.1221 (88)
util rest of house	0.8215	0.7955	0.7325	0.6345	0.4954	0.3319	0.2187	0.2209	0.4293	0.6276	0.7662	0.8323 (89)
MIT 2	17.8013	18.0420	18.6319	19.2492	19.7615	20.0321	20.1000	20.1043	19.9406	19.4471	18.5956	17.7445 (90)
Living area fraction									FLA = Living area / (4) =			0.3527 (91)
MIT	18.2235	18.4477	18.9983	19.5787	20.0666	20.3310	20.4026	20.4054	20.2370	19.7612	18.9604	18.1693 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2235	18.4477	18.9983	19.5787	20.0666	20.3310	20.4026	20.4054	20.2370	19.7612	18.9604	18.1693 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.7838	0.7591	0.7015	0.6147	0.4927	0.3450	0.2398	0.2428	0.4365	0.6111	0.7332	0.7946 (94)
Ext temp.	516.6600	537.8799	534.0019	502.5763	412.0345	290.1686	191.7529	184.5923	311.9339	405.6247	465.6386	500.6165 (95)
Heat loss rate W	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Space heating kWh	865.4209	855.8357	771.9630	651.8843	480.3212	310.7245	197.8187	190.5426	350.0067	523.6735	705.6817	855.8314 (97)
Space heating requirement - total per year (kWh/year)	259.4781	213.6663	177.0430	107.5017	50.8052	0.0000	0.0000	0.0000	0.0000	87.8283	172.8311	264.2799 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	259.4781	213.6663	177.0430	107.5017	50.8052	0.0000	0.0000	0.0000	0.0000	87.8283	172.8311	264.2799 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1333.4337 (99)
Space heating per m2										(98c) / (4) =		19.2721 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
259.4781	213.6663	177.0430	107.5017	50.8052	0.0000	0.0000	0.0000	0.0000	0.0000	87.8283	172.8311	264.2799 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	103.8328	85.5007	70.8456	43.0179	20.3302	0.0000	0.0000	0.0000	0.0000	35.1454	69.1601	105.7543 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	156.2431	138.2311	146.7585	128.5452	124.3327	111.7116	109.9017	114.3691	115.7611	129.4919	138.2277	154.4504 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	25.0461	20.0929	18.0914	13.2545	10.2382	8.3647	9.3396	12.1400	15.7686	20.6893	23.3685	25.7422 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												533.5869	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1568.0241	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												202.1361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2303.7471	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	533.5869	26.0600	139.0527	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1568.0241	26.0600	408.6271	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	202.1361	26.0600	52.6767	(250)
Additional standing charges			0.0000	(251)
Total energy cost			600.3565	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	533.5869	0.1551	82.7403	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1568.0241	0.1410	221.0279	(264)
Space and water heating			303.7682	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	202.1361	0.1443	29.1745	(268)
Total CO2, kg/year			332.9427	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	533.5869	1.5741	839.9169	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1568.0241	1.5212	2385.3100	(278)
Space and water heating			3225.2269	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	202.1361	1.5338	310.0430	(282)
Total Primary energy kWh/year			3535.2700	(286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures Typical annual savings Energy Environmental
(none) efficiency impact

Total Savings £0 0.00 kg/m²

Full SAP Calculation Printout



Potential energy efficiency rating:
Potential environmental impact rating:

C 80
A 96

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £600	Potential £600	£0
Electricity			
Space heating	£139	£139	£0
Water heating	£409	£409	£0
Lighting	£53	£53	£0
Total cost of fuels	£600	£600	£0
Total cost of uses	£601	£601	£0
Delivered energy	33 kWh/m ²	33 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m ²	5 kg/m ²	5 kg/m ²	0 kg/m ²
Primary energy	51 kWh/m ²	51 kWh/m ²	0 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 166.0560 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.1204 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3704 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3149 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4015	0.3936	0.3857	0.3464	0.3385	0.2991	0.2991	0.2913	0.3149	0.3385	0.3542	0.3700 (22b)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684 (25)

3. Heat losses and heat loss parameter

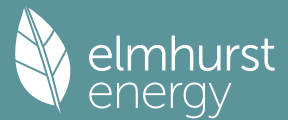
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			8.6400	1.1450	9.8931		(27)
Solid Doors			2.1200	1.0000	2.1200		(26)
Rooflight West			0.7600	1.1450	0.8702		(27a)
Ground Floor			4.1700	0.0900	0.3753	75.0000	312.7500 (28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632	9.0000	308.1600 (29a)
Ashlar	3.0100		3.0100	0.1800	0.5418	9.0000	27.0900 (29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036	9.0000	45.1800 (29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404	9.0000	7.0200 (29a)
Joists	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000 (30)
Rafters	14.0000	0.7600	13.2400	0.1300	1.7212	9.0000	119.1600 (30)
D Flat	4.8200		4.8200	0.1300	0.6266	9.0000	43.3800 (30)
Total net area of external elements Aum(A, m ²)			126.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.8555		(33)
Party Wall 1			44.7000	0.0000	0.0000	20.0000	894.0000 (32)
Party Floor 1			56.4100			30.0000	1692.3000 (32d)
GF			80.0000			9.0000	720.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	4619.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							66.7588 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

Water heating energy requirements (kWh/year)												
Assumed occupancy												
Hot water usage for mixer showers	2.2263 (42)											
76.9342	75.7780	74.0933	70.8698	68.4909	65.8380	64.3301	66.0021	67.8350	70.6834	73.9761	76.6394	(42a)
Hot water usage for baths	26.5007 (42b)											
26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007	(42b)
Hot water usage for other uses	37.4295 (42c)											
37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295	(42c)
Average daily hot water use (litres/day)	129.6113 (43)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.9544	138.0422	134.4403	128.8303	124.3226	119.4573	117.4895	121.0748	124.8700	129.9905	135.6908	140.5697 (44)
Energy content	223.2373	196.5703	206.6297	176.3623	167.3621	146.8867	142.0934	149.9159	153.9772	176.3958	193.3164	220.0982 (45)
Energy content (annual)	Total = Sum(45)m =											2152.8451
Distribution loss (46)m = 0.15 x (45)m												
33.4856	29.4855	30.9944	26.4543	25.1043	22.0330	21.3140	22.4874	23.0966	26.4594	28.9975	33.0147	(46)
Water storage loss:												
Store volume	180.0000 (47)											
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0103 (51)											
Volume factor from Table 2a	0.8736 (52)											
Temperature factor from Table 2b	0.5400 (53)											
Enter (49) or (54) in (55)	0.8736 (55)											
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426 (64)
Total per year (kWh/year) = Sum(64)m =												2745.6102 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	114.5019	101.7375	108.9799	97.6168	95.9234	87.8161	87.5216	90.1226	90.1738	98.9272	103.2540	113.4582 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6145	25.4151	20.6690	15.6477	11.6969	9.8750	10.6703	13.8696	18.6158	23.6370	27.5879	29.4097 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6406	294.6670	287.0407	270.8054	250.3112	231.0496	218.1816	215.1553	222.7815	239.0169	259.5110	278.7727 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520 (71)
Water heating gains (Table 5)	153.9005	151.3951	146.4784	135.5789	128.9294	121.9669	117.6366	121.1325	125.2413	132.9666	143.4084	152.4976 (72)
Total internal gains	572.2657	569.5873	552.2982	520.1421	489.0476	458.0016	441.5986	445.2676	461.7487	493.7306	528.6174	558.7901 (73)

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[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.1600	10.6334	0.6300		0.7000		0.7700		7.0194 (74)
South				2.1600	46.7521	0.6300		0.7000		0.7700		30.8622 (78)
West				4.3200	19.6403	0.6300		0.7000		0.7700		25.9300 (80)
West				0.7600	25.9287	0.6300		0.7000		1.0000		7.8212 (82)
Solar gains	71.6328	130.3314	197.3747	271.5296	325.1671	331.1084	315.8434	275.1934	223.2888	149.4734	87.3872	60.2356 (83)
Total gains	643.8984	699.9187	749.6729	791.6717	814.2146	789.1100	757.4420	720.4609	685.0376	643.2040	616.0046	619.0257 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.6855	18.7322	18.7783	18.9978	19.0395	19.2358	19.2358	19.2725	19.1597	19.0395	18.9554	18.8683
alpha	2.2457	2.2488	2.2519	2.2665	2.2693	2.2824	2.2824	2.2848	2.2773	2.2693	2.2637	2.2579
util living area	0.8582	0.8297	0.7822	0.7048	0.5995	0.4705	0.3589	0.3882	0.5510	0.7233	0.8233	0.8671 (86)
MIT	18.6511	18.9336	19.3975	19.9672	20.4473	20.7772	20.9134	20.8936	20.6615	20.0604	19.2738	18.5946 (87)
Th 2	20.0896	20.0917	20.0937	20.1033	20.1051	20.1134	20.1134	20.1149	20.1102	20.1051	20.1015	20.0977 (88)
util rest of house	0.8455	0.8147	0.7628	0.6780	0.5619	0.4186	0.2944	0.3231	0.5000	0.6927	0.8055	0.8551 (89)
MIT 2	17.3531	17.7045	18.2796	18.9798	19.5480	19.9210	20.0550	20.0401	19.8027	19.1076	18.1420	17.2874 (90)
Living area fraction	17.8108	18.1379	18.6739	19.3280	19.8651	20.2229	20.3577	20.3411	fLA = Living area / (4) =	19.4436	18.5411	0.3527 (91)
MIT	17.8108	18.1379	18.6739	19.3280	19.8651	20.2229	20.3577	20.3411	20.1056	19.4436	18.5411	17.7484 (92)
Temperature adjustment	17.8108	18.1379	18.6739	19.3280	19.8651	20.2229	20.3577	20.3411	20.1056	19.4436	18.5411	0.0000
adjusted MIT	17.8108	18.1379	18.6739	19.3280	19.8651	20.2229	20.3577	20.3411	20.1056	19.4436	18.5411	17.7484 (93)
8. Space heating requirement												
Utilisation	0.8060	0.7760	0.7276	0.6524	0.5511	0.4253	0.3127	0.3403	0.4998	0.6673	0.7684	0.8159 (94)
Useful gains	518.9616	543.1033	545.4849	516.4786	448.7439	335.5915	236.8430	245.1605	342.3535	429.1810	473.3566	505.0768 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	927.7420	906.7337	831.8037	704.2805	550.2471	375.0619	250.6474	262.3778	402.1741	595.9685	774.4333	921.3067 (97)
Space heating kWh	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	309.6751 (98a)
Space heating requirement - total per year (kWh/year)	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	1622.7893
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	309.6751 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	1622.7893
Space heating per m2	(98c) / (4) =										23.4541 (99)	
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	304.1326	244.3596	213.0212	135.2173	75.5184	0.0000	0.0000	0.0000	0.0000	124.0899	216.7752	309.6751 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	121.7017	97.7830	85.2426	54.1086	30.2194	0.0000	0.0000	0.0000	0.0000	49.6558	86.7448	123.9196 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426 (64)
Water heating requirement	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	175.1000 (216)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (217)
Fuel for water heating, kWh/month	156.2431	138.2311	146.7585	128.5452	124.3327	111.7116	109.9017	114.3691	115.7611	129.4919	138.2277	154.4504 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	25.0461	20.0929	18.0914	13.2545	10.2382	8.3647	9.3396	12.1400	15.7686	20.6893	23.3685	25.7422 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

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Annual totals kWh/year		
Space heating fuel - main system 1	649.3755	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	175.1000	
Water heating fuel used	1568.0241	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	202.1361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2419.5356	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	649.3755	16.4900	107.0820	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1568.0241	16.4900	258.5672	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	202.1361	16.4900	33.3322	(250)
Additional standing charges			0.0000	(251)
Total energy cost			398.9814	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2578	(257)
SAP value		79.6103	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	649.3755	0.1545	100.3018	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1568.0241	0.1410	221.0279	(264)
Space and water heating			321.3297	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	202.1361	0.1443	29.1745	(268)
Total CO2, kg/year			350.5042	(272)
CO2 emissions per m2			5.0700	(273)
EI value			95.8869	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

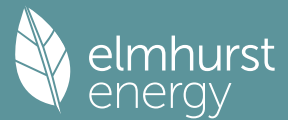
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	4.1700 (1b)	x 2.4000 (2b)	= 10.0080 (1b) - (3b)	
First floor	65.0200 (1c)	x 2.4000 (2c)	= 156.0480 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	69.1900			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n) =	166.0560	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1204 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3704 (18)
Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3149 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate													
Effective ac	0.2834	0.2598	0.2519	0.2519	0.2598	0.2283	0.2440	0.2204	0.2204	0.2362	0.2204	0.2519	(22b)
	0.5402	0.5337	0.5317	0.5317	0.5337	0.5261	0.5298	0.5243	0.5243	0.5279	0.5243	0.5317	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			8.6400	1.1450	9.8931			(27)
Solid Doors			2.1200	1.0000	2.1200			(26)
Rooflight West			0.7600	1.1450	0.8702			(27a)
Ground Floor			4.1700	0.0900	0.3753	75.0000	312.7500	(28a)
Tile/Cladding	38.5600	4.3200	34.2400	0.1800	6.1632	9.0000	308.1600	(29a)
Ashlar	3.0100		3.0100	0.1800	0.5418	9.0000	27.0900	(29a)
Dormers	9.3400	4.3200	5.0200	0.1800	0.9036	9.0000	45.1800	(29a)
Brick	2.9000	2.1200	0.7800	0.1800	0.1404	9.0000	7.0200	(29a)
Joists	50.0000		50.0000	0.1100	5.5000	9.0000	450.0000	(30)
Rafters	14.0000	0.7600	13.2400	0.1300	1.7212	9.0000	119.1600	(30)
D Flat	4.8200		4.8200	0.1300	0.6266	9.0000	43.3800	(30)
Total net area of external elements Aum(A, m2)			126.8000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.8555			(33)
Party Wall 1			44.7000	0.0000	0.0000	20.0000	894.0000	(32)
Party Floor 1			56.4100			30.0000	1692.3000	(32d)
GF			80.0000			9.0000	720.0000	(32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 4619.0400 (34)
List of Thermal Bridges 66.7588 (35)

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	9.9600	0.0600	0.5976
E10 Eaves (insulation at ceiling level)	3.8400	0.0600	0.2304
E16 Corner (normal)	9.6000	0.0900	0.8640
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
P1 Party wall - Ground floor	7.9600	0.0800	0.6368
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.4800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	23.1700	0.0700	1.6219
E14 Flat roof	12.4000	0.0400	0.4960
E11 Eaves (insulation at rafter level)	3.4100	0.0400	0.1364
R6 Flat ceiling	3.4100	0.0600	0.2046
E13 Gable (insulation at rafter level)	3.4000	0.0800	0.2720
P4 Party wall - Roof (insulation at ceiling level)	9.4800	0.1200	1.1376
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105
E3 Sill	7.2000	0.0500	0.3600
E4 Jamb	13.8000	0.0500	0.6900
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.9600	0.0800	0.1568
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.9958 (36)
Point Thermal Bridges			0.0000 (36a) =
Total fabric heat loss			(33) + (36) + (36a) = 36.8513 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m Jan 29.5996 Feb 29.2482 Mar 29.1378 Apr 29.1378 May 29.2482 Jun 28.8271 Jul 29.0309 Aug 28.7303 Sep 28.7303 Oct 28.9273 Nov 28.7303 Dec 29.1378 (38)
Heat transfer coeff 66.4509 66.0994 65.9891 65.9891 66.0994 65.6784 65.8821 65.5816 65.5816 65.7785 65.5816 65.9891 (39)
Average = Sum(39)m / 12 = 65.8917

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9604	0.9553	0.9537	0.9537	0.9553	0.9492	0.9522	0.9478	0.9478	0.9507	0.9478	0.9537	(40)
HLP (average)												0.9523	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2263 (42)
Hot water usage for mixer showers													
	76.9342	75.7780	74.0933	70.8698	68.4909	65.8380	64.3301	66.0021	67.8350	70.6834	73.9761	76.6394	(42a)
Hot water usage for baths													
	26.5906	26.1957	25.6396	24.6142	23.8464	22.9951	22.5352	23.0874	23.6887	24.5997	25.6462	26.5007	(42b)
Hot water usage for other uses													
	37.4295	36.0685	34.7074	33.3463	31.9852	30.6242	30.6242	31.9852	33.3463	34.7074	36.0685	37.4295	(42c)
Average daily hot water use (litres/day)													129.6113 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	140.9544	138.0422	134.4403	128.8303	124.3226	119.4573	117.4895	121.0748	124.8700	129.9905	135.6908	140.5697	(44)
Energy conte	223.2373	196.5703	206.6297	176.3623	167.3621	146.8867	142.0934	149.9159	153.9772	176.3958	193.3164	220.0982	(45)
Energy content (annual)										Total = Sum(45)m =			2152.8451
Distribution loss (46)m = 0.15 x (45)m													
	33.4856	29.4855	30.9944	26.4543	25.1043	22.0330	21.3140	22.4874	23.0966	26.4594	28.9975	33.0147	(46)
Water storage loss:													
Store volume													180.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.8736 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													0.8736 (55)
Total storage loss													

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If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)
Primary loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
WWHRS	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	114.5019	101.7375	108.9799	97.6168	95.9234	87.8161	87.5216	90.1226	90.1738	98.9272	103.2540	113.4582 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780	133.5780 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6145	25.4151	20.6690	15.6477	11.6969	9.8750	10.6703	13.8696	18.6158	23.6370	27.5879	29.4097 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6406	294.6670	287.0407	270.8054	250.3112	231.0496	218.1816	215.1553	222.7815	239.0169	259.5110	278.7727 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841	50.5841 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520	-89.0520 (71)
Water heating gains (Table 5)	153.9005	151.3951	146.4784	135.5789	128.9294	121.9669	117.6366	121.1325	125.2413	132.9666	143.4084	152.4976 (72)
Total internal gains	572.2657	569.5873	552.2982	520.1421	489.0476	458.0016	441.5986	445.2676	461.7487	493.7306	528.6174	558.7901 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	

North					2.1600	13.0723	0.6300	0.7000			0.7700	8.6293 (74)	
South					2.1600	54.9219	0.6300	0.7000			0.7700	36.2553 (78)	
West					4.3200	24.4329	0.6300	0.7000			0.7700	32.2574 (80)	
West					0.7600	32.4879	0.6300	0.7000			1.0000	9.7998 (82)	

Solar gains	86.9418	139.0188	208.9593	297.4787	347.2353	383.0715	358.1052	314.8592	252.8976	170.0485	106.4548	71.2607 (83)	
Total gains	659.2075	708.6061	761.2575	817.6208	836.2829	841.0730	799.7037	760.1267	714.6463	663.7790	635.0722	630.0508 (84)	

7. Mean internal temperature (heating season)

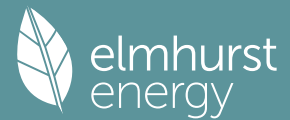
Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	19.3085	19.4112	19.4436	19.4436	19.4112	19.5356	19.4752	19.5644	19.5644	19.5059	19.5644	19.4436
tau	2.2872	2.2941	2.2962	2.2962	2.2941	2.3024	2.2983	2.3043	2.3043	2.3004	2.3043	2.2962
util living area	0.8362	0.8118	0.7540	0.6640	0.5372	0.3862	0.2836	0.2884	0.4839	0.6642	0.7875	0.8463 (86)
MIT	18.9985	19.1924	19.6710	20.1835	20.6269	20.8797	20.9581	20.9582	20.7811	20.3376	19.6299	18.9491 (87)
Th 2	20.1165	20.1207	20.1221	20.1221	20.1207	20.1258	20.1234	20.1270	20.1270	20.1246	20.1270	20.1221 (88)
util rest of house	0.8215	0.7955	0.7325	0.6345	0.4954	0.3319	0.2187	0.2209	0.4293	0.6276	0.7662	0.8323 (89)
MIT 2	17.8013	18.0420	18.6319	19.2492	19.7615	20.0321	20.1000	20.1043	19.9406	19.4471	18.5956	17.7445 (90)
Living area fraction	18.2235	18.4477	18.9983	19.5787	20.0666	20.3310	20.4026	20.4054	20.2370	19.7612	18.9604	18.1693 (92)
MIT	18.2235	18.4477	18.9983	19.5787	20.0666	20.3310	20.4026	20.4054	20.2370	19.7612	18.9604	18.1693 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.7838	0.7591	0.7015	0.6147	0.4927	0.3450	0.2398	0.2428	0.4365	0.6111	0.7332	0.7946 (94)
Ext temp.	516.6600	537.8799	534.0019	502.5763	412.0345	290.1686	191.7529	184.5923	311.9339	405.6247	465.6386	500.6165 (95)
Heat loss rate W	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Space heating kWh	865.4209	855.8357	771.9630	651.8843	480.3212	310.7245	197.8187	190.5426	350.0067	523.6735	705.6817	855.8314 (97)
Space heating requirement - total per year (kWh/year)	259.4781	213.6663	177.0430	107.5017	50.8052	0.0000	0.0000	0.0000	0.0000	87.8283	172.8311	264.2799 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	259.4781	213.6663	177.0430	107.5017	50.8052	0.0000	0.0000	0.0000	0.0000	87.8283	172.8311	264.2799 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	259.4781	213.6663	177.0430	107.5017	50.8052	0.0000	0.0000	0.0000	0.0000	87.8283	172.8311	264.2799 (98c)
Space heating per m2	1333.4337	1333.4337	1333.4337	1333.4337	1333.4337	1333.4337	1333.4337	1333.4337	1333.4337	1333.4337	1333.4337	1333.4337 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

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Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	249.9000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	259.4781	213.6663	177.0430	107.5017	50.8052	0.0000	0.0000	0.0000	0.0000	87.8283	172.8311	264.2799	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	103.8328	85.5007	70.8456	43.0179	20.3302	0.0000	0.0000	0.0000	0.0000	35.1454	69.1601	105.7543	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	273.5817	242.0427	256.9741	225.0827	217.7065	195.6071	192.4378	200.2604	202.6976	226.7403	242.0368	270.4426	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	156.2431	138.2311	146.7585	128.5452	124.3327	111.7116	109.9017	114.3691	115.7611	129.4919	138.2277	154.4504	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	25.0461	20.0929	18.0914	13.2545	10.2382	8.3647	9.3396	12.1400	15.7686	20.6893	23.3685	25.7422	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												533.5869	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1568.0241	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												202.1361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2303.7471	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	533.5869	26.0600	139.0527	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1568.0241	26.0600	408.6271	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	202.1361	26.0600	52.6767	(250)
Additional standing charges			0.0000	(251)
Total energy cost			600.3565	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	533.5869	0.1551	82.7403	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1568.0241	0.1410	221.0279	(264)
Space and water heating			303.7682	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	202.1361	0.1443	29.1745	(268)
Total CO2, kg/year			332.9427	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	533.5869	1.5741	839.9169	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1568.0241	1.5212	2385.3100	(278)
Space and water heating			3225.2269	(279)

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Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	202.1361	1.5338	310.0430 (282)
Total Primary energy kWh/year			3535.2700 (286)

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Property Reference	FURNERS LANE 20				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 20, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	79 C	DER	5.85	TER	13.78	
Environmental	96 A	% DER < TER				57.55
CO ₂ Emissions (t/year)	0.3	DFEE	38.06	TFEE	39.04	
Compliance Check	See BREL	% DFEE < TFEE				2.51
% DPER < TPER	14.39	DPER	61.91	TPER	72.31	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.4100 (1b)	x 2.4000 (2b)	= 135.3840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 135.3840 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1477 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3977 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3381 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4310	0.4226	0.4141	0.3719	0.3634	0.3212	0.3212	0.3127	0.3381	0.3634	0.3803	0.3972 (22b)
Effective ac	0.5929	0.5893	0.5858	0.5691	0.5660	0.5516	0.5516	0.5489	0.5571	0.5660	0.5723	0.5789 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			11.4000	1.1450	13.0534		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			56.4100	0.1100	6.2051	75.0000	4230.7500 (28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	9.0000	317.7900 (29a)
Cladding	6.9500		6.9500	0.1800	1.2510	9.0000	62.5500 (29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400 (30)
Total net area of external elements Aum(A, m ²)			118.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.5369		(33)
Party Wall 1			26.8300	0.0000	0.0000	20.0000	536.6000 (32)
Party Ceiling 1			50.0000			20.0000	1000.0000 (32b)
GF			80.0000			9.0000	720.0000 (32c)
Heat capacity Cm = Sum (A x k)						(28)...(30) + (32) + (32a)...(32e) =	6926.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							122.7926 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				2.0000	0.0600	0.1200	
E10 Eaves (insulation at ceiling level)				8.0000	0.0600	0.4800	
E16 Corner (normal)				12.0000	0.0900	1.0800	
E17 Corner (inverted - internal area greater than external area)				2.4000	-0.0900	-0.2160	

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E2 Other lintels (including other steel lintels)	8.5500	0.0500	0.4275	
E3 Sill	7.6200	0.0500	0.3810	
E4 Jamb	17.9000	0.0500	0.8950	
E5 Ground floor (normal)	23.1700	0.1600	3.7072	
P1 Party wall - Ground floor	11.1800	0.0800	0.8944	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.1800	0.0000	0.0000	
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880	
E7 Party floor between dwellings (in blocks of flats)	18.0000	0.0700	1.2600	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.3171 (36)
Point Thermal bridges				0.0000
Total fabric heat loss		(33) + (36) + (36a) =		38.8540 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	26.4887	26.3275	26.1695	25.4276	25.2887	24.6425	24.6425	24.5228	24.8914	25.2887	25.5696	25.8632 (38)
Average = Sum(39)m / 12 =	65.3427	65.1816	65.0236	64.2816	64.1428	63.4965	63.4965	63.3769	63.7455	64.1428	64.4236	64.7172 (39)
												64.2809
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1584	1.1555	1.1527	1.1395	1.1371	1.1256	1.1256	1.1235	1.1300	1.1371	1.1421	1.1473 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.8785 (42)
Hot water usage for mixer showers												
	69.6455	68.5989	67.0737	64.1556	62.0021	59.6006	58.2355	59.7492	61.4084	63.9869	66.9677	69.3787 (42a)
Hot water usage for baths												
	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017 (42b)
Hot water usage for other uses												
	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681 (42c)
Average daily hot water use (litres/day)												117.3289 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	127.5967	124.9609	121.7005	116.6221	112.5417	108.1375	106.3559	109.6013	113.0366	117.6718	122.8319	127.2485 (44)
Energy content (annual)	202.0820	177.9426	187.0491	159.6498	151.5027	132.9677	128.6283	135.7093	139.3854	159.6795	174.9966	199.2404 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1948.8335
	30.3123	26.6914	28.0574	23.9475	22.7254	19.9451	19.2942	20.3564	20.9078	23.9519	26.2495	29.8861 (46)
Water storage loss:												
Store volume												180.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8736 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.8736 (55)
Total storage loss												
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)
If cylinder contains dedicated solar storage												
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
FV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
12Total per year (kWh/year)												2541.5986 (64)
Electric shower(s)												2542 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	107.4678	95.5438	102.4694	92.0599	90.6502	83.1881	83.0445	85.3989	85.3220	93.3690	97.1627	106.5230 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	83.1186	92.0241	83.1186	85.8892	83.1186	85.8892	83.1186	83.1186	85.8892	83.1186	85.8892	83.1186 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	163.8111	165.5109	161.2274	152.1082	140.5969	129.7778	122.5500	120.8502	125.1338	134.2529	145.7643	156.5833 (68)
Pumps, fans	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415 (71)
Total internal gains	144.4460	142.1783	137.7277	127.8610	121.8417	115.5390	111.6189	114.7834	118.5028	125.4959	134.9482	143.1760 (72)
	445.5537	453.8914	436.2516	420.0364	399.7351	382.3841	368.4655	369.9302	380.7038	397.0455	420.7797	437.0560 (73)

6. Solar gains						
[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.4800	10.6334	0.6300	0.7000	0.7700	21.0581 (74)
South	2.3400	46.7521	0.6300	0.7000	0.7700	33.4340 (78)
West	2.5800	19.6403	0.6300	0.7000	0.7700	15.4860 (80)

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Solar gains	69.9781	125.2932	188.0223	261.4339	319.2847	328.7403	312.0355	266.9937	213.1040	142.9101	84.9178	59.1800 (83)
Total gains	515.5318	579.1847	624.2739	681.4703	719.0199	711.1243	680.5011	636.9239	593.8077	539.9556	505.6975	496.2360 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.4462	29.5190	29.5907	29.9322	29.9970	30.3023	30.3023	30.3595	30.1840	29.9970	29.8662	29.7308
alpha	2.9631	2.9679	2.9727	2.9955	2.9998	3.0202	3.0202	3.0240	3.0123	2.9998	2.9911	2.9821
util living area	0.9397	0.9152	0.8769	0.7969	0.6763	0.5209	0.3936	0.4333	0.6296	0.8229	0.9122	0.9452 (86)
MIT	19.0759	19.3517	19.7439	20.2513	20.6480	20.8849	20.9631	20.9502	20.7890	20.2891	19.6164	19.0330 (87)
Th 2	19.9535	19.9558	19.9580	19.9687	19.9707	19.9800	19.9800	19.9817	19.9764	19.9707	19.9666	19.9624 (88)
util rest of house	0.9303	0.9023	0.8578	0.7656	0.6274	0.4516	0.3087	0.3461	0.5618	0.7886	0.8967	0.9365 (89)
MIT 2	17.7429	18.0873	18.5739	19.1922	19.6455	19.8959	19.9613	19.9547	19.8082	19.2530	18.4313	17.6950 (90)
Living area fraction	fLA = Living area / (4) =											0.4042 (91)
MIT	18.2817	18.5984	19.0468	19.6203	20.0507	20.2956	20.3662	20.3571	20.2046	19.6718	18.9103	18.2358 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.2817	18.5984	19.0468	19.6203	20.0507	20.2956	20.3662	20.3571	20.2046	19.6718	18.9103	18.2358 (93)

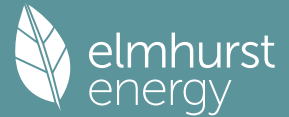
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9108	0.8815	0.8381	0.7539	0.6314	0.4738	0.3416	0.3792	0.5779	0.7773	0.8771	0.9178 (94)
Useful gains	469.5478	510.5464	523.2183	513.7493	454.0171	336.9625	232.4501	241.4917	343.1511	419.7061	443.5525	455.4562 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.1000	14.0000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	913.6007	892.8801	815.8376	689.1155	535.6363	361.6529	239.1408	250.7864	389.1431	581.8886	760.8604	908.3551 (97)
Space heating kWh	330.3753	256.9282	217.7088	126.2636	60.7247	0.0000	0.0000	0.0000	0.0000	120.6637	228.4617	336.9567 (98a)
Space heating requirement - total per year (kWh/year)												1678.0829
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	330.3753	256.9282	217.7088	126.2636	60.7247	0.0000	0.0000	0.0000	0.0000	120.6637	228.4617	336.9567 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1678.0829
Space heating per m2												(98c) / (4) = 29.7480 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	330.3753	256.9282	217.7088	126.2636	60.7247	0.0000	0.0000	0.0000	0.0000	120.6637	228.4617	336.9567 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	132.2030	102.8124	87.1184	50.5257	24.2996	0.0000	0.0000	0.0000	0.0000	48.2848	91.4213	134.8366 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	144.1613	127.5928	135.5760	119.0007	115.2754	103.7625	102.2117	106.2557	107.4277	119.9451	127.7653	142.5384 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	18.3728	14.7394	13.2712	9.7230	7.5103	6.1360	6.8512	8.9054	11.5673	15.1769	17.1423	18.8835 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												671.5018 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1451.5126 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												148.2792 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2271.2936 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	671.5018	0.1550	104.1106 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1451.5126	0.1409	204.5324 (264)
Space and water heating			308.6430 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	148.2792	0.1443	21.4013 (268)
Total CO2, kg/year			330.0443 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.8500 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	671.5018	1.5740	1056.9414 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1451.5126	1.5210	2207.8002 (278)
Space and water heating			3264.7416 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	148.2792	1.5338	227.4356 (282)
Total Primary energy kWh/year			3492.1773 (286)
Dwelling Primary energy Rate (DPER)			61.9100 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4100 (1b)	x 2.4000 (2b)	= 135.3840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 135.3840 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

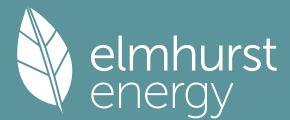
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1477 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3977	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3381 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4310	0.4226	0.4141	0.3719	0.3634	0.3212	0.3212	0.3127	0.3381	0.3634	0.3803	0.3972 (22b)
Effective ac	0.5929	0.5893	0.5858	0.5691	0.5660	0.5516	0.5516	0.5489	0.5571	0.5660	0.5723	0.5789 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)

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TER Opening Type (Uw = 1.20)			11.4000	1.1450	13.0534	(27)
Ground Floor			56.4100	0.1300	7.3333	(28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	(29a)
Cladding	6.9500		6.9500	0.1800	1.2510	(29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	(30)
Total net area of external elements Aum(A, m2)			118.5800			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	30.6651		(33)
Party Wall 1			26.8300	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

131.6563 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	2.0000	0.0600	0.1200
E10 Eaves (insulation at ceiling level)	8.0000	0.0600	0.4800
E16 Corner (normal)	12.0000	0.0900	1.0800
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E2 Other lintels (including other steel lintels)	8.5500	0.0500	0.4275
E3 Sill	7.6200	0.0500	0.3810
E4 Jamb	17.9000	0.0500	0.8950
E5 Ground floor (normal)	23.1700	0.1600	3.7072
P1 Party wall - Ground floor	11.1800	0.0800	0.8944
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.1800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	18.0000	0.0700	1.2600

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

9.3171 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 39.9822 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.4887	26.3275	26.1695	25.4276	25.2887	24.6425	24.6425	24.5228	24.8914	25.2887	25.5696	25.8632
Heat transfer coeff	66.4709	66.3098	66.1518	65.4098	65.2710	64.6247	64.6247	64.5051	64.8737	65.2710	65.5518	65.8454
Average = Sum(39)m / 12 =												65.4091

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1784	1.1755	1.1727	1.1595	1.1571	1.1456	1.1456	1.1435	1.1500	1.1571	1.1621	1.1673
HLP (average)												1.1595
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy

1.8785 (42)

Hot water usage for mixer showers

	55.7164	54.8791	53.6590	51.3245	49.6017	47.6805	46.5884	47.7993	49.1267	51.1895	53.5741	55.5030

Hot water usage for baths

	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017

Hot water usage for other uses

	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681

Average daily hot water use (litres/day)

104.4867 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.6676	111.2411	108.2857	103.7910	100.1412	96.2174	94.7088	97.6514	100.7549	104.8744	109.4384	113.3727
Energy conte	180.0217	158.4058	166.4311	142.0847	134.8094	118.3105	114.5421	120.9129	124.2409	142.3136	155.9151	177.5143
Energy content (annual)										Total = Sum(45)m =		1735.5021

Distribution loss (46)m = 0.15 x (45)m

	27.0033	23.7609	24.9647	21.3127	20.2214	17.7466	17.1813	18.1369	18.6361	21.3470	23.3873	26.6271

Water storage loss:

Store volume

180.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):

1.5520 (48)

Temperature factor from Table 2b

0.5400 (49)

Enter (49) or (54) in (55)

0.8381 (55)

Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803

Primary loss

	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624

Combi loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total heat required for water heating calculated for each month

	229.2644	202.8831	215.6738	189.7389	184.0520	165.9647	163.7848	170.1556	171.8951	191.5563	203.5693	226.7570

WWHRS

	-25.4712	-22.5270	-23.5889	-19.5326	-18.2037	-15.5770	-14.6009	-15.5266	-16.1166	-18.9996	-21.5243	-24.9995

PV diverter

	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000

Solar input

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

FGHRS

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Output from w/h

	203.7932	180.3561	192.0849	170.2063	165.8484	150.3877	149.1839	154.6289	155.7786	172.5566	182.0450	201.7575

Total per year (kWh/year) = Sum(64)m = 2078.6269 (64)

2079 (64)

12Total per year (kWh/year)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

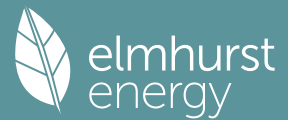
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

0.0000 (64a)

Heat gains from water heating, kWh/month

	99.2514	88.2517	94.7325	85.3665	84.2183	77.4616	77.4794	79.5977	79.4335	86.7134	89.9651	98.4176

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				6.4800	10.6334	0.6300	0.7000	0.7700	21.0581 (74)			
South				2.3400	46.7521	0.6300	0.7000	0.7700	33.4340 (78)			
West				2.5800	19.6403	0.6300	0.7000	0.7700	15.4860 (80)			
Solar gains	69.9781	125.2932	188.0223	261.4339	319.2847	328.7403	312.0355	266.9937	213.1040	142.9101	84.9178	59.1800 (83)
Total gains	504.4882	568.3333	613.8749	672.1739	710.3748	703.1709	673.0211	629.1266	585.6292	531.0100	495.7008	485.3417 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.0358	31.1113	31.1856	31.5393	31.6064	31.9225	31.9225	31.9817	31.8000	31.6064	31.4710	31.3307
alpha	3.0691	3.0741	3.0790	3.1026	3.1071	3.1282	3.1282	3.1321	3.1200	3.1071	3.0981	3.0887
util living area	0.9495	0.9271	0.8913	0.8141	0.6942	0.5363	0.4055	0.4469	0.6480	0.8402	0.9246	0.9544 (86)
MIT	19.0993	19.3701	19.7569	20.2604	20.6548	20.8891	20.9653	20.9526	20.7931	20.2949	19.6297	19.0571 (87)
Th 2	19.9374	19.9397	19.9419	19.9525	19.9545	19.9637	19.9637	19.9655	19.9602	19.9545	19.9505	19.9463 (88)
util rest of house	0.9409	0.9150	0.8731	0.7830	0.6441	0.4640	0.3166	0.3555	0.5780	0.8065	0.9102	0.9466 (89)
MIT 2	17.7547	18.0938	18.5744	19.1885	19.6387	19.8844	19.9468	19.9407	19.7978	19.2455	18.4314	17.7076 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2982	18.6097	19.0524	19.6218	20.0494	20.2905	20.3585	20.3497	20.2001	19.6697	18.9157	18.2530 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.2982	18.6097	19.0524	19.6218	20.0494	20.2905	20.3585	20.3497	20.2001	19.6697	18.9157	18.2530 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9237	0.8962	0.8548	0.7721	0.6490	0.4877	0.3512	0.3904	0.5952	0.7959	0.8924	0.9302 (94)
Useful gains	466.0130	509.3619	524.7346	518.9529	461.0190	342.9488	236.3911	245.6212	348.5787	422.6570	442.3589	451.4737 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	930.4707	909.0836	830.3607	701.3081	544.9731	367.7488	242.8911	254.7746	395.7354	591.9855	774.5420	925.3289 (97)
Space heating kWh	345.5566	268.6130	227.3858	131.2957	62.4618	0.0000	0.0000	0.0000	0.0000	125.9804	239.1718	352.5483 (98a)
Space heating requirement - total per year (kWh/year)	1753.0135											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	345.5566	268.6130	227.3858	131.2957	62.4618	0.0000	0.0000	0.0000	0.0000	125.9804	239.1718	352.5483 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1753.0135											
Space heating per m2	(98c) / (4) = 31.0763 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	345.5566	268.6130	227.3858	131.2957	62.4618	0.0000	0.0000	0.0000	0.0000	125.9804	239.1718	352.5483 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	374.3842	291.0217	246.3552	142.2489	67.6726	0.0000	0.0000	0.0000	0.0000	136.4901	259.1244	381.9591 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	203.7932	180.3561	192.0849	170.2063	165.8484	150.3877	149.1839	154.6289	155.7786	172.5566	182.0450	201.7575 (64)
Efficiency of water heater (217)m	85.2339	84.9512	84.4391	83.4847	82.0758	79.8000	79.8000	79.8000	79.8000	83.3655	84.6728	79.8000 (216)
Fuel for water heating, kWh/month	239.0987	212.3055	227.4833	203.8774	202.0673	188.4557	186.9472	193.7706	195.2112	206.9880	214.9982	85.2984 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	17.2704	13.8550	12.4748	9.1396	7.0597	5.7678	6.4401	8.3711	10.8732	14.2662	16.1137	17.7504 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-26.7507	-37.9038	-54.7755	-61.9604	-67.1705	-62.8701	-62.1308	-58.4951	-52.1075	-43.5448	-29.4908	-23.1084 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-14.5470	-30.6638	-61.0452	-91.8141	-121.5025	-122.0794	-120.6062	-102.0415	-74.7187	-43.8534	-19.4267	-11.4958 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												

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(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1899.2562	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2507.7344	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												139.3820	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1394.1028	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3238.2698	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1899.2562	0.2100	398.8438	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2507.7344	0.2100	526.6242	(264)
Space and water heating			925.4680	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	139.3820	0.1443	20.1171	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-580.3085	0.1345	-78.0238	
PV Unit electricity exported	-813.7943	0.1259	-102.4263	
Total			-180.4501	(269)
Total CO2, kg/year			777.0643	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.7800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1899.2562	1.1300	2146.1595	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2507.7344	1.1300	2833.7399	(278)
Space and water heating			4979.8994	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	139.3820	1.5338	213.7887	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-580.3085	1.4969	-868.6669	
PV Unit electricity exported	-813.7943	0.4620	-375.9743	
Total			-1244.6412	(283)
Total Primary energy kWh/year			4079.1477	(286)
Target Primary Energy Rate (TPER)			72.3100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	56.4100	(1b) x 2.4000 (2b)	= 135.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 135.3840	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	= 20.0000 / (5) = 0.1477 (8)
Pressure test		Yes
Pressure Test Method		Blower Door

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Measured/design AP50 5.0000 (17)
Infiltration rate 0.3977 (18)
Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3381 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4310	0.4226	0.4141	0.3719	0.3634	0.3212	0.3212	0.3127	0.3381	0.3634	0.3803	0.3972 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.5929	0.5893	0.5858	0.5691	0.5660	0.5516	0.5516	0.5489	0.5571	0.5660	0.5723	0.5789 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			11.4000	1.1450	13.0534		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			56.4100	0.1100	6.2051	75.0000	4230.7500 (28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	9.0000	317.7900 (29a)
Cladding	6.9500		6.9500	0.1800	1.2510	9.0000	62.5500 (29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400 (30)
Total net area of external elements Aum(A, m2)			118.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.5369		(33)
Party Wall 1			26.8300	0.0000	0.0000	20.0000	536.6000 (32)
Party Ceiling 1			50.0000			30.0000	1500.0000 (32b)
GF			80.0000			9.0000	720.0000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 7426.7300 (34)
List of Thermal Bridges 131.6563 (35)

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	2.0000	0.0600	0.1200
E10 Eaves (insulation at ceiling level)	8.0000	0.0600	0.4800
E16 Corner (normal)	12.0000	0.0900	1.0800
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E2 Other lintels (including other steel lintels)	8.5500	0.0500	0.4275
E3 Sill	7.6200	0.0500	0.3810
E4 Jamb	17.9000	0.0500	0.8950
E5 Ground floor (normal)	23.1700	0.1600	3.7072
P1 Party wall - Ground floor	11.1800	0.0800	0.8944
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.1800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	18.0000	0.0700	1.2600
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 38.8540 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.4887	26.3275	26.1695	25.4276	25.2887	24.6425	24.6425	24.5228	24.8914	25.2887	25.5696	25.8632 (38)
Heat transfer coeff	65.3427	65.1816	65.0236	64.2816	64.1428	63.4965	63.4965	63.3769	63.7455	64.1428	64.4236	64.7172 (39)
Average = Sum(39)m / 12 = 64.2809												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1584	1.1555	1.1527	1.1395	1.1371	1.1256	1.1256	1.1235	1.1300	1.1371	1.1421	1.1473 (40)
HLP (average)												1.1395
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.8785 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths 24.0831 23.7254 23.2218 22.2931 21.5977 20.8266 20.4101 20.9103 21.4549 22.2799 23.2277 24.0017 (42b)

Hot water usage for other uses 33.8681 32.6365 31.4050 30.1734 28.9418 27.7103 27.7103 28.9418 30.1734 31.4050 32.6365 33.8681 (42c)

Average daily hot water use (litres/day) 53.1180 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	57.9512	56.3620	54.6267	52.4665	50.5395	48.5369	48.1204	49.8521	51.6283	53.6849	55.8643	57.8698 (44)
Energy conte	91.7805	80.2587	83.9593	71.8240	68.0359	59.6818	58.1975	61.7273	63.6628	72.8499	79.5889	90.6101 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (46)												
Water storage loss:												
Total storage loss												
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)												
If cylinder contains dedicated solar storage												
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)												
Primary loss												
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)												
Combi loss												
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)												
Total heat required for water heating calculated for each month												
WWHRS	78.0135	68.2199	71.3654	61.0504	57.8305	50.7295	49.4678	52.4682	54.1134	61.9224	67.6506	77.0186 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	78.0135	68.2199	71.3654	61.0504	57.8305	50.7295	49.4678	52.4682	54.1134	61.9224	67.6506	77.0186 (64)
Total per year (kWh/year)												
Electric shower(s)												
44.6196 39.7564 43.4125 41.4280 42.2054 40.2598 41.6018 42.2054 41.4280 43.4125 42.5961 44.6196 (64a)												
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 507.5450 (64a)												
Heat gains from water heating, kWh/month												

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30.6583 26.9941 28.6945 25.6196 25.0090 22.7473 22.7674 23.6684 23.8853 26.3337 27.5617 30.4095 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	83.1186	92.0241	83.1186	85.8892	83.1186	85.8892	83.1186	83.1186	85.8892	83.1186	85.8892	83.1186	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.8111	165.5109	161.2274	152.1082	140.5969	129.7778	122.5500	120.8502	125.1338	134.2529	145.7643	156.5833	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	(71)
Water heating gains (Table 5)	41.2073	40.1698	38.5678	35.5828	33.6142	31.5935	30.6014	31.8124	33.1741	35.3948	38.2801	40.8730	(72)
Total internal gains	339.3150	348.8829	334.0918	324.7582	308.5077	298.4386	287.4480	286.9592	295.3751	303.9443	321.1116	331.7530	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					6.4800	10.6334	0.6300	0.7000	0.7700		21.0581 (74)	
South					2.3400	46.7521	0.6300	0.7000	0.7700		33.4340 (78)	
West					2.5800	19.6403	0.6300	0.7000	0.7700		15.4860 (80)	
Solar gains	69.9781	125.2932	188.0223	261.4339	319.2847	328.7403	312.0355	266.9937	213.1040	142.9101	84.9178	59.1800 (83)
Total gains	409.2931	474.1761	522.1141	586.1921	627.7924	627.1789	599.4835	553.9528	508.4790	446.8545	406.0294	390.9330 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.5717	31.6498	31.7267	32.0929	32.1623	32.4897	32.4897	32.5510	32.3628	32.1623	32.0221	31.8768	
alpha	3.1048	3.1100	3.1151	3.1395	3.1442	3.1660	3.1660	3.1701	3.1575	3.1442	3.1348	3.1251	
util living area	0.9697	0.9518	0.9224	0.8531	0.7390	0.5789	0.4429	0.4913	0.7019	0.8844	0.9524	0.9734	(86)
MIT	18.8966	19.1867	19.6004	20.1540	20.5958	20.8675	20.9575	20.9407	20.7466	20.1712	19.4514	18.8522	(87)
Th 2	19.9535	19.9558	19.9580	19.9687	19.9707	19.9800	19.9800	19.9817	19.9764	19.9707	19.9666	19.9624	(88)
util rest of house	0.9642	0.9433	0.9083	0.8262	0.6915	0.5053	0.3490	0.3951	0.6339	0.8572	0.9425	0.9686	(89)
MIT 2	18.0505	18.3366	18.7417	19.2766	19.6769	19.9045	19.9634	19.9568	19.8168	19.3061	18.6085	18.0130	(90)
Living area fraction	18.3925	18.6802	19.0888	19.6312	20.0483	20.2937	20.3652	20.3545	20.1926	19.6557	18.9491	18.3522	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3925	18.6802	19.0888	19.6312	20.0483	20.2937	20.3652	20.3545	20.1926	19.6557	18.9491	18.3522	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9535	0.9302	0.8941	0.8162	0.6954	0.5290	0.3855	0.4316	0.6494	0.8474	0.9302	0.9587	(94)
Useful gains	390.2717	441.0805	466.8329	478.4445	436.5471	331.7634	231.0788	239.0962	330.2316	378.6624	377.6779	374.7875	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	920.8407	898.2129	818.5690	689.8200	535.4816	361.5307	239.0794	250.6235	388.3759	580.8608	763.3647	915.8904	(97)
Space heating kWh	394.7433	307.1929	261.6917	152.1904	73.6073	0.0000	0.0000	0.0000	0.0000	150.4356	277.6945	402.5805	(98a)
Space heating requirement - total per year (kWh/year)												2020.1363	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	394.7433	307.1929	261.6917	152.1904	73.6073	0.0000	0.0000	0.0000	0.0000	150.4356	277.6945	402.5805	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2020.1363	
Space heating per m ²												35.8117	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	596.8674	469.8743	481.6641	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8179	0.8749	0.8462	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	488.1551	411.0750	407.5628	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	702.5267	671.8075	620.1912	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	154.3475	193.9850	158.1955	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.5869	48.4962	39.5489	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												126.6320	(107)
Energy for space heating												35.8117	(99)
Energy for space cooling												2.2449	(108)
Total												38.0565	(109)

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Fabric Energy Efficiency (DFEE)

38.1 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.4100 (1b)	x 2.4000 (2b)	= 135.3840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 135.3840 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000	Air changes per hour (5) =	0.1477 (8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.3977	(18)
Number of sides sheltered			2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3381	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4310	0.4226	0.4141	0.3719	0.3634	0.3212	0.3212	0.3127	0.3381	0.3634	0.3803	0.3972 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5929	0.5893	0.5858	0.5691	0.5660	0.5516	0.5516	0.5489	0.5571	0.5660	0.5723	0.5789 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			11.4000	1.1450	13.0534		(27)
Ground Floor			56.4100	0.1300	7.3333		(28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558		(29a)
Cladding	6.9500		6.9500	0.1800	1.2510		(29a)
GF Joists	6.5600		6.5600	0.1100	0.7216		(30)
Total net area of external elements Aum(A, m ²)			118.5800				(31)
Fabric heat loss, W/K = Sum (A x U)							(32)
Party Wall 1			26.8300	0.0000	30.6651		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 131.6563 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E12 Gable (insulation at ceiling level)	2.0000	0.0600	0.1200
E10 Eaves (insulation at ceiling level)	8.0000	0.0600	0.4800
E16 Corner (normal)	12.0000	0.0900	1.0800
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E2 Other lintels (including other steel lintels)	8.5500	0.0500	0.4275
E3 Sill	7.6200	0.0500	0.3810
E4 Jamb	17.9000	0.0500	0.8950
E5 Ground floor (normal)	23.1700	0.1600	3.7072
P1 Party wall - Ground floor	11.1800	0.0800	0.8944
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.1800	0.0000	0.0000
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880
E7 Party floor between dwellings (in blocks of flats)	18.0000	0.0700	1.2600
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.3171 (36)
Point Thermal bridges			0.0000
Total fabric heat loss			(33) + (36) + (36a) = 39.9822 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	26.4887	26.3275	26.1695	25.4276	25.2887	24.6425	24.6425	24.5228	24.8914	25.2887	25.5696	25.8632 (38)
Heat transfer coeff	66.4709	66.3098	66.1518	65.4098	65.2710	64.6247	64.6247	64.5051	64.8737	65.2710	65.5518	65.8454 (39)
Average = Sum(39)m / 12 =												65.4091
HLP	1.1784	1.1755	1.1727	1.1595	1.1571	1.1456	1.1456	1.1435	1.1500	1.1571	1.1621	1.1673 (40)
HLP (average)												1.1595
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.8785 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017 (42b)
Hot water usage for other uses	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681 (42c)
Average daily hot water use (litres/day)												53.1180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	57.9512	56.3620	54.6267	52.4665	50.5395	48.5369	48.1204	49.8521	51.6283	53.6849	55.8643	57.8698 (44)
Energy content	91.7805	80.2587	83.9593	71.8240	68.0359	59.6818	58.1975	61.7273	63.6628	72.8499	79.5889	90.6101 (45)
Energy content (annual)	Total = Sum(45)m =											882.1767
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	78.0135	68.2199	71.3654	61.0504	57.8305	50.7295	49.4678	52.4682	54.1134	61.9224	67.6506	77.0186 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	78.0135	68.2199	71.3654	61.0504	57.8305	50.7295	49.4678	52.4682	54.1134	61.9224	67.6506	77.0186 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											749.8502 (64)
Electric shower(s)	44.6196	39.7564	43.4125	41.4280	42.2054	40.2598	41.6018	42.2054	41.4280	43.4125	42.5961	44.6196 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											507.5450 (64a)
Heat gains from water heating, kWh/month	30.6583	26.9941	28.6945	25.6196	25.0090	22.7473	22.7674	23.6684	23.8853	26.3337	27.5617	30.4095 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268	93.9268 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	83.1186	92.0241	83.1186	85.8892	83.1186	85.8892	83.1186	83.1186	85.8892	83.1186	85.8892	83.1186 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.8111	165.5109	161.2274	152.1082	140.5969	129.7778	122.5500	120.8502	125.1338	134.2529	145.7643	156.5833 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927	32.3927 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415 (71)
Water heating gains (Table 5)	41.2073	40.1698	38.5678	35.5828	33.6142	31.5935	30.6014	31.8124	33.1741	35.3948	38.2801	40.8730 (72)
Total internal gains	339.3150	348.8829	334.0918	324.7582	308.5077	298.4386	287.4480	286.9592	295.3751	303.9443	321.1116	331.7530 (73)

6. Solar gains

[Jan]				Area	Solar flux	g		FF		Access	Gains				
				m2	Table 6a	Specific data		Specific data		factor	W				
					W/m2	or Table 6b		or Table 6c		Table 6d					
North				6.4800	10.6334	0.6300		0.7000		0.7700	21.0581 (74)				
South				2.3400	46.7521	0.6300		0.7000		0.7700	33.4340 (78)				
West				2.5800	19.6403	0.6300		0.7000		0.7700	15.4860 (80)				
Solar gains				69.9781	125.2932	188.0223	261.4339	319.2847	328.7403	312.0355	266.9937	213.1040	142.9101	84.9178	59.1800 (83)
Total gains				409.2931	474.1761	522.1141	586.1921	627.7924	627.1789	599.4835	553.9528	508.4790	446.8545	406.0294	390.9330 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.0358	31.1113	31.1856	31.5393	31.6064	31.9225	31.9225	31.9817	31.8000	31.6064	31.4710	31.3307
alpha	3.0691	3.0741	3.0790	3.1026	3.1071	3.1282	3.1282	3.1321	3.1200	3.1071	3.0981	3.0887
util living area	0.9699	0.9524	0.9236	0.8557	0.7436	0.5851	0.4490	0.4976	0.7071	0.8864	0.9530	0.9736 (86)
MIT	18.8523	19.1432	19.5610	20.1223	20.5752	20.8581	20.9538	20.9358	20.7325	20.1432	19.4136	18.8076 (87)
Th 2	19.9374	19.9397	19.9419	19.9525	19.9545	19.9637	19.9637	19.9655	19.9602	19.9545	19.9505	19.9463 (88)
util rest of house	0.9645	0.9439	0.9096	0.8289	0.6960	0.5103	0.3528	0.3993	0.6386	0.8593	0.9431	0.9688 (89)
MIT 2	17.9957	18.2827	18.6920	19.2347	19.6458	19.8830	19.9458	19.9387	19.7918	19.2678	18.5602	17.9578 (90)
Living area fraction	18.3419	18.6305	19.0432	19.5935	20.0215	20.2771	20.3532	20.3417	20.1720	19.6216	18.9051	18.3013 (91)
MIT	18.3419	18.6305	19.0432	19.5935	20.0215	20.2771	20.3532	20.3417	20.1720	19.6216	18.9051	18.3013 (92)
Temperature adjustment	18.3419	18.6305	19.0432	19.5935	20.0215	20.2771	20.3532	20.3417	20.1720	19.6216	18.9051	18.3013 (93)
adjusted MIT	18.3419	18.6305	19.0432	19.5935	20.0215	20.2771	20.3532	20.3417	20.1720	19.6216	18.9051	18.3013 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9537	0.9306	0.8951	0.8184	0.6993	0.5340	0.3900	0.4364	0.6537	0.8491	0.9306	0.9588	(94)
Useful gains	390.3250	441.2870	467.3416	479.7627	438.9974	334.9347	233.8258	241.7581	332.4115	379.4272	377.8569	374.8188	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
Space heating kWh	933.3798	910.4659	829.7582	699.4566	543.1495	366.8828	242.5519	254.2597	393.9123	588.8504	773.8475	928.5059	(97)
Space heating requirement - total per year (kWh/year)	404.0328	315.2883	269.6379	158.1796	77.4892	0.0000	0.0000	0.0000	0.0000	155.8108	285.1133	411.9432	(98a)
Solar heating kWh													
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating kWh	404.0328	315.2883	269.6379	158.1796	77.4892	0.0000	0.0000	0.0000	0.0000	155.8108	285.1133	411.9432	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2077.4950	
Space heating per m2										(98c) / (4) =		36.8285	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	607.4725	478.2230	490.2384	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8097	0.8681	0.8386	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	491.8869	415.1242	411.1046	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	702.5267	671.8075	620.1912	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	151.6607	190.9724	155.5604	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	37.9152	47.7431	38.8901	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												124.5484	(107)
Energy for space heating												36.8285	(99)
Energy for space cooling												2.2079	(108)
Total												39.0364	(109)
Fabric Energy Efficiency (TFEE)												39.0	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

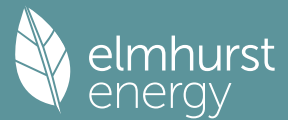
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4100	(1b) x 2.4000 (2b)	135.3840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	135.3840 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1477 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3977 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3381 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infilt rate	0.4310 0.4226 0.4141 0.3719 0.3634 0.3212 0.3212 0.3127 0.3381 0.3634 0.3803 0.3972 (22b)
Effective ac	0.5929 0.5893 0.5858 0.5691 0.5660 0.5516 0.5516 0.5489 0.5571 0.5660 0.5723 0.5789 (25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.4000	1.1450	13.0534			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			56.4100	0.1100	6.2051	75.0000	4230.7500	(28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	9.0000	317.7900	(29a)
Cladding	6.9500		6.9500	0.1800	1.2510	9.0000	62.5500	(29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
Total net area of external elements Aum(A, m2)			118.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.5369			(33)
Party Wall 1			26.8300	0.0000	0.0000	20.0000	536.6000	(32)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)
GF			80.0000			9.0000	720.0000	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7426.7300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							131.6563	(35)

List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E12 Gable (insulation at ceiling level)				2.0000	0.0600	0.1200							
E10 Eaves (insulation at ceiling level)				8.0000	0.0600	0.4800							
E16 Corner (normal)				12.0000	0.0900	1.0800							
E17 Corner (inverted - internal area greater than external area)				2.4000	-0.0900	-0.2160							
E2 Other lintels (including other steel lintels)				8.5500	0.0500	0.4275							
E3 Sill				7.6200	0.0500	0.3810							
E4 Jamb				17.9000	0.0500	0.8950							
E5 Ground floor (normal)				23.1700	0.1600	3.7072							
P1 Party wall - Ground floor				11.1800	0.0800	0.8944							
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				11.1800	0.0000	0.0000							
E25 Staggered party wall between dwellings				4.8000	0.0600	0.2880							
E7 Party floor between dwellings (in blocks of flats)				18.0000	0.0700	1.2600							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												9.3171	(36)
Point Thermal Bridges												0.0000	(36a) =
Total fabric heat loss												38.8540	(33) + (36) + (36a) = (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	26.4887	26.3275	26.1695	25.4276	25.2887	24.6425	24.6425	24.5228	24.8914	25.2887	25.5696	25.8632	(38)
Average = Sum(39)m / 12 =	65.3427	65.1816	65.0236	64.2816	64.1428	63.4965	63.4965	63.3769	63.7455	64.1428	64.4236	64.7172	(39)
												64.2809	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1584	1.1555	1.1527	1.1395	1.1371	1.1256	1.1256	1.1235	1.1300	1.1371	1.1421	1.1473	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												1.1395	
												31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.8785	(42)
Hot water usage for mixer showers	69.6455	68.5989	67.0737	64.1556	62.0021	59.6006	58.2355	59.7492	61.4084	63.9869	66.9677	69.3787	69.3787	(42a)
Hot water usage for baths	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017	24.0017	(42b)
Hot water usage for other uses	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681	33.8681	(42c)
Average daily hot water use (litres/day)													117.3289	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	127.5967	124.9609	121.7005	116.6221	112.5417	108.1375	106.3559	109.6013	113.0366	117.6718	122.8319	127.2485	127.2485	(44)
Energy content (annual)	202.0820	177.9426	187.0491	159.6498	151.5027	132.9677	128.6283	135.7093	139.3854	159.6795	174.9966	199.2404	199.2404	(45)
Distribution loss (46)m = 0.15 x (45)m	30.3123	26.6914	28.0574	23.9475	22.7254	19.9451	19.2942	20.3564	20.9078	23.9519	26.2495	29.8861	29.8861	(46)
Water storage loss:														
Store volume													180.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.8736	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848	249.5848	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848	249.5848	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	107.4678	95.5438	102.4694	92.0599	90.6502	83.1881	83.0445	85.3989	85.3220	93.3690	97.1627	106.5230	106.5230	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	20.9905	18.6435	15.1619	11.4786	8.5804	7.2439	7.8273	10.1742	13.6558	17.3392	20.2374	21.5738	21.5738	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	244.4942	247.0313	240.6379	227.0272	209.8461	193.6982	182.9105	180.3734	186.7668	200.3775	217.5586	233.7065	233.7065	(68)
Pumps, fans	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	3.0000	(70)

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	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	(71)
Water heating gains (Table 5)	144.4460	142.1783	137.7277	127.8610	121.8417	115.5390	111.6189	114.7834	118.5028	125.4959	134.9482	(72)
Total internal gains	498.6511	496.5736	482.2480	455.0872	428.9886	402.2016	388.0772	391.0516	404.6459	431.9332	461.4647	(73)

6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		FF Access factor Table 6d		Gains W	
North	6.4800		10.6334		0.6300		0.7000		0.7700		21.0581 (74)	
South	2.3400		46.7521		0.6300		0.7000		0.7700		33.4340 (78)	
West	2.5800		19.6403		0.6300		0.7000		0.7700		15.4860 (80)	
Solar gains	69.9781	125.2932	188.0223	261.4339	319.2847	328.7403	312.0355	266.9937	213.1040	142.9101	84.9178	59.1800 (83)
Total gains	568.6292	621.8668	670.2703	716.5211	748.2733	730.9419	700.1127	658.0452	617.7498	574.8433	546.3825	546.3569 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.5717	31.6498	31.7267	32.0929	32.1623	32.4897	32.4897	32.5510	32.3628	32.1623	32.0221	31.8768
alpha	3.1048	3.1100	3.1151	3.1395	3.1442	3.1660	3.1660	3.1701	3.1575	3.1442	3.1348	3.1251
util living area	0.9320	0.9094	0.8676	0.7886	0.6670	0.5138	0.3857	0.4237	0.6193	0.8119	0.9048	0.9385 (86)
MIT	19.2998	19.5329	19.9037	20.3519	20.7031	20.9058	20.9714	20.9611	20.8250	20.3892	19.7791	19.2540 (87)
Th 2	19.9535	19.9558	19.9580	19.9687	19.9707	19.9800	19.9800	19.9817	19.9764	19.9707	19.9666	19.9624 (88)
util rest of house	0.9212	0.8953	0.8469	0.7558	0.6169	0.4440	0.3015	0.3371	0.5502	0.7753	0.8877	0.9286 (89)
MIT 2	18.0136	18.3039	18.7610	19.3042	19.7011	19.9129	19.9660	19.9614	19.8403	19.3630	18.6234	17.9627 (90)
Living area fraction	18.5335	18.8006	19.2229	19.7277	20.1061	20.3142	20.3724	20.3655	20.2383	19.7777	19.0905	18.4846 (92)
MIT	18.5335	18.8006	19.2229	19.7277	20.1061	20.3142	20.3724	20.3655	20.2383	19.7777	19.0905	18.4846 (92)
Temperature adjustment	18.5335	18.8006	19.2229	19.7277	20.1061	20.3142	20.3724	20.3655	20.2383	19.7777	19.0905	18.4846 (93)
adjusted MIT	18.5335	18.8006	19.2229	19.7277	20.1061	20.3142	20.3724	20.3655	20.2383	19.7777	19.0905	18.4846 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9027	0.8764	0.8300	0.7473	0.6238	0.4676	0.3345	0.3705	0.5688	0.7676	0.8701	0.9108 (94)
Useful gains	513.3263	544.9953	556.2951	535.4613	466.8063	341.7988	234.1894	243.8377	351.3880	441.2755	475.4232	497.5973 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	930.0527	906.0642	827.2856	696.0209	539.1889	362.8325	239.5324	251.3195	391.2874	588.6857	772.4734	924.4624 (97)
Space heating kWh	310.0445	242.6383	201.6170	115.6030	53.8527	0.0000	0.0000	0.0000	0.0000	109.6732	213.8762	317.5876 (98a)
Space heating requirement - total per year (kWh/year)												1564.8924
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	310.0445	242.6383	201.6170	115.6030	53.8527	0.0000	0.0000	0.0000	0.0000	109.6732	213.8762	317.5876 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1564.8924
Space heating per m2										(98c) / (4) =		27.7414 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	310.0445	242.6383	201.6170	115.6030	53.8527	0.0000	0.0000	0.0000	0.0000	109.6732	213.8762	317.5876 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	124.0674	97.0942	80.6791	46.2597	21.5497	0.0000	0.0000	0.0000	0.0000	43.8869	85.5847	127.0859 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	144.1613	127.5928	135.5760	119.0007	115.2754	103.7625	102.2117	106.2557	107.4277	119.9451	127.7653	142.5384 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	18.3728	14.7394	13.2712	9.7230	7.5103	6.1360	6.8512	8.9054	11.5673	15.1769	17.1423	18.8835 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												626.2074	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1451.5126	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												148.2792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2225.9993	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	626.2074	16.4900	103.2616	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1451.5126	16.4900	239.3544	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	148.2792	16.4900	24.4512	(250)
Additional standing charges			0.0000	(251)
Total energy cost			367.0673	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		1.3031	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	78.8773	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	626.2074	0.1552	97.1685	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1451.5126	0.1409	204.5324	(264)
Space and water heating			301.7009	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	148.2792	0.1443	21.4013	(268)
Total CO2, kg/year			323.1022	(272)
CO2 emissions per m2			5.7300	(273)
EI value			95.7306	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

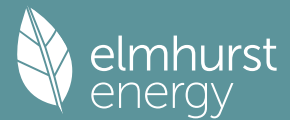
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	56.4100	2.4000	135.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100			(4)
Dwelling volume				(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)

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Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000	Air changes per hour	0.1477 (8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.3977	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500		(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3381		(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Adj infilt rate	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Effective ac	0.3043	0.2789	0.2705	0.2705	0.2789	0.2451	0.2620	0.2366	0.2366	0.2536	0.2366	0.2705	(22b)
	0.5463	0.5389	0.5366	0.5366	0.5389	0.5300	0.5343	0.5280	0.5280	0.5321	0.5280	0.5366	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.4000	1.1450	13.0534			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			56.4100	0.1100	6.2051	75.0000	4230.7500	(28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	9.0000	317.7900	(29a)
Cladding	6.9500		6.9500	0.1800	1.2510	9.0000	62.5500	(29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
Total net area of external elements Aum(A, m2)			118.5800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.5369			(33)
Party Wall 1			26.8300	0.0000	0.0000	20.0000	536.6000	(32)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)
GF			80.0000			9.0000	720.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7426.7300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		131.6563	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	2.0000	0.0600	0.1200	
E10 Eaves (insulation at ceiling level)	8.0000	0.0600	0.4800	
E16 Corner (normal)	12.0000	0.0900	1.0800	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160	
E2 Other lintels (including other steel lintels)	8.5500	0.0500	0.4275	
E3 Sill	7.6200	0.0500	0.3810	
E4 Jamb	17.9000	0.0500	0.8950	
E5 Ground floor (normal)	23.1700	0.1600	3.7072	
P1 Party wall - Ground floor	11.1800	0.0800	0.8944	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.1800	0.0000	0.0000	
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880	
E7 Party floor between dwellings (in blocks of flats)	18.0000	0.0700	1.2600	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.3171	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =		38.8540	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	24.4063	24.0760	23.9723	23.9723	24.0760	23.6803	23.8718	23.5894	23.5894	23.7745	23.5894	23.9723	(38)
Average = Sum(39)m / 12 =	63.2604	62.9301	62.8264	62.8264	62.9301	62.5343	62.7258	62.4434	62.4434	62.6285	62.4434	62.8264	(39)
												62.7349	

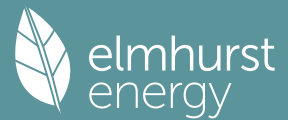
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1214	1.1156	1.1137	1.1137	1.1156	1.1086	1.1120	1.1070	1.1070	1.1102	1.1070	1.1137	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.8785	(42)
Hot water usage for mixer showers														
Hot water usage for baths	69.6455	68.5989	67.0737	64.1556	62.0021	59.6006	58.2355	59.7492	61.4084	63.9869	66.9677	69.3787	(42a)	
Hot water usage for other uses	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017	(42b)	
Average daily hot water use (litres/day)	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681	(42c)	
												117.3289	(43)	

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	127.5967	124.9609	121.7005	116.6221	112.5417	108.1375	106.3559	109.6013	113.0366	117.6718	122.8319	127.2485	(44)
Energy content (annual)	202.0820	177.9426	187.0491	159.6498	151.5027	132.9677	128.6283	135.7093	139.3854	159.6795	174.9966	199.2404	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1948.8335	
Water storage loss:	30.3123	26.6914	28.0574	23.9475	22.7254	19.9451	19.2942	20.3564	20.9078	23.9519	26.2495	29.8861	(46)
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)

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Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
								Total per year (kWh/year) = Sum(64)m =				2541.5986 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000 (64a)
Heat gains from water heating, kWh/month	107.4678	95.5438	102.4694	92.0599	90.6502	83.1881	83.0445	85.3989	85.3220	93.3690	97.1627	106.5230 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9905	18.6435	15.1619	11.4786	8.5804	7.2439	7.8273	10.1742	13.6558	17.3392	20.2374	21.5738 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4942	247.0313	240.6379	227.0272	209.8461	193.6982	182.9105	180.3734	186.7668	200.3775	217.5586	233.7065 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415 (71)
Water heating gains (Table 5)	144.4460	142.1783	137.7277	127.8610	121.8417	115.5390	111.6189	114.7834	118.5028	125.4959	134.9482	143.1760 (72)
Total internal gains	498.6511	496.5736	482.2480	455.0872	428.9886	402.2016	388.0772	391.0516	404.6459	431.9332	461.4647	487.1768 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				6.4800	13.0723	0.6300	0.7000	0.7700	25.8880 (74)			
South				2.3400	54.9219	0.6300	0.7000	0.7700	39.2766 (78)			
West				2.5800	24.4329	0.6300	0.7000	0.7700	19.2649 (80)			
Solar gains	84.4294	133.1461	199.1755	287.8297	343.2268	382.9266	356.1963	307.2826	241.9701	162.2183	102.8883	69.5648 (83)
Total gains	583.0805	629.7197	681.4235	742.9169	772.2154	785.1282	744.2735	698.3342	646.6160	594.1514	564.3530	556.7416 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	32.6109	32.7821	32.8362	32.8362	32.7821	32.9896	32.8889	33.0376	33.0376	32.9400	33.0376	32.8362
alpha	3.1741	3.1855	3.1891	3.1891	3.1855	3.1993	3.1926	3.2025	3.2025	3.1960	3.2025	3.1891
util living area	0.9158	0.8953	0.8415	0.7437	0.5929	0.4131	0.2987	0.3077	0.5392	0.7499	0.8745	0.9238 (86)
MIT	19.5745	19.7374	20.1183	20.5169	20.8216	20.9590	20.9892	20.9887	20.9009	20.5986	20.0598	19.5319 (87)
Th 2	19.9834	19.9881	19.9896	19.9896	19.9881	19.9938	19.9911	19.9952	19.9952	19.9925	19.9952	19.9896 (88)
util rest of house	0.9024	0.8792	0.8173	0.7060	0.5363	0.3420	0.2170	0.2217	0.4649	0.7032	0.8520	0.9114 (89)
MIT 2	18.3760	18.5786	19.0431	19.5092	19.8379	19.9690	19.9872	19.9912	19.9258	19.6168	18.9862	18.3285 (90)
Living area fraction	18.8604	19.0469	19.4777	19.9165	20.2355	20.3692	20.3922	20.3944	20.3199	20.0136	19.4201	18.8149 (92)
MIT	18.8604	19.0469	19.4777	19.9165	20.2355	20.3692	20.3922	20.3944	20.3199	20.0136	19.4201	18.8149 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8604	19.0469	19.4777	19.9165	20.2355	20.3692	20.3922	20.3944	20.3199	20.0136	19.4201	18.8149 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8843	0.8614	0.8034	0.7030	0.5507	0.3690	0.2498	0.2563	0.4898	0.7042	0.8370	0.8936 (94)
Useful gains	515.6210	542.4572	547.4243	522.2740	425.2969	289.7331	185.9555	178.9642	316.7234	418.4154	472.3866	497.5282 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	864.1647	852.5098	765.0798	641.8640	467.9140	298.2378	187.6871	180.7365	338.4389	514.4059	700.6217	855.3759 (97)
Space heating kWh	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388 (98a)
Space heating requirement - total per year (kWh/year)												1249.4044
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1249.4044
Space heating per m ²												22.1486 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	249.9000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)

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Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	103.7681	83.3755	64.8002	34.4557	12.6879	0.0000	0.0000	0.0000	0.0000	28.5782	65.7580	106.5381 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	144.1613	127.5928	135.5760	119.0007	115.2754	103.7625	102.2117	106.2557	107.4277	119.9451	127.7653	142.5384 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	18.3728	14.7394	13.2712	9.7230	7.5103	6.1360	6.8512	8.9054	11.5673	15.1769	17.1423	18.8835 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												499.9618 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1451.5126 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												148.2792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												2099.7536 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	499.9618	26.0600	130.2900 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1451.5126	26.0600	378.2642 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	148.2792	26.0600	38.6416 (250)
Additional standing charges			0.0000 (251)
Total energy cost			547.1958 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	499.9618	0.1559	77.9525 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1451.5126	0.1409	204.5324 (264)
Space and water heating			282.4849 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	148.2792	0.1443	21.4013 (268)
Total CO2, kg/year			303.8862 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	499.9618	1.5772	788.5643 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1451.5126	1.5210	2207.8002 (278)
Space and water heating			2996.3645 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	148.2792	1.5338	227.4356 (282)
Total Primary energy kWh/year			3223.8001 (286)

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SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: (none)	SAP change	Cost change	CO2 change

Recommended measures (none)	Total Savings	£0	Typical annual savings	0.00 kg/m²	Energy efficiency	Environmental impact

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£547	£547	£0
Space heating	£130	£130	£0
Water heating	£378	£378	£0
Lighting	£39	£39	£0
Total cost of fuels	£547	£547	£0
Total cost of uses	£547	£547	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4100 (1b)	x 2.4000 (2b)	= 135.3840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 135.3840 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

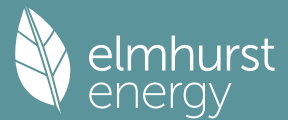
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1477 (8)

Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3977 (18)
Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3381 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4310	0.4226	0.4141	0.3719	0.3634	0.3212	0.3212	0.3127	0.3381	0.3634	0.3803	0.3972 (22b)
Effective ac	0.5929	0.5893	0.5858	0.5691	0.5660	0.5516	0.5516	0.5489	0.5571	0.5660	0.5723	0.5789 (25)

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3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Windows (Uw = 1.20)			11.4000	1.1450	13.0534			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			56.4100	0.1100	6.2051	75.0000	4230.7500	(28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	9.0000	317.7900	(29a)
Cladding	6.9500		6.9500	0.1800	1.2510	9.0000	62.5500	(29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
Total net area of external elements Aum(A, m ²)			118.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.5369			(33)
Party Wall 1			26.8300	0.0000	0.0000	20.0000	536.6000	(32)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)
GF			80.0000			9.0000	720.0000	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7426.7300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							131.6563	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	2.0000	0.0600	0.1200	
E10 Eaves (insulation at ceiling level)	8.0000	0.0600	0.4800	
E16 Corner (normal)	12.0000	0.0900	1.0800	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160	
E2 Other lintels (including other steel lintels)	8.5500	0.0500	0.4275	
E3 Sill	7.6200	0.0500	0.3810	
E4 Jamb	17.9000	0.0500	0.8950	
E5 Ground floor (normal)	23.1700	0.1600	3.7072	
P1 Party wall - Ground floor	11.1800	0.0800	0.8944	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.1800	0.0000	0.0000	
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880	
E7 Party floor between dwellings (in blocks of flats)	18.0000	0.0700	1.2600	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.3171 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	38.8540 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.4887	26.3275	26.1695	25.4276	25.2887	24.6425	24.6425	24.5228	24.8914	25.2887	25.5696	25.8632	(38)
Heat transfer coeff	65.3427	65.1816	65.0236	64.2816	64.1428	63.4965	63.4965	63.3769	63.7455	64.1428	64.4236	64.7172	(39)
Average = Sum(39)m / 12 =												64.2809	
HLP	1.1584	1.1555	1.1527	1.1395	1.1371	1.1256	1.1256	1.1235	1.1300	1.1371	1.1421	1.1473	(40)
HLP (average)												1.1395	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

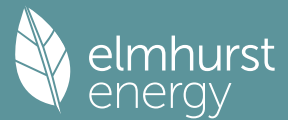
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.8785	(42)
Hot water usage for mixer showers	69.6455	68.5989	67.0737	64.1556	62.0021	59.6006	58.2355	59.7492	61.4084	63.9869	66.9677	69.3787	69.3787	(42a)
Hot water usage for baths	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017	24.0017	(42b)
Hot water usage for other uses	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681	33.8681	(42c)
Average daily hot water use (litres/day)													117.3289	(43)
Daily hot water use	127.5967	124.9609	121.7005	116.6221	112.5417	108.1375	106.3559	109.6013	113.0366	117.6718	122.8319	127.2485	127.2485	(44)
Energy conte	202.0820	177.9426	187.0491	159.6498	151.5027	132.9677	128.6283	135.7093	139.3854	159.6795	174.9966	199.2404	199.2404	(45)
Energy content (annual)										Total = Sum(45)m =			1948.8335	
Distribution loss (46)m = 0.15 x (45)m	30.3123	26.6914	28.0574	23.9475	22.7254	19.9451	19.2942	20.3564	20.9078	23.9519	26.2495	29.8861	29.8861	(46)
Water storage loss:														
Store volume													180.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.8736	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848	249.5848	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848	249.5848	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000	(64a)
Heat gains from water heating, kWh/month	107.4678	95.5438	102.4694	92.0599	90.6502	83.1881	83.0445	85.3989	85.3220	93.3690	97.1627	106.5230	106.5230	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts														
(66)m	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9905	18.6435	15.1619	11.4786	8.5804	7.2439	7.8273	10.1742	13.6558	17.3392	20.2374	21.5738	21.5738	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4942	247.0313	240.6379	227.0272	209.8461	193.6982	182.9105	180.3734	186.7668	200.3775	217.5586	233.7065	233.7065	(68)

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5											
	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)											
	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415 (71)
Water heating gains (Table 5)											
	144.4460	142.1783	137.7277	127.8610	121.8417	115.5390	111.6189	114.7834	118.5028	125.4959	134.9482 (72)
Total internal gains											
	498.6511	496.5736	482.2480	455.0872	428.9886	402.2016	388.0772	391.0516	404.6459	431.9332	461.4647 (73)

6. Solar gains

[Jan]	Area m ²		Solar flux Table 6a W/m ²		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North	6.4800		10.6334		0.6300		0.7000		0.7700		21.0581 (74)
South	2.3400		46.7521		0.6300		0.7000		0.7700		33.4340 (78)
West	2.5800		19.6403		0.6300		0.7000		0.7700		15.4860 (80)
Solar gains	69.9781	125.2932	188.0223	261.4339	319.2847	328.7403	312.0355	266.9937	213.1040	142.9101	84.9178 (83)
Total gains	568.6292	621.8668	670.2703	716.5211	748.2733	730.9419	700.1127	658.0452	617.7498	574.8433	546.3825 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.5717	31.6498	31.7267	32.0929	32.1623	32.4897	32.4897	32.5510	32.3628	32.1623	32.0221	31.8768
alpha	3.1048	3.1100	3.1151	3.1395	3.1442	3.1660	3.1660	3.1701	3.1575	3.1442	3.1348	3.1251
util living area	0.9320	0.9094	0.8676	0.7886	0.6670	0.5138	0.3857	0.4237	0.6193	0.8119	0.9048	0.9385 (86)
MIT	19.2998	19.5329	19.9037	20.3519	20.7031	20.9058	20.9714	20.9611	20.8250	20.3892	19.7791	19.2540 (87)
Th 2	19.9535	19.9558	19.9580	19.9687	19.9707	19.9800	19.9800	19.9817	19.9764	19.9707	19.9666	19.9624 (88)
util rest of house	0.9212	0.8953	0.8469	0.7558	0.6169	0.4440	0.3015	0.3371	0.5502	0.7753	0.8877	0.9286 (89)
MIT 2	18.0136	18.3039	18.7610	19.3042	19.7011	19.9129	19.9660	19.9614	19.8403	19.3630	18.6234	17.9627 (90)
Living area fraction	FLA = Living area / (4) =											0.4042 (91)
MIT	18.5335	18.8006	19.2229	19.7277	20.1061	20.3142	20.3724	20.3655	20.2383	19.7777	19.0905	18.4846 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5335	18.8006	19.2229	19.7277	20.1061	20.3142	20.3724	20.3655	20.2383	19.7777	19.0905	18.4846 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9027	0.8764	0.8300	0.7473	0.6238	0.4676	0.3345	0.3705	0.5688	0.7676	0.8701	0.9108 (94)
Useful gains	513.3263	544.9953	556.2951	535.4613	466.8063	341.7988	234.1894	243.8377	351.3880	441.2755	475.4232	497.5973 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	930.0527	906.0642	827.2856	696.0209	539.1889	362.8325	239.5324	251.3195	391.2874	588.6857	772.4734	924.4624 (97)
Space heating kWh	310.0445	242.6383	201.6170	115.6030	53.8527	0.0000	0.0000	0.0000	0.0000	109.6732	213.8762	317.5876 (98a)
Space heating requirement - total per year (kWh/year)												1564.8924
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	310.0445	242.6383	201.6170	115.6030	53.8527	0.0000	0.0000	0.0000	0.0000	109.6732	213.8762	317.5876 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1564.8924
Space heating per m ²	(98c) / (4) =											27.7414 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	310.0445	242.6383	201.6170	115.6030	53.8527	0.0000	0.0000	0.0000	0.0000	109.6732	213.8762	317.5876 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	124.0674	97.0942	80.6791	46.2597	21.5497	0.0000	0.0000	0.0000	0.0000	43.8869	85.5847	127.0859 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	144.1613	127.5928	135.5760	119.0007	115.2754	103.7625	102.2117	106.2557	107.4277	119.9451	127.7653	142.5384 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	18.3728	14.7394	13.2712	9.7230	7.5103	6.1360	6.8512	8.9054	11.5673	15.1769	17.1423	18.8835 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)

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Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													626.2074	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													175.1000	
Water heating fuel used													1451.5126	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													148.2792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													2225.9993	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	626.2074	16.4900	103.2616	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1451.5126	16.4900	239.3544	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	148.2792	16.4900	24.4512	(250)
Additional standing charges			0.0000	(251)
Total energy cost			367.0673	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3031	(257)
SAP value		78.8773	
SAP rating (Section 12)		79	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	626.2074	0.1552	97.1685	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1451.5126	0.1409	204.5324	(264)
Space and water heating			301.7009	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	148.2792	0.1443	21.4013	(268)
Total CO2, kg/year			323.1022	(272)
CO2 emissions per m2			5.7300	(273)
EI value			95.7306	
EI rating			96	(274)
EI band			A	

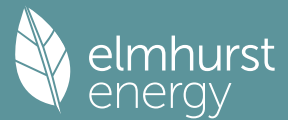
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	56.4100	2.4000	135.3840	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4100			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	135.3840	(5)

2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1477 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3977 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3381 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate													
Effective ac	0.3043	0.2789	0.2705	0.2705	0.2789	0.2451	0.2620	0.2366	0.2366	0.2536	0.2366	0.2705	(22b)
	0.5463	0.5389	0.5366	0.5366	0.5389	0.5300	0.5343	0.5280	0.5280	0.5321	0.5280	0.5366	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			11.4000	1.1450	13.0534			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			56.4100	0.1100	6.2051	75.0000	4230.7500	(28a)
Brick	48.6600	13.3500	35.3100	0.1800	6.3558	9.0000	317.9900	(29a)
Cladding	6.9500		6.9500	0.1800	1.2510	9.0000	62.5500	(29a)
GF Joists	6.5600		6.5600	0.1100	0.7216	9.0000	59.0400	(30)
Total net area of external elements Aum(A, m2)			118.5800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.5369			(33)
Party Wall 1			26.8300	0.0000	0.0000	20.0000	536.6000	(32)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)
GF			80.0000			9.0000	720.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7426.7300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		131.6563	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	2.0000	0.0600	0.1200	
E10 Eaves (insulation at ceiling level)	8.0000	0.0600	0.4800	
E16 Corner (normal)	12.0000	0.0900	1.0800	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160	
E2 Other lintels (including other steel lintels)	8.5500	0.0500	0.4275	
E3 Sill	7.6200	0.0500	0.3810	
E4 Jamb	17.9000	0.0500	0.8950	
E5 Ground floor (normal)	23.1700	0.1600	3.7072	
P1 Party wall - Ground floor	11.1800	0.0800	0.8944	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.1800	0.0000	0.0000	
E25 Staggered party wall between dwellings	4.8000	0.0600	0.2880	
E7 Party floor between dwellings (in blocks of flats)	18.0000	0.0700	1.2600	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.3171	(36)
Point Thermal bridges		0.0000	(36a)
Total fabric heat loss	(33) + (36) + (36a) =	38.8540	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	24.4063	24.0760	23.9723	23.9723	24.0760	23.6803	23.8718	23.5894	23.5894	23.7745	23.5894	23.9723	(38)
Heat transfer coeff	63.2604	62.9301	62.8264	62.8264	62.9301	62.5343	62.7258	62.4434	62.4434	62.6285	62.4434	62.8264	(39)
Average = Sum(39)m / 12 =												62.7349	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.1214	1.1156	1.1137	1.1137	1.1156	1.1086	1.1120	1.1070	1.1070	1.1102	1.1070	1.1137	(40)
HLP (average)												1.1121	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.8785	(42)
Hot water usage for mixer showers	69.6455	68.5989	67.0737	64.1556	62.0021	59.6006	58.2355	59.7492	61.4084	63.9869	66.9677	69.3787	(42a)	
Hot water usage for baths	24.0831	23.7254	23.2218	22.2931	21.5977	20.8266	20.4101	20.9103	21.4549	22.2799	23.2277	24.0017	(42b)	
Hot water usage for other uses	33.8681	32.6365	31.4050	30.1734	28.9418	27.7103	27.7103	28.9418	30.1734	31.4050	32.6365	33.8681	(42c)	
Average daily hot water use (litres/day)													117.3289	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	127.5967	124.9609	121.7005	116.6221	112.5417	108.1375	106.3559	109.6013	113.0366	117.6718	122.8319	127.2485	(44)	
Energy conte	202.0820	177.9426	187.0491	159.6498	151.5027	132.9677	128.6283	135.7093	139.3854	159.6795	174.9966	199.2404	(45)	
Energy content (annual)											Total = Sum(45)m =		1948.8335	
Distribution loss (46)m = 0.15 x (45)m	30.3123	26.6914	28.0574	23.9475	22.7254	19.9451	19.2942	20.3564	20.9078	23.9519	26.2495	29.8861	(46)	
Water storage loss:														
Store volume													180.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.8736	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													0.8736	(55)

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Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
	Total per year (kWh/year) = Sum(64)m =											2541.5986 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	107.4678	95.5438	102.4694	92.0599	90.6502	83.1881	83.0445	85.3989	85.3220	93.3690	97.1627	106.5230 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	112.7122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9905	18.6435	15.1619	11.4786	8.5804	7.2439	7.8273	10.1742	13.6558	17.3392	20.2374	21.5738	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4942	247.0313	240.6379	227.0272	209.8461	193.6982	182.9105	180.3734	186.7668	200.3775	217.5586	233.7065	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	48.1498	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	-75.1415	(71)
Water heating gains (Table 5)	144.4460	142.1783	137.7277	127.8610	121.8417	115.5390	111.6189	114.7834	118.5028	125.4959	134.9482	143.1760	(72)
Total internal gains	498.6511	496.5736	482.2480	455.0872	428.9886	402.2016	388.0772	391.0516	404.6459	431.9332	461.4647	487.1768	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W	

North					6.4800	13.0723	0.6300	0.7000				0.7700			25.8880	(74)
South					2.3400	54.9219	0.6300	0.7000				0.7700			39.2766	(78)
West					2.5800	24.4329	0.6300	0.7000				0.7700			19.2649	(80)

Solar gains	84.4294	133.1461	199.1755	287.8297	343.2268	382.9266	356.1963	307.2826	241.9701	162.2183	102.8883	69.5648	(83)			
Total gains	583.0805	629.7197	681.4235	742.9169	772.2154	785.1282	744.2735	698.3342	646.6160	594.1514	564.3530	556.7416	(84)			

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.6109	32.7821	32.8362	32.8362	32.7821	32.9896	32.8889	33.0376	33.0376	32.9400	33.0376	32.8362	
alpha	3.1741	3.1855	3.1891	3.1891	3.1855	3.1993	3.1926	3.2025	3.2025	3.1960	3.2025	3.1891	
util living area	0.9158	0.8953	0.8415	0.7437	0.5929	0.4131	0.2987	0.3077	0.5392	0.7499	0.8745	0.9238	(86)
MIT	19.5745	19.7374	20.1183	20.5169	20.8216	20.9590	20.9892	20.9887	20.9009	20.5986	20.0598	19.5319	(87)
Th 2	19.9834	19.9881	19.9896	19.9896	19.9881	19.9938	19.9911	19.9952	19.9952	19.9925	19.9952	19.9896	(88)
util rest of house	0.9024	0.8792	0.8173	0.7060	0.5363	0.3420	0.2170	0.2217	0.4649	0.7032	0.8520	0.9114	(89)
MIT 2	18.3760	18.5786	19.0431	19.5092	19.8379	19.9690	19.9872	19.9912	19.9258	19.6168	18.9862	18.3285	(90)
Living area fraction	18.8604	19.0469	19.4777	19.9165	20.2355	20.3692	20.3922	20.3944	20.3199	20.0136	19.4201	18.8149	(91)
MIT	18.8604	19.0469	19.4777	19.9165	20.2355	20.3692	20.3922	20.3944	20.3199	20.0136	19.4201	18.8149	(92)
Temperature adjustment	18.8604	19.0469	19.4777	19.9165	20.2355	20.3692	20.3922	20.3944	20.3199	20.0136	19.4201	18.8149	(93)
adjusted MIT	18.8604	19.0469	19.4777	19.9165	20.2355	20.3692	20.3922	20.3944	20.3199	20.0136	19.4201	18.8149	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8843	0.8614	0.8034	0.7030	0.5507	0.3690	0.2498	0.2563	0.4898	0.7042	0.8370	0.8936	(94)
Ext temp.	515.6210	542.4572	547.4243	522.2740	425.2969	289.7331	185.9555	178.9642	316.7234	418.4154	472.3866	497.5282	(95)
Heat loss rate W	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Space heating kWh	864.1647	852.5098	765.0798	641.8640	467.9140	298.2378	187.6871	180.7365	338.4389	514.4059	700.6217	855.3759	(97)
Space heating requirement - total per year (kWh/year)	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388	(98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388	(98c)
Space heating per m ²	(98c) / (4) =											22.1486	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

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Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	259.3165	208.3553	161.9357	86.1048	31.7071	0.0000	0.0000	0.0000	0.0000	71.4169	164.3293	266.2388 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	103.7681	83.3755	64.8002	34.4557	12.6879	0.0000	0.0000	0.0000	0.0000	28.5782	65.7580	106.5381 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	252.4265	223.4150	237.3935	208.3703	201.8472	181.6881	178.9727	186.0537	188.1059	210.0239	223.7171	249.5848 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	144.1613	127.5928	135.5760	119.0007	115.2754	103.7625	102.2117	106.2557	107.4277	119.9451	127.7653	142.5384 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	18.3728	14.7394	13.2712	9.7230	7.5103	6.1360	6.8512	8.9054	11.5673	15.1769	17.1423	18.8835 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												499.9618 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1451.5126 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												148.2792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												2099.7536 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	499.9618	26.0600	130.2900 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1451.5126	26.0600	378.2642 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	148.2792	26.0600	38.6416 (250)
Additional standing charges			0.0000 (251)
Total energy cost			547.1958 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	499.9618	0.1559	77.9525 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1451.5126	0.1409	204.5324 (264)
Space and water heating			282.4849 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	148.2792	0.1443	21.4013 (268)
Total CO2, kg/year			303.8862 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	499.9618	1.5772	788.5643 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1451.5126	1.5210	2207.8002 (278)
Space and water heating			2996.3645 (279)

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Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	148.2792	1.5338	227.4356 (282)
Total Primary energy kWh/year			3223.8001 (286)

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Property Reference	FURNERS LANE 21				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 21, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	4.00	TER	8.82	
Environmental	96 A	% DER < TER				54.65
CO ₂ Emissions (t/year)	0.55	DFEE	38.97	TFEE	39.39	
Compliance Check	See BREL	% DFEE < TFEE				1.06
% DPER < TPER	9.17	DPER	41.85	TPER	46.08	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

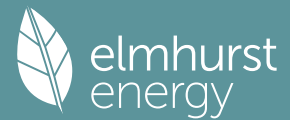
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1577 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4077	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3466 (21)

Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4419	0.4332	0.4246	0.3812	0.3726	0.3292	0.3292	0.3206	0.3466	0.3726	0.3899	0.4072 (22b)
Effective ac	0.5976	0.5938	0.5901	0.5727	0.5694	0.5542	0.5542	0.5514	0.5601	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			35.9200	1.1450	41.1298		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000 (28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600 (29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500 (29a)
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400 (30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900 (30)
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400 (30)
Total net area of external elements Aum(A, m ²)			348.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609		(33)
GF			110.0000			9.0000	990.0000 (32c)
FF			130.0000			9.0000	1170.0000 (32c)
Internal Floor 1			75.1100			18.0000	1351.9800 (32d)
Internal Ceiling 1			75.1100			9.0000	675.9900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.2547 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E12 Gable (insulation at ceiling level)	14.9500	0.0600	0.8970
E10 Eaves (insulation at ceiling level)	26.1800	0.0600	1.5708
E14 Flat roof	2.7200	0.0800	0.2176
E16 Corner (normal)	39.6000	0.0900	3.5640
E17 Corner (inverted - internal area greater than external area)	19.6000	-0.0900	-1.7640
E2 Other lintels (including other steel lintels)	25.4000	0.0500	1.2700
E3 Sill	24.4700	0.0500	1.2235
E4 Jamb	57.9000	0.0500	2.8950
E5 Ground floor (normal)	39.3700	0.1600	6.2992
E6 Intermediate floor within a dwelling	38.4100	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.1731 (36)
 Point Thermal bridges 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 104.3340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	75.0169	74.5410	74.0745	71.8836	71.4737	69.5654	69.5654	69.2120	70.3004	71.4737	72.3029	73.1699 (38)
Heat transfer coeff	179.3508	178.8749	178.4085	176.2175	175.8076	173.8994	173.8994	173.5460	174.6344	175.8076	176.6369	177.5038 (39)
Average = Sum(39)m / 12 =												176.2156

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1782	1.1750	1.1720	1.1576	1.1549	1.1423	1.1423	1.1400	1.1472	1.1549	1.1603	1.1660 (40)
HLP (average)												1.1576
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9376 (42)
Hot water usage for mixer showers												
91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906 (42a)	
Hot water usage for baths												
31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122 (42b)	
Hot water usage for other uses												
44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141 (42c)	
Average daily hot water use (litres/day)												154.7338 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169 (44)
Energy conte	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607 (45)
Energy content (annual)										Total = Sum(45)m =		2570.1301
Distribution loss (46)m = 0.15 x (45)m												
39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141 (46)	
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)	
If cylinder contains dedicated solar storage												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (64)	
										Total per year (kWh/year) = Sum(64)m =		3240.9655 (64)
12Total per year (kWh/year)												3241 (64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
134.1940	119.1973	127.6011	114.1162	112.0138	102.4158	101.9836	105.0890	105.2309	115.6003	120.8466	132.9480 (65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
162.8850	180.3370	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889	308.6889 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046 (71)
Water heating gains (Table 5)												
180.3683	177.3769	171.5068	158.4947	150.5562	142.2441	137.0748	141.2486	146.1541	155.3768	167.8425	178.6935	178.6935 (72)
Total internal gains												
736.2553	754.0670	722.3003	696.7401	660.6786	633.4673	608.6196	609.4424	628.2220	652.9928	693.5814	720.3317	720.3317 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	9.8400	10.6334	0.6300	0.7000	0.7700	31.9771 (74)
East	5.8000	19.6403	0.6300	0.7000	0.7700	34.8135 (76)
South	13.8100	46.7521	0.6300	0.7000	0.7700	197.3178 (78)

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West	6.4700		19.6403		0.6300		0.7000		0.7700		38.8350 (80)	
Solar gains	302.9434	528.3376	752.7497	978.0790	1133.5858	1141.2278	1093.7400	975.8987	830.8101	592.2506	365.1677	257.7233 (83)
Total gains	1039.1987	1282.4046	1475.0500	1674.8191	1794.2644	1774.6951	1702.3596	1585.3411	1459.0320	1245.2434	1058.7492	978.0550 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.6861	18.7359	18.7848	19.0184	19.0627	19.2719	19.2719	19.3112	19.1908	19.0627	18.9732	18.8806	
alpha	2.2457	2.2491	2.2523	2.2679	2.2708	2.2848	2.2848	2.2874	2.2794	2.2708	2.2649	2.2587	
util living area	0.9374	0.9031	0.8555	0.7727	0.6614	0.5244	0.4066	0.4454	0.6264	0.8136	0.9096	0.9444 (86)	
MIT	17.9408	18.3906	18.9894	19.7210	20.3153	20.7202	20.8879	20.8584	20.5539	19.7546	18.7253	17.8693 (87)	
Th 2	19.9375	19.9400	19.9425	19.9541	19.9563	19.9664	19.9664	19.9683	19.9625	19.9563	19.9519	19.9473 (88)	
util rest of house	0.9295	0.8913	0.8378	0.7445	0.6180	0.4605	0.3236	0.3616	0.5658	0.7839	0.8966	0.9373 (89)	
MIT 2	16.3688	16.9332	17.6806	18.5820	19.2850	19.7381	19.8983	19.8775	19.5728	18.6459	17.3695	16.2832 (90)	
Living area fraction	fLA = Living area / (4) =												0.1378 (91)
MIT	16.5854	17.1340	17.8609	18.7390	19.4270	19.8734	20.0347	20.0127	19.7080	18.7987	17.5563	16.5018 (92)	
Temperature adjustment													0.0000
adjusted MIT	16.5854	17.1340	17.8609	18.7390	19.4270	19.8734	20.0347	20.0127	19.7080	18.7987	17.5563	16.5018 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8930	0.8489	0.7934	0.7059	0.5935	0.4544	0.3294	0.3654	0.5493	0.7433	0.8555	0.9029 (94)
Useful gains	927.9573	1088.6822	1170.3732	1182.2762	1064.8998	806.3396	560.7019	579.3043	801.4403	925.5659	905.7551	883.1188 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2203.4035	2188.3601	2026.8884	1733.8060	1358.4586	917.0478	597.2957	626.9684	979.3568	1441.4001	1846.9717	2183.6125 (97)
Space heating kWh	948.9320	738.9835	637.2474	397.1015	218.4078	0.0000	0.0000	0.0000	0.0000	383.7807	677.6759	967.5673 (98a)
Space heating requirement - total per year (kWh/year)	4969.6960											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	948.9320	738.9835	637.2474	397.1015	218.4078	0.0000	0.0000	0.0000	0.0000	383.7807	677.6759	967.5673 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4969.6960											
Space heating per m2	(98c) / (4) = 32.6460 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	948.9320	738.9835	637.2474	397.1015	218.4078	0.0000	0.0000	0.0000	0.0000	383.7807	677.6759	967.5673 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	379.7247	295.7117	255.0009	158.9041	87.3981	0.0000	0.0000	0.0000	0.0000	153.5737	271.1788	387.1818 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	184.7420	163.4110	173.4179	151.7321	146.6453	131.6355	129.4174	134.7511	136.4708	152.8055	163.2922	182.6018 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1	1988.6739 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	175.1000											
Water heating fuel used	1850.9226 (219)											
Space cooling fuel	0.0000 (221)											

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Electricity for pumps and fans:
 Total electricity for the above, kWh/year 0.0000 (231)
 Electricity for lighting (calculated in Appendix L) 279.4701 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV generation 0.0000 (233)
 Wind generation 0.0000 (234)
 Hydro-electric generation (Appendix N) 0.0000 (235a)
 Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
 Appendix Q - special features
 Energy saved or generated -0.0000 (236)
 Energy used 0.0000 (237)
 Total delivered energy for all uses 4119.0666 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1988.6739	0.1546	307.4286 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1850.9226	0.1410	260.9524 (264)
Space and water heating			568.3811 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	279.4701	0.1443	40.3362 (268)
Total CO2, kg/year			608.7172 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.0000 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1988.6739	1.5723	3126.8245 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1850.9226	1.5213	2815.8381 (278)
Space and water heating			5942.6626 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	279.4701	1.5338	428.6606 (282)
Total Primary energy kWh/year			6371.3232 (286)
Dwelling Primary energy Rate (DPER)			41.8500 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
 CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

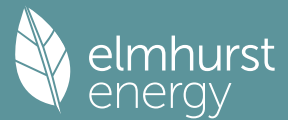
2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1052 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3552 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3019 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3849	0.3774	0.3698	0.3321	0.3245	0.2868	0.2868	0.2792	0.3019	0.3245	0.3396	0.3547 (22b)
Effective ac	0.5741	0.5712	0.5684	0.5551	0.5527	0.5411	0.5411	0.5390	0.5456	0.5527	0.5577	0.5629 (25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			1.9500	1.0000	1.9500			(26)					
TER Opening Type (Uw = 1.20)			35.9200	1.1450	41.1298			(27)					
Ground Floor			77.0400	0.1300	10.0152			(28a)					
Brick	128.3500	32.4100	95.9400	0.1800	17.2692			(29a)					
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450			(29a)					
Joists GF	0.9600		0.9600	0.1100	0.1056			(30)					
Joists FF	75.1100		75.1100	0.1100	8.2621			(30)					
Flat	0.9600		0.9600	0.1100	0.1056			(30)					
Total net area of external elements Aum(A, m2)			348.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	89.6825			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E12 Gable (insulation at ceiling level)				14.9500	0.0600		0.8970						
E10 Eaves (insulation at ceiling level)				26.1800	0.0600		1.5708						
E14 Flat roof				2.7200	0.0800		0.2176						
E16 Corner (normal)				39.6000	0.0900		3.5640						
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900		-1.7640						
E2 Other lintels (including other steel lintels)				25.4000	0.0500		1.2700						
E3 Sill				24.4700	0.0500		1.2235						
E4 Jamb				57.9000	0.0500		2.8950						
E5 Ground floor (normal)				39.3700	0.1600		6.2992						
E6 Intermediate floor within a dwelling				38.4100	0.0000		0.0000						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1731	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss					(33) + (36) + (36a) =		105.8556	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	72.0599	71.6989	71.3450	69.6827	69.3716	67.9238	67.9238	67.6557	68.4815	69.3716	70.0008	70.6586	(38)
Heat transfer coeff	177.9155	177.5544	177.2005	175.5382	175.2272	173.7794	173.7794	173.5113	174.3371	175.2272	175.8564	176.5142	(39)
Average = Sum(39)m / 12 =												175.5367	
HLP	1.1687	1.1664	1.1640	1.1531	1.1511	1.1416	1.1416	1.1398	1.1452	1.1511	1.1552	1.1595	(40)
HLP (average)												1.1531	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.9376 (42)
Hot water usage for mixer showers	73.4740	72.3698	70.7608	67.6823	65.4104	62.8769	61.4368	63.0336	64.7840	67.5043	70.6489	73.1925	(42a)
Hot water usage for baths	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	(42b)
Hot water usage for other uses	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	(42c)
Average daily hot water use (litres/day)												137.7987	(43)
Daily hot water use	149.9075	146.7063	142.8080	136.8804	132.0666	126.8915	124.9029	128.7844	132.8780	138.3110	144.3299	149.5188	(44)
Energy conte	237.4169	208.9078	219.4906	187.3824	177.7871	156.0279	151.0592	159.4620	163.8519	187.6867	205.6244	234.1103	(45)
Energy content (annual)										Total = Sum(45)m =		2288.8072	
Distribution loss (46)m = 0.15 x (45)m	35.6125	31.3362	32.9236	28.1074	26.6681	23.4042	22.6589	23.9193	24.5778	28.1530	30.8437	35.1165	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0208	(55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	292.3237	258.5011	274.3973	240.5180	232.6939	209.1635	205.9660	214.3688	216.9875	242.5935	258.7600	289.0171	(62)
WWHRS	-33.5892	-29.7066	-31.1070	-25.7579	-24.0054	-20.5416	-19.2545	-20.4752	-21.2531	-25.0551	-28.3844	-32.9672	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	258.7345	228.7945	243.2903	214.7601	208.6885	188.6220	186.7116	193.8936	195.7344	217.5384	230.3757	256.0499	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2623.1932	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	122.8666	109.1364	116.9060	104.8131	103.0396	94.3878	94.1526	96.9465	96.9892	106.3313	110.8786	121.7671	(65)

5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
(66)m	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.8850	180.3370	162.8850	168.3145	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	165.1432	162.4054	157.1318	145.5738	138.4941	131.0941	126.5492	130.3045	134.7073	142.9184	153.9981	163.6655	(72)
Total internal gains													

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721.0302 739.0955 707.9253 683.8192 648.6165 622.3173 598.0941 598.4983 616.7752 640.5343 679.7370 705.3036 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	9.8400	10.6334	0.6300	0.7000	0.7700	31.9771 (74)
East	5.8000	19.6403	0.6300	0.7000	0.7700	34.8135 (76)
South	13.8100	46.7521	0.6300	0.7000	0.7700	197.3178 (78)
West	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350 (80)
Solar gains	302.9434	528.3376	752.7497	978.0790	1133.5858	1141.2278
Total gains	1023.9736	1267.4331	1460.6750	1661.8982	1782.2023	1763.5451

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	18.8369	18.8752	18.9129	19.0920	19.1259	19.2852	19.2852	19.3150	19.2235	19.1259	19.0575	18.9864
alpha	2.2558	2.2583	2.2609	2.2728	2.2751	2.2857	2.2857	2.2877	2.2816	2.2751	2.2705	2.2658
util living area	0.9388	0.9046	0.8570	0.7743	0.6630	0.5266	0.4084	0.4478	0.6288	0.8158	0.9114	0.9458 (86)
MIT	17.9464	18.3963	18.9944	19.7203	20.3147	20.7181	20.8869	20.8568	20.5512	19.7507	18.7209	17.8671 (87)
Th 2	19.9451	19.9470	19.9489	19.9577	19.9593	19.9670	19.9670	19.9685	19.9641	19.9593	19.9560	19.9525 (88)
util rest of house	0.9311	0.8930	0.8395	0.7464	0.6198	0.4626	0.3252	0.3637	0.5684	0.7864	0.8986	0.9389 (89)
MIT 2	16.3794	16.9439	17.6904	18.5837	19.2868	19.7368	19.8983	19.8766	19.5715	18.6434	17.3663	16.2829 (90)
Living area fraction	16.5953	17.1441	17.8701	18.7404	19.4285	19.8720	20.0346	20.0117	19.7065	18.7960	17.5530	16.5012 (92)
MIT	16.5953	17.1441	17.8701	18.7404	19.4285	19.8720	20.0346	20.0117	19.7065	18.7960	17.5530	16.5012 (93)
Temperature adjustment												0.0000
adjusted MIT	16.5953	17.1441	17.8701	18.7404	19.4285	19.8720	20.0346	20.0117	19.7065	18.7960	17.5530	16.5012 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8952	0.8510	0.7954	0.7078	0.5952	0.4563	0.3310	0.3674	0.5516	0.7458	0.8579	0.9051 (94)
Ext temp.	916.6263	1078.6238	1161.8101	1176.2124	1060.7200	804.6689	559.9555	578.4865	798.5441	919.3590	896.4382	871.6732 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating	2187.5293	2173.9878	2014.7871	1727.3612	1354.2400	916.1703	596.8598	626.6711	977.4265	1436.1681	1838.2225	2171.3385 (97)
Space heating requirement - total per year (kWh/year)	945.5518	736.0847	634.6149	396.8271	218.3789	0.0000	0.0000	0.0000	0.0000	384.5060	678.0847	966.9510 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	945.5518	736.0847	634.6149	396.8271	218.3789	0.0000	0.0000	0.0000	0.0000	384.5060	678.0847	966.9510 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (99)
Space heating per m2												

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	945.5518	736.0847	634.6149	396.8271	218.3789	0.0000	0.0000	0.0000	0.0000	384.5060	678.0847	966.9510 (98)
Space heating fuel (main heating system)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating efficiency (main heating system 2)	1024.4332	797.4915	687.5568	429.9318	236.5969	0.0000	0.0000	0.0000	0.0000	416.5828	734.6530	1047.6175 (211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Water heating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	258.7345	228.7945	243.2903	214.7601	208.6885	188.6220	186.7116	193.8936	195.7344	217.5384	230.3757	256.0499 (64)
Efficiency of water heater	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (216)
Fuel for water heating, kWh/month	33.8443	27.1511	24.4466	17.9106	13.8347	11.3031	12.6205	16.4046	21.3079	27.9571	31.5775	34.7849 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-66.7341	-91.4457	-127.7690	-139.4456	-146.8080	-135.6370	-133.7868	-127.8989	-117.1848	-102.3589	-72.3488	-57.9947 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233b)m	-46.1847	-96.0365	-188.9159	-281.0150	-369.0743	-370.0645	-365.8650	-311.0512	-229.5918	-136.6110	-61.4048	-36.6223	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												5374.8635	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3120.4564	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												273.1428	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-3811.8492	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5042.6135	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5374.8635	0.2100	1128.7213	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3120.4564	0.2100	655.2958	(264)
Space and water heating			1784.0172	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	273.1428	0.1443	39.4229	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1319.4124	0.1352	-178.4236	
PV Unit electricity exported	-2492.4369	0.1262	-314.4789	
Total			-492.9025	(269)
Total CO2, kg/year			1342.4669	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.8200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5374.8635	1.1300	6073.5958	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3120.4564	1.1300	3526.1157	(278)
Space and water heating			9599.7115	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	273.1428	1.5338	418.9556	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1319.4124	1.4998	-1978.8831	
PV Unit electricity exported	-2492.4369	0.4632	-1154.3831	
Total			-3133.2662	(283)
Total Primary energy kWh/year			7015.5017	(286)
Target Primary Energy Rate (TPER)			46.0800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)	
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

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Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											Air changes per hour
Pressure test												40.0000 / (5) = 0.1052 (8)
Pressure Test Method												Yes
Measured/design AP50												Blower Door
Infiltration rate												5.0000 (17)
Number of sides sheltered												0.3552 (18)
												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3019 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.3849	0.3774	0.3698	0.3321	0.3245	0.2868	0.2868	0.2792	0.3019	0.3245	0.3396	0.3547 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5741	0.5712	0.5684	0.5551	0.5527	0.5411	0.5411	0.5390	0.5456	0.5527	0.5577	0.5629 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)					
Solid Doors			1.9500	1.0000	1.9500			(26)					
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)					
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)					
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)					
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400	(30)					
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)					
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400	(30)					
Total net area of external elements Aum(A, m2)			348.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609			(33)					
GF			110.0000			9.0000	990.0000	(32c)					
FF			130.0000			9.0000	1170.0000	(32c)					
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)					
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E12 Gable (insulation at ceiling level)				14.9500	0.0600	0.8970							
E10 Eaves (insulation at ceiling level)				26.1800	0.0600	1.5708							
E14 Flat roof				2.7200	0.0800	0.2176							
E16 Corner (normal)				39.6000	0.0900	3.5640							
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900	-1.7640							
E2 Other lintels (including other steel lintels)				25.4000	0.0500	1.2700							
E3 Sill				24.4700	0.0500	1.2235							
E4 Jamb				57.9000	0.0500	2.8950							
E5 Ground floor (normal)				39.3700	0.1600	6.2992							
E6 Intermediate floor within a dwelling				38.4100	0.0000	0.0000							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1731	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	104.3340	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 72.0599	Feb 71.6989	Mar 71.3450	Apr 69.6827	May 69.3716	Jun 67.9238	Jul 67.9238	Aug 67.6557	Sep 68.4815	Oct 69.3716	Nov 70.0008	Dec 70.6586	(38)
Heat transfer coeff	176.3939	176.0328	175.6789	174.0166	173.7056	172.2578	172.2578	171.9897	172.8155	173.7056	174.3348	174.9926	(39)
Average = Sum(39)m / 12 =												174.0151	
HLP	Jan 1.1587	Feb 1.1564	Mar 1.1540	Apr 1.1431	May 1.1411	Jun 1.1316	Jul 1.1316	Aug 1.1298	Sep 1.1352	Oct 1.1411	Nov 1.1452	Dec 1.1495	(40)
HLP (average)												1.1431	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9376 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hot water usage for other uses	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122 (42b)
Average daily hot water use (litres/day)	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141 (42c)
												70.0581 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	76.4336	74.3365	72.0472	69.1980	66.6562	64.0147	63.4661	65.7508	68.0940	70.8067	73.6810	76.3263 (44)
Energy content (annual)	121.0521	105.8542	110.7338	94.7287	89.7321	78.7135	76.7568	81.4132	83.9667	96.0840	104.9721	119.5086 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1163.5157
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823 (64)

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12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =										988.9883 (64)
Electric shower(s)	989 (64)										
58.8404	52.4273	57.2486	54.6316	55.6568	53.0912	54.8609	55.6568	54.6316	57.2486	56.1721	58.8404 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =										669.3063 (64a)	
Heat gains from water heating, kWh/month	40.4337	35.6008	37.8431	33.7878	32.9823	29.9994	30.0260	31.2145	31.5008	34.7300	36.3496 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.8850	180.3370	162.8850	168.3145	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	54.3463	52.9774	50.8644	46.9274	44.3310	41.6658	40.3576	41.9550	43.7512	46.6801	50.4855	53.9055	(72)
Total internal gains	607.2334	626.6675	598.6579	582.1728	551.4534	532.8891	511.9024	510.1487	525.8191	541.2961	573.2245	592.5436	(73)

6. Solar gains

[Jan]													Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W		

North														9.8400	10.6334	0.6300		0.7000		0.7700		31.9771 (74)			
East														5.8000	19.6403	0.6300		0.7000		0.7700		34.8135 (76)			
South														13.8100	46.7521	0.6300		0.7000		0.7700		197.3178 (78)			
West														6.4700	19.6403	0.6300		0.7000		0.7700		38.8350 (80)			

Solar gains														302.9434	528.3376	752.7497	978.0790	1133.5858	1141.2278	1093.7400	975.8987	830.8101	592.2506	365.1677	257.7233 (83)
Total gains														910.1767	1155.0051	1351.4076	1560.2519	1685.0392	1674.1169	1605.6424	1486.0475	1356.6291	1133.5467	938.3922	850.2670 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.9994	19.0384	19.0767	19.2589	19.2934	19.4556	19.4556	19.4859	19.3928	19.2934	19.2238	19.1515
alpha	2.2666	2.2692	2.2718	2.2839	2.2862	2.2970	2.2970	2.2991	2.2929	2.2862	2.2816	2.2768
util living area	0.9507	0.9184	0.8728	0.7915	0.6809	0.5433	0.4235	0.4656	0.6503	0.8362	0.9264	0.9571 (86)
MIT	17.8267	18.2925	18.9098	19.6637	20.2810	20.7027	20.8799	20.8469	20.5224	19.6812	18.6171	17.7453 (87)
Th 2	19.9532	19.9551	19.9569	19.9658	19.9674	19.9751	19.9751	19.9766	19.9722	19.9674	19.9641	19.9606 (88)
util rest of house	0.9443	0.9082	0.8568	0.7648	0.6385	0.4792	0.3389	0.3802	0.5907	0.8090	0.9155	0.9515 (89)
MIT 2	17.0526	17.5105	18.1137	18.8418	19.4141	19.7844	19.9177	19.8991	19.6435	18.8767	17.8424	16.9770 (90)
Living area fraction	FLA = Living area / (4) =											0.1378 (91)
MIT	17.1593	17.6183	18.2234	18.9551	19.5336	19.9109	20.0503	20.0298	19.7646	18.9876	17.9492	17.0829 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1593	17.6183	18.2234	18.9551	19.5336	19.9109	20.0503	20.0298	19.7646	18.9876	17.9492	17.0829 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9204	0.8782	0.8235	0.7343	0.6186	0.4748	0.3454	0.3849	0.5772	0.7774	0.8868	0.9295 (94)
Useful gains	837.7251	1014.3145	1112.9020	1145.6512	1042.3977	794.9543	554.6615	571.9965	783.0689	881.1840	832.2059	790.2968 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2268.3047	2238.8394	2059.5504	1749.7472	1360.7334	914.8521	594.3391	624.2807	978.9330	1456.9714	1891.3874	2254.4128 (97)
Space heating kWh	1064.3512	822.8808	704.3064	434.9492	236.8418	0.0000	0.0000	0.0000	0.0000	428.3858	762.6107	1089.3024 (98a)
Space heating requirement - total per year (kWh/year)											5543.6281	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)											0.0000	
Space heating kWh	1064.3512	822.8808	704.3064	434.9492	236.8418	0.0000	0.0000	0.0000	0.0000	428.3858	762.6107	1089.3024 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											5543.6281	
Space heating per m2											(98c) / (4) =	36.4161 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1619.2232	1274.7076	1307.1215	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7478	0.8070	0.7773	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1210.9343	1028.6531	1016.0142	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1885.9933	1809.0606	1672.5372	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	486.0424	580.6232	488.4531	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =										1.0000 (105)	
Intermittency factor (Table 10b)												

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Space cooling kWh	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	121.5106	145.1558	122.1133	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												388.7797 (107)
Energy for space cooling												36.4161 (99)
Total												2.5539 (108)
Fabric Energy Efficiency (DFEE)												38.9700 (109)
												39.0 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

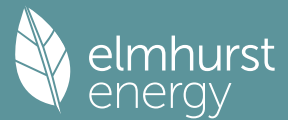
2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	
Pressure test	40.0000 / (5) =	
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	
Infiltration rate	5.0000 (17)	
Number of sides sheltered	0.3552 (18)	
	2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	
	0.8500 (20)	
	0.3019 (21)	
Wind speed	Jan 5.1000	Feb 5.0000
Wind factor	Mar 4.9000	Apr 4.4000
Adj infilt rate	May 4.3000	Jun 3.8000
	Jul 3.8000	Aug 3.7000
	Sep 4.0000	Oct 4.3000
	Nov 4.5000	Dec 4.7000 (22)
	1.2750	1.2500
	1.2250	1.1000
	0.3849	0.3774
	0.3698	0.3321
	0.3245	0.2868
	0.2868	0.2792
	0.3019	0.3245
	0.3396	0.3547 (22b)
		0.0000 (23b)
		0.0000 (23c)
		0.5629 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			35.9200	1.1450	41.1298		(27)
Ground Floor			77.0400	0.1300	10.0152		(28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692		(29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450		(29a)
Joists GF	0.9600		0.9600	0.1100	0.1056		(30)
Joists FF	75.1100		75.1100	0.1100	8.2621		(30)
Flat	0.9600		0.9600	0.1100	0.1056		(30)
Total net area of external elements Aum(A, m ²)			348.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.6825		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.2547 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				14.9500	0.0600	0.8970	
E10 Eaves (insulation at ceiling level)				26.1800	0.0600	1.5708	
E14 Flat roof				2.7200	0.0800	0.2176	
E16 Corner (normal)				39.6000	0.0900	3.5640	
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900	-1.7640	
E2 Other lintels (including other steel lintels)				25.4000	0.0500	1.2700	
E3 Sill				24.4700	0.0500	1.2235	
E4 Jamb				57.9000	0.0500	2.8950	
E5 Ground floor (normal)				39.3700	0.1600	6.2992	
E6 Intermediate floor within a dwelling				38.4100	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						16.1731 (36)	
Point Thermal bridges						0.0000	
Total fabric heat loss					(33) + (36) + (36a) =	105.8556 (37)	
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	Jan 72.0599	Feb 71.6989	Mar 71.3450	Apr 69.6827	May 69.3716	Jun 67.9238	Jul 67.9238
Heat transfer coeff	Aug 67.6557	Sep 68.4815	Oct 69.3716	Nov 70.0008	Dec 70.6586 (38)		

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Average = Sum(39)m / 12 =	177.9155	177.5544	177.2005	175.5382	175.2272	173.7794	173.7794	173.5113	174.3371	175.2272	175.8564	176.5142 (39)
	175.5367											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1687	1.1664	1.1640	1.1531	1.1511	1.1416	1.1416	1.1398	1.1452	1.1511	1.1552	1.1595 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9376 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122 (42b)
Hot water usage for other uses	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141 (42c)
Average daily hot water use (litres/day)												70.0581 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	76.4336	74.3365	72.0472	69.1980	66.6562	64.0147	63.4661	65.7508	68.0940	70.8067	73.6810	76.3263 (44)
Energy conte	121.0521	105.8542	110.7338	94.7287	89.7321	78.7135	76.7568	81.4132	83.9667	96.0840	104.9721	119.5086 (45)
Energy content (annual)												1163.5157
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823 (64)
12Total per year (kWh/year)												988.9883 (64)
Electric shower(s)	58.8404	52.4273	57.2486	54.6316	55.6568	53.0912	54.8609	55.6568	54.6316	57.2486	56.1721	58.8404 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												669.3063 (64a)
Heat gains from water heating, kWh/month	40.4337	35.6008	37.8431	33.7878	32.9823	29.9994	30.0260	31.2145	31.5008	34.7300	36.3496	40.1057 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.8850	180.3370	162.8850	168.3145	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046 (71)
Water heating gains (Table 5)	54.3463	52.9774	50.8644	46.9274	44.3310	41.6658	40.3576	41.9550	43.7512	46.6801	50.4855	53.9055 (72)
Total internal gains	607.2334	626.6675	598.6579	582.1728	551.4534	532.8891	511.9024	510.1487	525.8191	541.2961	573.2245	592.5436 (73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	9.8400				10.6334		0.6300		0.7000		0.7700		31.9771 (74)	
East	5.8000				19.6403		0.6300		0.7000		0.7700		34.8135 (76)	
South	13.8100				46.7521		0.6300		0.7000		0.7700		197.3178 (78)	
West	6.4700				19.6403		0.6300		0.7000		0.7700		38.8350 (80)	
Solar gains	302.9434	528.3376	752.7497	978.0790	1133.5858	1141.2278	1093.7400	975.8987	830.8101	592.2506	365.1677	257.7233	(83)	
Total gains	910.1767	1155.0051	1351.4076	1560.2519	1685.0392	1674.1169	1605.6424	1486.0475	1356.6291	1133.5467	938.3922	850.2670	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.8369	18.8752	18.9129	19.0920	19.1259	19.2852	19.2852	19.3150	19.2235	19.1259	19.0575	18.9864
alpha	2.2558	2.2583	2.2609	2.2728	2.2751	2.2857	2.2857	2.2877	2.2816	2.2751	2.2705	2.2658
util living area	0.9509	0.9188	0.8735	0.7929	0.6830	0.5459	0.4261	0.4682	0.6525	0.8373	0.9267	0.9572 (86)
MIT	17.8007	18.2666	18.8859	19.6441	20.2675	20.6954	20.8764	20.8426	20.5128	19.6640	18.5946	17.7193 (87)
Th 2	19.9451	19.9470	19.9489	19.9577	19.9593	19.9670	19.9670	19.9685	19.9641	19.9593	19.9560	19.9525 (88)
util rest of house	0.9445	0.9086	0.8575	0.7661	0.6404	0.4812	0.3405	0.3819	0.5926	0.8101	0.9158	0.9516 (89)
MIT 2	17.0222	17.4801	18.0854	18.8178	19.3960	19.7719	19.9081	19.8891	19.6291	18.8551	17.8154	16.9465 (90)

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Living area fraction										fLA = Living area / (4) =	0.1378 (91)
MIT	17.1295	17.5885	18.1957	18.9317	19.5161	19.8992	20.0415	20.0205	19.7509	18.9666	17.9228 (92)
Temperature adjustment											0.0000
adjusted MIT	17.1295	17.5885	18.1957	18.9317	19.5161	19.8992	20.0415	20.0205	19.7509	18.9666	17.9228 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9204	0.8784	0.8240	0.7353	0.6201	0.4766	0.3470	0.3866	0.5788	0.7781	0.8870	0.9295	(94)
Useful gains	837.7702	1014.5971	1113.6131	1147.2157	1044.9215	797.9476	557.2017	574.4428	785.1802	882.0242	832.3885	790.3100	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2282.5618	2252.8987	2072.4880	1760.9411	1369.5925	920.8878	598.0626	628.1994	985.1640	1466.0518	1903.2649	2268.7311	(97)
Space heating kWh	1074.9249	832.1387	713.4030	441.8823	241.5552	0.0000	0.0000	0.0000	0.0000	434.5165	771.0310	1099.9453	(98a)
Space heating requirement - total per year (kWh/year)												5609.3970	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1074.9249	832.1387	713.4030	441.8823	241.5552	0.0000	0.0000	0.0000	0.0000	434.5165	771.0310	1099.9453	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5609.3970	
Space heating per m2												(98c) / (4) =	36.8482 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1633.5263	1285.9675	1318.6857	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7439	0.8034	0.7735	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1215.1975	1033.1582	1020.0126	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1885.9933	1809.0606	1672.5372	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	482.9729	577.2714	485.4783	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	120.7432	144.3179	121.3696	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												386.4307	(107)
Energy for space heating												36.8482	(99)
Energy for space cooling												2.5385	(108)
Total												39.3866	(109)
Fabric Energy Efficiency (TFEE)												39.4	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)	
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	380.3740 (5)	

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	1 * 10 =	10.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		60.0000 / (5) = 0.1577 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.4077 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3466 (21)
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000
Wind factor	1.2750	1.2500	1.2250
Adj infilt rate	1.2750	1.2500	1.2250

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Effective ac	0.4419	0.4332	0.4246	0.3812	0.3726	0.3292	0.3292	0.3206	0.3466	0.3726	0.3899	0.4072 (22b)
	0.5976	0.5938	0.5901	0.5727	0.5694	0.5542	0.5542	0.5514	0.5601	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)					
Solid Doors			1.9500	1.0000	1.9500			(26)					
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)					
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)					
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)					
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400	(30)					
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)					
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400	(30)					
Total net area of external elements Aum(A, m2)			348.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609			(33)					
GF			110.0000			9.0000	990.0000	(32c)					
FF			130.0000			9.0000	1170.0000	(32c)					
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)					
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E12 Gable (insulation at ceiling level)				14.9500	0.0600		0.8970						
E10 Eaves (insulation at ceiling level)				26.1800	0.0600		1.5708						
E14 Flat roof				2.7200	0.0800		0.2176						
E16 Corner (normal)				39.6000	0.0900		3.5640						
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900		-1.7640						
E2 Other lintels (including other steel lintels)				25.4000	0.0500		1.2700						
E3 Sill				24.4700	0.0500		1.2235						
E4 Jamb				57.9000	0.0500		2.8950						
E5 Ground floor (normal)				39.3700	0.1600		6.2992						
E6 Intermediate floor within a dwelling				38.4100	0.0000		0.0000						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.1731 (36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	104.3340	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 75.0169	Feb 74.5410	Mar 74.0745	Apr 71.8836	May 71.4737	Jun 69.5654	Jul 69.5654	Aug 69.2120	Sep 70.3004	Oct 71.4737	Nov 72.3029	Dec 73.1699	(38)
Heat transfer coeff	179.3508	178.8749	178.4085	176.2175	175.8076	173.8994	173.8994	173.5460	174.6344	175.8076	176.6369	177.5038	(39)
Average = Sum(39)m / 12 =												176.2156	
HLP	Jan 1.1782	Feb 1.1750	Mar 1.1720	Apr 1.1576	May 1.1549	Jun 1.1423	Jul 1.1423	Aug 1.1400	Sep 1.1472	Oct 1.1549	Nov 1.1603	Dec 1.1660	(40)
HLP (average)												1.1576	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9376 (42)
Hot water usage for mixer showers													
	91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906	(42a)
Hot water usage for baths													
	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	(42b)
Hot water usage for other uses													
	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	(42c)
Average daily hot water use (litres/day)												154.7338	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169	(44)
Energy conte	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607	(45)
Energy content (annual)										Total = Sum(45)m =		2570.1301	
Distribution loss (46)m = 0.15 x (45)m													
	39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141	(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
	134.1940	119.1973	127.6011	114.1162	112.0138	102.4158	101.9836	105.0890	105.2309	115.6003	120.8466	132.9480	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	180.3683	177.3769	171.5068	158.4947	150.5562	142.2441	137.0748	141.2486	146.1541	155.3768	167.8425	178.6935	(72)
Total internal gains	819.2424	816.8293	791.7934	745.0068	697.7350	652.0701	626.7333	630.3289	654.4003	700.3975	752.1965	797.4003	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					9.8400	10.6334		0.6300	0.7000	0.7700		31.9771 (74)	
East					5.8000	19.6403		0.6300	0.7000	0.7700		34.8135 (76)	
South					13.8100	46.7521		0.6300	0.7000	0.7700		197.3178 (78)	
West					6.4700	19.6403		0.6300	0.7000	0.7700		38.8350 (80)	
Solar gains	302.9434	528.3376	752.7497	978.0790	1133.5858	1141.2278	1093.7400	975.8987	830.8101	592.2506	365.1677	257.7233 (83)	
Total gains	1122.1858	1345.1669	1544.5431	1723.0858	1831.3207	1793.2979	1720.4734	1606.2277	1485.2103	1292.6482	1117.3642	1055.1236 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
tau	18.6861	18.7359	18.7848	19.0184	19.0627	19.2719	19.2719	19.3112	19.1908	19.0627	18.9732	18.8806		
alpha	2.2457	2.2491	2.2523	2.2679	2.2708	2.2848	2.2848	2.2874	2.2794	2.2708	2.2649	2.2587		
util living area	0.9281	0.8950	0.8449	0.7640	0.6541	0.5206	0.4030	0.4409	0.6198	0.8034	0.9008	0.9360	(86)	
MIT	18.0427	18.4599	19.0548	19.7551	20.3321	20.7246	20.8899	20.8614	20.5641	19.7934	18.7916	17.9666	(87)	
Th 2	19.9375	19.9400	19.9425	19.9541	19.9563	19.9664	19.9664	19.9683	19.9625	19.9563	19.9519	19.9473	(88)	
util rest of house	0.9192	0.8825	0.8264	0.7353	0.6105	0.4568	0.3206	0.3575	0.5592	0.7728	0.8869	0.9281	(89)	
MIT 2	16.4961	17.0186	17.7594	18.6214	19.3028	19.7419	19.8997	19.8796	19.5826	18.6906	17.4509	16.4051	(90)	
Living area fraction														
MIT	16.7092	17.2173	17.9380	18.7776	19.4446	19.8774	20.0361	20.0149	19.7179	18.8426	17.6357	16.6203	(92)	
Temperature adjustment												0.0000		
adjusted MIT	16.7092	17.2173	17.9380	18.7776	19.4446	19.8774	20.0361	20.0149	19.7179	18.8426	17.6357	16.6203	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8805	0.8393	0.7821	0.6975	0.5868	0.4510	0.3264	0.3615	0.5433	0.7329	0.8448	0.8915	(94)
Useful gains	988.1229	1128.9484	1208.0048	1201.8464	1074.5313	808.6880	561.6190	580.7231	806.9681	947.3531	943.9650	940.6097	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2225.6071	2203.2528	2040.6321	1740.6125	1361.5623	917.7301	597.5438	627.3586	981.0730	1449.1111	1860.9956	2204.6453	(97)
Space heating kWh	920.6882	721.9326	619.4747	387.9116	213.5510	0.0000	0.0000	0.0000	0.0000	373.3079	660.2620	940.4425	(98a)
Space heating requirement - total per year (kWh/year)												4837.5705	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	920.6882	721.9326	619.4747	387.9116	213.5510	0.0000	0.0000	0.0000	0.0000	373.3079	660.2620	940.4425	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4837.5705	
Space heating per m ²										(98c) / (4) =		31.7780	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													65.0000	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	920.6882	721.9326	619.4747	387.9116	213.5510	0.0000	0.0000	0.0000	0.0000	373.3079	660.2620	940.4425	(98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating fuel (main heating system)	368.4227	288.8886	247.8890	155.2267	85.4546	0.0000	0.0000	0.0000	0.0000	149.3829	264.2105	376.3275	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(64)	
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
Fuel for water heating, kWh/month													(217)	

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	184.7420	163.4110	173.4179	151.7321	146.6453	131.6355	129.4174	134.7511	136.4708	152.8055	163.2922	182.6018	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1935.8025	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1850.9226	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												279.4701	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												4066.1952	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1935.8025	16.4900	319.2138	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1850.9226	16.4900	305.2171	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	279.4701	16.4900	46.0846	(250)
Additional standing charges			0.0000	(251)
Total energy cost			670.5156	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2239	(257)
SAP value		80.1609	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1935.8025	0.1546	299.2328	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1850.9226	0.1410	260.9524	(264)
Space and water heating			560.1852	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	279.4701	0.1443	40.3362	(268)
Total CO2, kg/year			600.5214	(272)
CO2 emissions per m2			3.9400	(273)
EI value			95.9200	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	77.1200 (1b)	x	2.4000 (2b)	=	185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x	2.6000 (2c)	=	195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300				(4)

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Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 380.3740 (5)

2. Ventilation rate

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		1 * 10 =	10.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		5 * 10 =	50.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1577	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.4077	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3466	(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000
Adj infilt rate												
	0.3119	0.2859	0.2773	0.2773	0.2859	0.2513	0.2686	0.2426	0.2426	0.2599	0.2426	0.2773
Effective ac	0.5486	0.5409	0.5384	0.5384	0.5409	0.5316	0.5361	0.5294	0.5294	0.5338	0.5294	0.5384

3. Heat losses and heat loss parameter

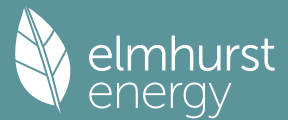
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400	(30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400	(30)
Total net area of external elements Aum(A, m2)			348.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		88.1609			(33)
GF			110.0000			9.0000	990.0000	(32c)
FF			130.0000			9.0000	1170.0000	(32c)
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) = 12064.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								79.2547 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E12 Gable (insulation at ceiling level)				14.9500	0.0600	0.8970		
E10 Eaves (insulation at ceiling level)				26.1800	0.0600	1.5708		
E14 Flat roof				2.7200	0.0800	0.2176		
E16 Corner (normal)				39.6000	0.0900	3.5640		
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900	-1.7640		
E2 Other lintels (including other steel lintels)				25.4000	0.0500	1.2700		
E3 Sill				24.4700	0.0500	1.2235		
E4 Jamb				57.9000	0.0500	2.8950		
E5 Ground floor (normal)				39.3700	0.1600	6.2992		
E6 Intermediate floor within a dwelling				38.4100	0.0000	0.0000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1731	(36)
Point Thermal bridges							(36a) =	0.0000
Total fabric heat loss							(33) + (36) + (36a) =	104.3340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	68.8681	67.8928	67.5865	67.5865	67.8928	66.7243	67.2897	66.4557	66.4557	67.0022	66.4557	67.5865
Heat transfer coeff	173.2021	172.2267	171.9205	171.9205	172.2267	171.0582	171.6236	170.7897	170.7897	171.3362	170.7897	171.9205
Average = Sum(39)m / 12 =												171.6503
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1378	1.1314	1.1293	1.1293	1.1314	1.1237	1.1274	1.1219	1.1219	1.1255	1.1219	1.1293
HLP (average)												1.1276
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9376 (42)
Hot water usage for mixer showers												
	91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906
Hot water usage for baths	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122
Hot water usage for other uses	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141
Average daily hot water use (litres/day)												154.7338
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169
Energy conte	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607
Energy content (annual)										Total = Sum(45)m =		2570.1301

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Distribution loss (46)m = 0.15 x (45)m												
39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141	(46)
Water storage loss:												
Store volume											250.0000	(47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)											0.0103	(51)
Volume factor from Table 2a											0.7830	(52)
Temperature factor from Table 2b											0.5400	(53)
Enter (49) or (54) in (55)											1.0875	(55)
Total storage loss												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000	(64a)
Heat gains from water heating, kWh/month												
134.1940	119.1973	127.6011	114.1162	112.0138	102.4158	101.9836	105.0890	105.2309	115.6003	120.8466	132.9480	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)												
180.3683	177.3769	171.5068	158.4947	150.5562	142.2441	137.0748	141.2486	146.1541	155.3768	167.8425	178.6935	(72)
Total internal gains												
819.2424	816.8293	791.7934	745.0068	697.7350	652.0701	626.7333	630.3289	654.4003	700.3975	752.1965	797.4003	(73)

6. Solar gains

[Jan]												Gains	
						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			W
North						9.8400	13.0723	0.6300	0.7000	0.7700			39.3114 (74)
East						5.8000	24.4329	0.6300	0.7000	0.7700			43.3086 (76)
South						13.8100	54.9219	0.6300	0.7000	0.7700			231.7988 (78)
West						6.4700	24.4329	0.6300	0.7000	0.7700			48.3115 (80)
Solar gains	362.7303	555.4650	785.9603	1060.1855	1201.8237	1312.9471	1232.3026	1106.3415	928.9679	664.0606	438.6982	300.9047	(83)
Total gains	1181.9727	1372.2943	1577.7537	1805.1923	1899.5586	1965.0173	1859.0360	1736.6705	1583.3682	1364.4581	1190.8947	1098.3050	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.3495	19.4591	19.4938	19.4938	19.4591	19.5920	19.5275	19.6228	19.6228	19.5602	19.6228	19.4938
alpha	2.2900	2.2973	2.2996	2.2996	2.2973	2.3061	2.3018	2.3082	2.3082	2.3040	2.3082	2.2996
util living area	0.9113	0.8814	0.8209	0.7221	0.5887	0.4225	0.3143	0.3244	0.5437	0.7459	0.8706	0.9218 (86)
MIT	18.4478	18.7488	19.3639	20.0136	20.5467	20.8553	20.9482	20.9467	20.7200	20.1367	19.2212	18.3706 (87)
Th 2	19.9701	19.9753	19.9769	19.9769	19.9753	19.9815	19.9785	19.9830	19.9830	19.9801	19.9830	19.9769 (88)
util rest of house	0.9003	0.8674	0.7997	0.6894	0.5388	0.3548	0.2313	0.2370	0.4766	0.7066	0.8524	0.9119 (89)
MIT 2	17.0221	17.3982	18.1598	18.9428	19.5554	19.8776	19.9538	19.9582	19.7576	19.1127	18.0023	16.9300 (90)
Living area fraction									fLA = Living area / (4) =			0.1378 (91)
MIT	17.2186	17.5843	18.3258	19.0904	19.6920	20.0123	20.0908	20.0944	19.8902	19.2538	18.1703	17.1285 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2186	17.5843	18.3258	19.0904	19.6920	20.0123	20.0908	20.0944	19.8902	19.2538	18.1703	17.1285 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8600	0.8248	0.7580	0.6572	0.5239	0.3569	0.2408	0.2469	0.4700	0.6740	0.8101	0.8734 (94)
Useful gains	1016.4943	1131.8230	1195.8633	1186.3009	995.0880	701.3396	447.5946	428.8379	744.1410	919.5902	964.7761	959.2423 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W												
2081.6389	2081.2397	1895.5585	1614.3973	1186.9838	754.7665	461.8054	443.0963	852.2782	1277.1137	1702.8182	2050.7598	(97)
Space heating kWh												
792.4675	638.0080	520.5732	308.2295	142.7704	0.0000	0.0000	0.0000	0.0000	265.9975	531.3903	812.0890	(98a)
Space heating requirement - total per year (kWh/year)												4011.5255
Solar heating kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000

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Space heating kWh	792.4675	638.0080	520.5732	308.2295	142.7704	0.0000	0.0000	0.0000	0.0000	265.9975	531.3903	812.0890 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4011.5255
Space heating per m2												(98c) / (4) = 26.3517 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	792.4675	638.0080	520.5732	308.2295	142.7704	0.0000	0.0000	0.0000	0.0000	265.9975	531.3903	812.0890 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	317.1139	255.3053	208.3126	123.3411	57.1310	0.0000	0.0000	0.0000	0.0000	106.4416	212.6412	324.9656 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	184.7420	163.4110	173.4179	151.7321	146.6453	131.6355	129.4174	134.7511	136.4708	152.8055	163.2922	182.6018 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1605.2523 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1850.9226 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												279.4701 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3735.6450 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1605.2523	26.0600	418.3287 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1850.9226	26.0600	482.3504 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	279.4701	26.0600	72.8299 (250)
Additional standing charges			0.0000 (251)
Total energy cost			973.5091 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1605.2523	0.1552	249.1436 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1850.9226	0.1410	260.9524 (264)
Space and water heating			510.0960 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	279.4701	0.1443	40.3362 (268)
Total CO2, kg/year			550.4322 (272)

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13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	1605.2523	1.5746	2527.6456 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1850.9226	1.5213	2815.8381 (278)
Space and water heating			5343.4838 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	279.4701	1.5338	428.6606 (282)
Total Primary energy kWh/year			5772.1443 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO ₂ change
N Solar water heating	+ 1.6	-£ 103	-49 kg (8.9%)
U Solar photovoltaic panels	+ 4.7	-£ 267	-138 kg (27.5%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£103	0.32 kg/m ²	B 82 A 96
Solar photovoltaic panels	£267	0.90 kg/m ²	B 86 A 97
Total Savings	£370	1.23 kg/m ²	

Potential energy efficiency rating: B 86
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £974	Potential £871	Saving £103
Electricity			
Space heating	£418	£440	-£21
Water heating	£482	£358	£124
Lighting	£73	£73	£0
Generated (PV)	-£0	-£267	£267
Total cost of fuels	£974	£604	£370
Total cost of uses	£973	£604	£370
Delivered energy	25 kWh/m ²	15 kWh/m ²	9 kWh/m ²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO ₂ emissions per m ²	4 kg/m ²	2 kg/m ²	1 kg/m ²
Primary energy	38 kWh/m ²	24 kWh/m ²	14 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

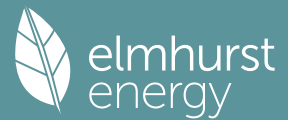
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c)	60.0000 / (5) = 0.1577 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.4077 (18)
2 (19)

Shelter factor

Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 (20)$$

$$(21) = (18) \times (20) = 0.3466 (21)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4419	0.4332	0.4246	0.3812	0.3726	0.3292	0.3292	0.3206	0.3466	0.3726	0.3899	0.4072	(22b)
Effective ac	0.5976	0.5938	0.5901	0.5727	0.5694	0.5542	0.5542	0.5514	0.5601	0.5694	0.5760	0.5829	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)
Joists GF			0.9600	0.1100	0.1056	9.0000	8.6400	(30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)
Flat			0.9600	0.1300	0.1248	9.0000	8.6400	(30)
Total net area of external elements Aum(A, m2)			348.1300					(31)
Fabric heat loss, W/K = Sum (A x U)					88.1609			(33)
GF			110.0000			9.0000	990.0000	(32c)
FF			130.0000			9.0000	1170.0000	(32c)
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)

Heat capacity Cm = Sum(A x k)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	14.9500	0.0600	0.8970	
E10 Eaves (insulation at ceiling level)	26.1800	0.0600	1.5708	
E14 Flat roof	2.7200	0.0800	0.2176	
E16 Corner (normal)	39.6000	0.0900	3.5640	
E17 Corner (inverted - internal area greater than external area)	19.6000	-0.0900	-1.7640	
E2 Other lintels (including other steel lintels)	25.4000	0.0500	1.2700	
E3 Sill	24.4700	0.0500	1.2235	
E4 Jamb	57.9000	0.0500	2.8950	
E5 Ground floor (normal)	39.3700	0.1600	6.2992	
E6 Intermediate floor within a dwelling	38.4100	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.1731	(36)
Point Thermal bridges			0.0000	(36a)
Total fabric heat loss			104.3340	(33) + (36) + (36a) = (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	75.0169	74.5410	74.0745	71.8836	71.4737	69.5654	69.5654	69.2120	70.3004	71.4737	72.3029	73.1699	(38)
Heat transfer coeff	179.3508	178.8749	178.4085	176.2175	175.8076	173.8994	173.8994	173.5460	174.6344	175.8076	176.6369	177.5038	(39)
Average = Sum(39)m / 12 =												176.2156	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1782	1.1750	1.1720	1.1576	1.1549	1.1423	1.1423	1.1400	1.1472	1.1549	1.1603	1.1660	(40)
HLP (average)												1.1576	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9376 (42)
Hot water usage for mixer showers													
91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906		(42a)
Hot water usage for baths													
31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122		(42b)
Hot water usage for other uses													
44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141		(42c)
Average daily hot water use (litres/day)												154.7338	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169	(44)
Energy conte	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141		(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127		(56)
If cylinder contains dedicated solar storage													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127		(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
323.4832	286.1326	302.2591	258.9293	243.9816	217.8870	213.5830	223.8528	233.5575	266.1667	285.9247	319.7358		(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)

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Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												645.6697	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												645.6697	
Solar input	-0.0000	-16.1744	-59.5270	-82.8499	-109.6591	-101.3233	-100.7026	-87.2595	-59.3262	-28.8476	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	323.4832	269.9582	242.7320	176.0794	134.3224	116.5637	112.8804	136.5933	174.2313	237.3191	285.9247	319.7358	(64)
												2529.8234	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month	134.1940	119.1973	126.4845	108.7133	101.7784	92.3304	91.5621	95.4118	100.9086	114.4837	120.8466	132.9480	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	180.3683	177.3769	170.0060	150.9907	136.7989	128.2367	123.0673	128.2417	140.1509	153.8760	167.8425	178.6935	(72)
Total internal gains	819.2424	816.8293	790.2926	737.5028	683.9776	638.0627	612.7259	617.3220	648.3971	698.8967	752.1965	797.4003	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	

North					9.8400	10.6334		0.6300	0.7000		0.7700		31.9771 (74)	
East					5.8000	19.6403		0.6300	0.7000		0.7700		34.8135 (76)	
South					13.8100	46.7521		0.6300	0.7000		0.7700		197.3178 (78)	
West					6.4700	19.6403		0.6300	0.7000		0.7700		38.8350 (80)	

Solar gains	302.9434	528.3376	752.7497	978.0790	1133.5858	1141.2278	1093.7400	975.8987	830.8101	592.2506	365.1677	257.7233 (83)		
Total gains	1122.1858	1345.1669	1543.0423	1715.5818	1817.5634	1779.2905	1706.4659	1593.2207	1479.2071	1291.1474	1117.3642	1055.1236 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	18.6861	18.7359	18.7848	19.0184	19.0627	19.2719	19.2719	19.3112	19.1908	19.0627	18.9732	18.8806		
alpha	2.2457	2.2491	2.2523	2.2679	2.2708	2.2848	2.2848	2.2874	2.2794	2.2708	2.2649	2.2587		
util living area	0.9281	0.8950	0.8451	0.7654	0.6568	0.5235	0.4058	0.4437	0.6213	0.8038	0.9008	0.9360	(86)	
MIT	18.0427	18.4599	19.0534	19.7499	20.3259	20.7213	20.8883	20.8595	20.5618	19.7922	18.7916	17.9666	(87)	
Th 2	19.9375	19.9400	19.9425	19.9541	19.9563	19.9664	19.9664	19.9683	19.9625	19.9563	19.9519	19.9473	(88)	
util rest of house	0.9192	0.8825	0.8266	0.7368	0.6133	0.4596	0.3229	0.3600	0.5607	0.7732	0.8869	0.9281	(89)	
MIT 2	16.4961	17.0186	17.7578	18.6154	19.2962	19.7390	19.8987	19.8783	19.5804	18.6892	17.4509	16.4051	(90)	
Living area fraction									FLA = Living area / (4) =			0.1378	(91)	
MIT	16.7092	17.2173	17.9363	18.7717	19.4381	19.8744	20.0350	20.0135	19.7156	18.8412	17.6357	16.6203	(92)	
Temperature adjustment												0.0000		
adjusted MIT	16.7092	17.2173	17.9363	18.7717	19.4381	19.8744	20.0350	20.0135	19.7156	18.8412	17.6357	16.6203	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8805	0.8393	0.7824	0.6988	0.5892	0.4535	0.3287	0.3639	0.5447	0.7332	0.8448	0.8915	(94)
Useful gains	988.1229	1128.9484	1207.2061	1198.8423	1070.9891	806.9242	560.9119	579.8446	805.7146	946.6750	943.9650	940.6097	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2225.6071	2203.2528	2040.3409	1739.5699	1360.4225	917.2178	597.3526	627.1171	980.6845	1448.8717	1860.9956	2204.6453	(97)
Space heating kWh	920.6882	721.9326	619.8523	389.3238	215.3385	0.0000	0.0000	0.0000	0.0000	373.6343	660.2620	940.4425	(98a)
Space heating requirement - total per year (kWh/year)												4841.4742	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	920.6882	721.9326	619.8523	389.3238	215.3385	0.0000	0.0000	0.0000	0.0000	373.6343	660.2620	940.4425	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4841.4742	
Space heating per m ²												31.8037	(99)

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	920.6882	721.9326	619.8523	389.3238	215.3385	0.0000	0.0000	0.0000	0.0000	373.6343	660.2620	940.4425	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	368.4227	288.8886	248.0402	155.7918	86.1698	0.0000	0.0000	0.0000	0.0000	149.5135	264.2105	376.3275	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	323.4832	269.9582	242.7320	176.0794	134.3224	116.5637	112.8804	136.5933	174.2313	237.3191	285.9247	319.7358	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	184.7420	154.1737	138.6248	100.5593	76.7118	66.5698	64.4662	78.0087	99.5039	135.5334	163.2922	182.6018	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.9669	-60.7172	-92.7974	-108.7852	-117.9593	-104.0971	-102.5408	-95.8168	-83.5804	-70.6381	-45.2074	-34.0749	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1937.3646	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1444.7878	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												279.4701	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-956.1815	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2785.4410	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1937.3646	16.4900	319.4714	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1444.7878	16.4900	238.2455	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	279.4701	16.4900	46.0846	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-956.1815	16.4900	-157.6743	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-157.6743	(252)
Total energy cost			459.3192	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF)	0.8384	(257)
SAP value	86.4098	
SAP rating (Section 12)	86	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1937.3646	0.1546	299.4489 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1444.7878	0.1449	209.3706 (264)
Space and water heating			508.8195 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	279.4701	0.1443	40.3362 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.1815	0.1342	-128.3436
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-128.3436 (269)
Total CO2, kg/year			431.9091 (272)
CO2 emissions per m2			2.8400 (273)
EI value			97.0656
EI rating			97 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.1577 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4077 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3466 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3119	0.2859	0.2773	0.2773	0.2859	0.2513	0.2686	0.2426	0.2426	0.2599	0.2426	0.2773 (22b)
Effective ac	0.5486	0.5409	0.5384	0.5384	0.5409	0.5316	0.5361	0.5294	0.5294	0.5338	0.5294	0.5384 (25)

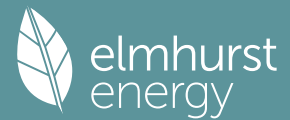
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			35.9200	1.1450	41.1298		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000 (28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600 (29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500 (29a)
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400 (30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900 (30)
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400 (30)
Total net area of external elements Aum(A, m2)			348.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609		(33)
GF			110.0000			9.0000	990.0000 (32c)
FF			130.0000			9.0000	1170.0000 (32c)
Internal Floor 1			75.1100			18.0000	1351.9800 (32d)
Internal Ceiling 1			75.1100			9.0000	675.9900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	14.9500	0.0600	0.8970
E10 Eaves (insulation at ceiling level)	26.1800	0.0600	1.5708
E14 Flat roof	2.7200	0.0800	0.2176
E16 Corner (normal)	39.6000	0.0900	3.5640
E17 Corner (inverted - internal area greater than external area)	19.6000	-0.0900	-1.7640

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E2 Other lintels (including other steel lintels)	25.4000	0.0500	1.2700	
E3 Sill	24.4700	0.0500	1.2235	
E4 Jamb	57.9000	0.0500	2.8950	
E5 Ground floor (normal)	39.3700	0.1600	6.2992	
E6 Intermediate floor within a dwelling	38.4100	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.1731	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	104.3340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	68.8681	67.8928	67.5865	67.5865	67.8928	66.7243	67.2897	66.4557	66.4557	67.0022	66.4557	67.5865	(38)
Average = Sum(39)m / 12 =	173.2021	172.2267	171.9205	171.9205	172.2267	171.0582	171.6236	170.7897	170.7897	171.3362	170.7897	171.9205	(39)
												171.6503	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1378	1.1314	1.1293	1.1293	1.1314	1.1237	1.1274	1.1219	1.1219	1.1255	1.1219	1.1293	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9376	(42)
Hot water usage for mixer showers														
Hot water usage for baths	91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906	(42a)	
Hot water usage for other uses	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	(42b)	
Average daily hot water use (litres/day)	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	(42c)	
												154.7338	(43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy content (annual)	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169	(44)	
Distribution loss (46)m = 0.15 x (45)m	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607	(45)	
Water storage loss:														
Store volume	39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141	(46)	
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.7830	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)	
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	323.4832	286.1326	302.2591	258.9293	243.9816	217.8870	213.5830	223.8528	233.5575	266.1667	285.9247	319.7358	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Aperture area of solar collector													3.0000	(H1)
Zero-loss collector efficiency													0.8000	(H2)
Collector linear heat loss coefficient													1.8000	(H3)
Collector 2nd order heat loss coefficient													0.0000	(H4)
Collector loop efficiency													0.9000	(H5)
Incidence angle modifier													1.0000	(H6)
Overshading factor													0.8000	(H8)
Overall heat loss coefficient of system													6.5000	(H10)
Heat loss coefficient of collector loop													3.9667	(H11)
Dedicated solar storage volume													75.0000	(H12)
Effective solar volume													75.0000	(H14)
Reference volume													225.0000	(H15)
Storage tank correction coefficient													1.3161	(H16)
Heat delivered to hot water													766.9681	(H24)
Heat delivered to space heating													0.0000	(H29)
Solar input													766.9681	
Solar input	-1.7466	-20.9163	-66.5500	-94.6101	-119.5844	-120.4956	-117.0516	-104.5221	-72.9819	-40.9657	-7.5439	-0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h	321.7366	265.2163	235.7091	164.3193	124.3972	97.3914	96.5314	119.3307	160.5756	225.2009	278.3808	319.7358	(64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)	
Heat gains from water heating, kWh/month	134.1940	119.1973	126.4845	108.7133	101.7784	92.3304	91.5621	95.4118	100.9086	114.4837	120.8466	132.9480	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)	
Pumps, fans	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)	
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)	
Water heating gains (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)	
Total internal gains	180.3683	177.3769	170.0060	150.9907	136.7989	128.2367	123.0673	128.2417	140.1509	153.8760	167.8425	178.6935	(72)	
	819.2424	816.8293	790.2926	737.5028	683.9776	638.0627	612.7259	617.3220	648.3971	698.8967	752.1965	797.4003	(73)	

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6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d		Gains W	

North						9.8400	13.0723		0.6300	0.7000		0.7700		39.3114 (74)	
East						5.8000	24.4329		0.6300	0.7000		0.7700		43.3086 (76)	
South						13.8100	54.9219		0.6300	0.7000		0.7700		231.7988 (78)	
West						6.4700	24.4329		0.6300	0.7000		0.7700		48.3115 (80)	

Solar gains		362.7303	555.4650	785.9603	1060.1855	1201.8237	1312.9471	1232.3026	1106.3415	928.9679	664.0606	438.6982	300.9047 (83)		
Total gains		1181.9727	1372.2943	1576.2529	1797.6883	1885.8013	1951.0098	1845.0285	1723.6635	1577.3650	1362.9573	1190.8947	1098.3050 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.3495	19.4591	19.4938	19.4938	19.4591	19.5920	19.5275	19.6228	19.6228	19.5602	19.6228	19.4938
alpha	2.2900	2.2973	2.2996	2.2996	2.2973	2.3061	2.3018	2.3082	2.3082	2.3040	2.3082	2.2996
util living area	0.9113	0.8814	0.8211	0.7235	0.5914	0.4249	0.3164	0.3265	0.5452	0.7462	0.8706	0.9218 (86)
MIT	18.4478	18.7488	19.3626	20.0091	20.5421	20.8535	20.9474	20.9459	20.7184	20.1357	19.2212	18.3706 (87)
Th 2	19.9701	19.9753	19.9769	19.9769	19.9753	19.9815	19.9785	19.9830	19.9830	19.9801	19.9830	19.9769 (88)
util rest of house	0.9003	0.8674	0.7999	0.6909	0.5415	0.3570	0.2330	0.2387	0.4780	0.7070	0.8524	0.9119 (89)
MIT 2	17.0221	17.3982	18.1583	18.9378	19.5508	19.8762	19.9534	19.9578	19.7562	19.1116	18.0023	16.9300 (90)
Living area fraction	17.2186	17.5843	18.3243	19.0854	19.6874	20.0109	20.0904	20.0940	19.8888	19.2528	18.1703	17.1285 (92)
MIT	17.2186	17.5843	18.3243	19.0854	19.6874	20.0109	20.0904	20.0940	19.8888	19.2528	18.1703	17.1285 (92)
Temperature adjustment	17.2186	17.5843	18.3243	19.0854	19.6874	20.0109	20.0904	20.0940	19.8888	19.2528	18.1703	17.1285 (93)
adjusted MIT	17.2186	17.5843	18.3243	19.0854	19.6874	20.0109	20.0904	20.0940	19.8888	19.2528	18.1703	17.1285 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8600	0.8248	0.7582	0.6585	0.5263	0.3590	0.2424	0.2486	0.4712	0.6743	0.8101	0.8734 (94)
Useful gains	1016.4943	1131.8230	1195.1300	1183.7401	992.4971	700.4422	447.3105	428.5553	743.3084	919.0456	964.7761	959.2423 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	2081.6389	2081.2397	1895.3000	1613.5450	1186.1971	754.5224	461.7314	443.0226	852.0362	1276.9312	1702.8182	2050.7598 (97)
Space heating kWh	792.4675	638.0080	520.9265	309.4595	144.1128	0.0000	0.0000	0.0000	0.0000	266.2669	531.3903	812.0890 (98a)
Space heating requirement - total per year (kWh/year)												4014.7205
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	792.4675	638.0080	520.9265	309.4595	144.1128	0.0000	0.0000	0.0000	0.0000	266.2669	531.3903	812.0890 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4014.7205
Space heating per m2										(98c) / (4) =		26.3727 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	792.4675	638.0080	520.9265	309.4595	144.1128	0.0000	0.0000	0.0000	0.0000	266.2669	531.3903	812.0890	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	317.1139	255.3053	208.4540	123.8333	57.6682	0.0000	0.0000	0.0000	0.0000	106.5494	212.6412	324.9656	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	321.7366	265.2163	235.7091	164.3193	124.3972	97.3914	96.5314	119.3307	160.5756	225.2009	278.3808	319.7358	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	183.7445	151.4656	134.6140	93.8431	71.0435	55.6204	55.1293	68.1500	91.7051	128.6128	158.9839	182.6018	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-47.2626	-63.8136	-95.9377	-113.7759	-119.7937	-111.6342	-108.9214	-102.9130	-90.3334	-76.8823	-53.1131	-39.5071	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1											1606.5308	(211)
Space heating fuel - main system 2											0.0000	(213)
Space heating fuel - secondary											0.0000	(215)
Efficiency of water heater											175.1000	
Water heating fuel used											1375.5140	(219)
Space cooling fuel											0.0000	(221)

Electricity for pumps and fans:												
pump for solar water heating											80.0000	(230g)
Total electricity for the above, kWh/year											80.0000	(231)
Electricity for lighting (calculated in Appendix L)											279.4701	(232)

Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation											-1023.8881	(233)
Wind generation											0.0000	(234)
Hydro-electric generation (Appendix N)											0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)											0.0000	(235)
Appendix Q - special features												
Energy saved or generated											-0.0000	(236)
Energy used											0.0000	(237)
Total delivered energy for all uses											2317.6268	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1606.5308	26.0600	418.6619	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1375.5140	26.0600	358.4589	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	279.4701	26.0600	72.8299	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1023.8881	26.0600	-266.8252	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-266.8252	(252)
Total energy cost			603.9735	(255)

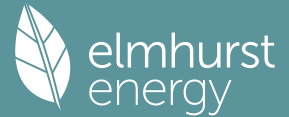
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1606.5308	0.1552	249.3212	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1375.5140	0.1457	200.4547	(264)
Space and water heating			449.7759	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	279.4701	0.1443	40.3362	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1023.8881	0.1344	-137.6242	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-137.6242	(269)
Total CO2, kg/year			363.5848	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1606.5308	1.5746	2529.5812	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1375.5140	1.5391	2117.0215	(278)
Space and water heating			4646.6027	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	279.4701	1.5338	428.6606	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1023.8881	1.4968	-1532.5143	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1532.5143	(283)
Total Primary energy kWh/year			3663.7730	(286)

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Property Reference	FURNERS LANE 22				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 22, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	4.00	TER	8.82	
Environmental	96 A	% DER < TER				54.65
CO ₂ Emissions (t/year)	0.55	DFEE	38.97	TFEE	39.39	
Compliance Check	See BREL	% DFEE < TFEE				1.06
% DPER < TPER	9.17	DPER	41.85	TPER	46.08	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

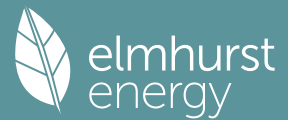
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	
Pressure test	60.0000 / (5) =	0.1577 (8)
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	5.0000 (17)
Infiltration rate		0.4077 (18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3466 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.4419	0.4332	0.4246	0.3812	0.3726	0.3292	0.3292	0.3206	0.3466	0.3726	0.3899	0.4072 (22b)
	0.5976	0.5938	0.5901	0.5727	0.5694	0.5542	0.5542	0.5514	0.5601	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			35.9200	1.1450	41.1298		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000 (28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600 (29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500 (29a)
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400 (30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900 (30)
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400 (30)
Total net area of external elements Aum(A, m ²)			348.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609		(33)
GF			110.0000			9.0000	990.0000 (32c)
FF			130.0000			9.0000	1170.0000 (32c)
Internal Floor 1			75.1100			18.0000	1351.9800 (32d)
Internal Ceiling 1			75.1100			9.0000	675.9900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.2547 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E12 Gable (insulation at ceiling level)	14.9500	0.0600	0.8970
E10 Eaves (insulation at ceiling level)	26.1800	0.0600	1.5708
E14 Flat roof	2.7200	0.0800	0.2176
E16 Corner (normal)	39.6000	0.0900	3.5640
E17 Corner (inverted - internal area greater than external area)	19.6000	-0.0900	-1.7640
E2 Other lintels (including other steel lintels)	25.4000	0.0500	1.2700
E3 Sill	24.4700	0.0500	1.2235
E4 Jamb	57.9000	0.0500	2.8950
E5 Ground floor (normal)	39.3700	0.1600	6.2992
E6 Intermediate floor within a dwelling	38.4100	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.1731 (36)
 Point Thermal bridges 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 104.3340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	75.0169	74.5410	74.0745	71.8836	71.4737	69.5654	69.5654	69.2120	70.3004	71.4737	72.3029	73.1699 (38)
Average = Sum(39)m / 12 =	179.3508	178.8749	178.4085	176.2175	175.8076	173.8994	173.8994	173.5460	174.6344	175.8076	176.6369	177.5038 (39)
												176.2156

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1782	1.1750	1.1720	1.1576	1.1549	1.1423	1.1423	1.1400	1.1472	1.1549	1.1603	1.1660 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy	2.9376 (42)											
Hot water usage for mixer showers	91.8425 90.4623 88.4510 84.6029 81.7630 78.5961 76.7960 78.7920 80.9800 84.3804 88.3112 91.4906 (42a)											
Hot water usage for baths	31.7194 31.2484 30.5850 29.3618 28.4460 27.4304 26.8818 27.5406 28.2578 29.3445 30.5928 31.6122 (42b)											
Hot water usage for other uses	44.7141 43.0881 41.4622 39.8362 38.2102 36.5843 36.5843 38.2102 39.8362 41.4622 43.0881 44.7141 (42c)											
Average daily hot water use (litres/day)	154.7338 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169 (44)
Energy content (annual)	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607 (45)
Distribution loss (46)m = 0.15 x (45)m	39.9762 35.2007 37.0020 31.5819 29.9701 26.3035 25.4452 26.8461 27.5735 31.5881 34.6181 39.4141 (46)											
Water storage loss:	250.0000 (47)											
Store volume	0.0103 (51)											
b) If manufacturer declared loss factor is not known :	0.7830 (52)											
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.5400 (53)											
Volume factor from Table 2a	1.0875 (55)											
Temperature factor from Table 2b	33.7127 30.4501 33.7127 32.6252 33.7127 32.6252 33.7127 33.7127 32.6252 33.7127 32.6252 33.7127 (56)											
Enter (49) or (54) in (55)	33.7127 30.4501 33.7127 32.6252 33.7127 32.6252 33.7127 33.7127 32.6252 33.7127 32.6252 33.7127 (57)											
Total storage loss	23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)											
If cylinder contains dedicated solar storage	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)											
Primary loss	323.4832 286.1326 303.6548 265.6829 256.7759 230.4937 226.6099 235.9493 238.9603 267.5624 285.9247 319.7358 (62)											
Combi loss	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)											
Total heat required for water heating calculated for each month	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)											
WWHRS	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)											
PV diverter	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)											
Solar input	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64)											
FGHRS	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)											
Output from w/h	323.4832 286.1326 303.6548 265.6829 256.7759 230.4937 226.6099 235.9493 238.9603 267.5624 285.9247 319.7358 (64)											
12Total per year (kWh/year)	3240.9655 (64)											
Electric shower(s)	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)											
Heat gains from water heating, kWh/month	134.1940 119.1973 127.6011 114.1162 112.0138 102.4158 101.9836 105.0890 105.2309 115.6003 120.8466 132.9480 (65)											

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts	146.8807 146.8807 146.8807 146.8807 146.8807 146.8807 146.8807 146.8807 146.8807 146.8807 146.8807 146.8807 (66)											
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.8850 180.3370 162.8850 168.3145 162.8850 168.3145 162.8850 162.8850 168.3145 162.8850 168.3145 162.8850 (67)											
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.9378 326.2889 317.8442 299.8666 277.1731 255.8445 241.5956 238.2445 246.6891 264.6667 287.3602 308.6889 (68)											
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6881 37.6881 37.6881 37.6881 37.6881 37.6881 37.6881 37.6881 37.6881 37.6881 37.6881 37.6881 (69)											
Pumps, fans	3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)											
Losses e.g. evaporation (negative values) (Table 5)	-117.5046 -117.5046 -117.5046 -117.5046 -117.5046 -117.5046 -117.5046 -117.5046 -117.5046 -117.5046 -117.5046 -117.5046 (71)											
Water heating gains (Table 5)	180.3683 177.3769 171.5068 158.4947 150.5562 142.2441 137.0748 141.2486 146.1541 155.3768 167.8425 178.6935 (72)											
Total internal gains	736.2553 754.0670 722.3003 696.7401 660.6786 633.4673 608.6196 609.4424 628.2220 652.9928 693.5814 720.3317 (73)											

6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
North	9.8400	10.6334	0.6300	0.7000	0.7700	31.9771 (74)						
East	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350 (76)						
South	13.8100	46.7521	0.6300	0.7000	0.7700	197.3178 (78)						

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West		5.8000			19.6403		0.6300		0.7000		0.7700		34.8135 (80)	
Solar gains	302.9434	528.3376	752.7497	978.0790	1133.5858	1141.2278	1093.7400	975.8987	830.8101	592.2506	365.1677	257.7233	(83)	
Total gains	1039.1987	1282.4046	1475.0500	1674.8191	1794.2644	1774.6951	1702.3596	1585.3411	1459.0320	1245.2434	1058.7492	978.0550	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.6861	18.7359	18.7848	19.0184	19.0627	19.2719	19.2719	19.3112	19.1908	19.0627	18.9732	18.8806	
alpha	2.2457	2.2491	2.2523	2.2679	2.2708	2.2848	2.2848	2.2874	2.2794	2.2708	2.2649	2.2587	
util living area	0.9374	0.9031	0.8555	0.7727	0.6614	0.5244	0.4066	0.4454	0.6264	0.8136	0.9096	0.9444	(86)
MIT	17.9408	18.3906	18.9894	19.7210	20.3153	20.7202	20.8879	20.8584	20.5539	19.7546	18.7253	17.8693	(87)
Th 2	19.9375	19.9400	19.9425	19.9541	19.9563	19.9664	19.9664	19.9683	19.9625	19.9563	19.9519	19.9473	(88)
util rest of house	0.9295	0.8913	0.8378	0.7445	0.6180	0.4605	0.3236	0.3616	0.5658	0.7839	0.8966	0.9373	(89)
MIT 2	16.3688	16.9332	17.6806	18.5820	19.2850	19.7381	19.8983	19.8775	19.5728	18.6459	17.3695	16.2832	(90)
Living area fraction	16.5854	17.1340	17.8609	18.7390	19.4270	19.8734	20.0347	20.0127	19.7080	18.7987	17.5563	16.5018	(91)
MIT	16.5854	17.1340	17.8609	18.7390	19.4270	19.8734	20.0347	20.0127	19.7080	18.7987	17.5563	16.5018	(92)
Temperature adjustment	16.5854	17.1340	17.8609	18.7390	19.4270	19.8734	20.0347	20.0127	19.7080	18.7987	17.5563	16.5018	(93)
adjusted MIT	16.5854	17.1340	17.8609	18.7390	19.4270	19.8734	20.0347	20.0127	19.7080	18.7987	17.5563	16.5018	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8930	0.8489	0.7934	0.7059	0.5935	0.4544	0.3294	0.3654	0.5493	0.7433	0.8555	0.9029	(94)
Useful gains	927.9573	1088.6822	1170.3732	1182.2762	1064.8998	806.3396	560.7019	579.3043	801.4403	925.5659	905.7551	883.1188	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2203.4035	2188.3601	2026.8884	1733.8060	1358.4586	917.0478	597.2957	626.9684	979.3568	1441.4001	1846.9717	2183.6125	(97)
Space heating kWh	948.9320	738.9835	637.2474	397.1015	218.4078	0.0000	0.0000	0.0000	0.0000	383.7807	677.6759	967.5673	(98a)
Space heating requirement - total per year (kWh/year)												4969.6960	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	948.9320	738.9835	637.2474	397.1015	218.4078	0.0000	0.0000	0.0000	0.0000	383.7807	677.6759	967.5673	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4969.6960	
Space heating per m2										(98c) / (4) =		32.6460	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	948.9320	738.9835	637.2474	397.1015	218.4078	0.0000	0.0000	0.0000	0.0000	383.7807	677.6759	967.5673	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	379.7247	295.7117	255.0009	158.9041	87.3981	0.0000	0.0000	0.0000	0.0000	153.5737	271.1788	387.1818	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	184.7420	163.4110	173.4179	151.7321	146.6453	131.6355	129.4174	134.7511	136.4708	152.8055	163.2922	182.6018	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1988.6739	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1850.9226	(219)
Space cooling fuel												0.0000	(221)

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Electricity for pumps and fans:
 Total electricity for the above, kWh/year 0.0000 (231)
 Electricity for lighting (calculated in Appendix L) 279.4701 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV generation 0.0000 (233)
 Wind generation 0.0000 (234)
 Hydro-electric generation (Appendix N) 0.0000 (235a)
 Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
 Appendix Q - special features
 Energy saved or generated -0.0000 (236)
 Energy used 0.0000 (237)
 Total delivered energy for all uses 4119.0666 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1988.6739	0.1546	307.4286 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1850.9226	0.1410	260.9524 (264)
Space and water heating			568.3811 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	279.4701	0.1443	40.3362 (268)
Total CO2, kg/year			608.7172 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.0000 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1988.6739	1.5723	3126.8245 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1850.9226	1.5213	2815.8381 (278)
Space and water heating			5942.6626 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	279.4701	1.5338	428.6606 (282)
Total Primary energy kWh/year			6371.3232 (286)
Dwelling Primary energy Rate (DPER)			41.8500 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
 CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

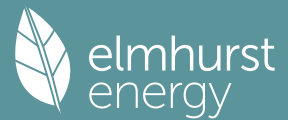
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1052 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 5.0000 (17)
 Infiltration rate 0.3552 (18)
 Number of sides sheltered 2 (19)
 Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3019 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3849	0.3774	0.3698	0.3321	0.3245	0.2868	0.2868	0.2792	0.3019	0.3245	0.3396	0.3547 (22b)
Effective ac	0.5741	0.5712	0.5684	0.5551	0.5527	0.5411	0.5411	0.5390	0.5456	0.5527	0.5577	0.5629 (25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			1.9500	1.0000	1.9500			(26)					
TER Opening Type (Uw = 1.20)			35.9200	1.1450	41.1298			(27)					
Ground Floor			77.0400	0.1300	10.0152			(28a)					
Brick	128.3500	32.4100	95.9400	0.1800	17.2692			(29a)					
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450			(29a)					
Joists GF	0.9600		0.9600	0.1100	0.1056			(30)					
Joists FF	75.1100		75.1100	0.1100	8.2621			(30)					
Flat	0.9600		0.9600	0.1100	0.1056			(30)					
Total net area of external elements Aum(A, m2)			348.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	89.6825			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E12 Gable (insulation at ceiling level)				14.9500	0.0600		0.8970						
E10 Eaves (insulation at ceiling level)				26.1800	0.0600		1.5708						
E14 Flat roof				2.7200	0.0800		0.2176						
E16 Corner (normal)				39.6000	0.0900		3.5640						
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900		-1.7640						
E2 Other lintels (including other steel lintels)				25.4000	0.0500		1.2700						
E3 Sill				24.4700	0.0500		1.2235						
E4 Jamb				57.9000	0.0500		2.8950						
E5 Ground floor (normal)				39.3700	0.1600		6.2992						
E6 Intermediate floor within a dwelling				38.4100	0.0000		0.0000						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1731	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss					(33) + (36) + (36a) =		105.8556	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 72.0599	Feb 71.6989	Mar 71.3450	Apr 69.6827	May 69.3716	Jun 67.9238	Jul 67.9238	Aug 67.6557	Sep 68.4815	Oct 69.3716	Nov 70.0008	Dec 70.6586	(38)
Heat transfer coeff	177.9155	177.5544	177.2005	175.5382	175.2272	173.7794	173.7794	173.5113	174.3371	175.2272	175.8564	176.5142	(39)
Average = Sum(39)m / 12 =												175.5367	
HLP	Jan 1.1687	Feb 1.1664	Mar 1.1640	Apr 1.1531	May 1.1511	Jun 1.1416	Jul 1.1416	Aug 1.1398	Sep 1.1452	Oct 1.1511	Nov 1.1552	Dec 1.1595	(40)
HLP (average)												1.1531	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

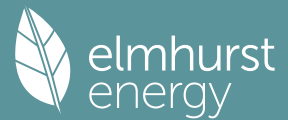
4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.9376 (42)
Hot water usage for mixer showers													
73.4740	72.3698	70.7608	67.6823	65.4104	62.8769	61.4368	63.0336	64.7840	67.5043	70.6489	73.1925	(42a)	
Hot water usage for baths													
31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	(42b)	
Hot water usage for other uses													
44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	(42c)	
Average daily hot water use (litres/day)												137.7987	(43)
Daily hot water use	Jan 149.9075	Feb 146.7063	Mar 142.8080	Apr 136.8804	May 132.0666	Jun 126.8915	Jul 124.9029	Aug 128.7844	Sep 132.8780	Oct 138.3110	Nov 144.3299	Dec 149.5188	(44)
Energy conte	237.4169	208.9078	219.4906	187.3824	177.7871	156.0279	151.0592	159.4620	163.8519	187.6867	205.6244	234.1103	(45)
Energy content (annual)										Total = Sum(45)m =		2288.8072	
Distribution loss (46)m = 0.15 x (45)m													
35.6125	31.3362	32.9236	28.1074	26.6681	23.4042	22.6589	23.9193	24.5778	28.1530	30.8437	35.1165	(46)	
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0208	(55)
Total storage loss													
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)	
If cylinder contains dedicated solar storage													
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
292.3237	258.5011	274.3973	240.5180	232.6939	209.1635	205.9660	214.3688	216.9875	242.5935	258.7600	289.0171	(62)	
WWHRS	-33.5892	-29.7066	-31.1070	-25.7579	-24.0054	-20.5416	-19.2545	-20.4752	-21.2531	-25.0551	-28.3844	-32.9672	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	258.7345	228.7945	243.2903	214.7601	208.6885	188.6220	186.7116	193.8936	195.7344	217.5384	230.3757	256.0499	(64)
12Total per year (kWh/year)												2623.1932	(64)
Electric shower(s)												2623	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
122.8666	109.1364	116.9060	104.8131	103.0396	94.3878	94.1526	96.9465	96.9892	106.3313	110.8786	121.7671	(65)	

5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
(66)m	Jan 146.8807	Feb 146.8807	Mar 146.8807	Apr 146.8807	May 146.8807	Jun 146.8807	Jul 146.8807	Aug 146.8807	Sep 146.8807	Oct 146.8807	Nov 146.8807	Dec 146.8807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
162.8850	180.3370	162.8850	168.3145	162.8850	168.3145	162.8850	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)													
165.1432	162.4054	157.1318	145.5738	138.4941	131.0941	126.5492	130.3045	134.7073	142.9184	153.9981	163.6655	(72)	
Total internal gains													

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721.0302 739.0955 707.9253 683.8192 648.6165 622.3173 598.0941 598.4983 616.7752 640.5343 679.7370 705.3036 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					9.8400	10.6334		0.6300	0.7000	0.7700		31.9771 (74)
East					6.4700	19.6403		0.6300	0.7000	0.7700		38.8350 (76)
South					13.8100	46.7521		0.6300	0.7000	0.7700		197.3178 (78)
West					5.8000	19.6403		0.6300	0.7000	0.7700		34.8135 (80)

Solar gains	302.9434	528.3376	752.7497	978.0790	1133.5858	1141.2278	1093.7400	975.8987	830.8101	592.2506	365.1677	257.7233 (83)
Total gains	1023.9736	1267.4331	1460.6750	1661.8982	1782.2023	1763.5451	1691.8341	1574.3970	1447.5852	1232.7850	1044.9048	963.0270 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.8369	18.8752	18.9129	19.0920	19.1259	19.2852	19.2852	19.3150	19.2235	19.1259	19.0575	18.9864
alpha	2.2558	2.2583	2.2609	2.2728	2.2751	2.2857	2.2857	2.2877	2.2816	2.2751	2.2705	2.2658
util living area	0.9388	0.9046	0.8570	0.7743	0.6630	0.5266	0.4084	0.4478	0.6288	0.8158	0.9114	0.9458 (86)
MIT	17.9464	18.3963	18.9944	19.7203	20.3147	20.7181	20.8869	20.8568	20.5512	19.7507	18.7209	17.8671 (87)
Th 2	19.9451	19.9470	19.9489	19.9577	19.9593	19.9670	19.9670	19.9685	19.9641	19.9593	19.9560	19.9525 (88)
util rest of house	0.9311	0.8930	0.8395	0.7464	0.6198	0.4626	0.3252	0.3637	0.5684	0.7864	0.8986	0.9389 (89)
MIT 2	16.3794	16.9439	17.6904	18.5837	19.2868	19.7368	19.8983	19.8766	19.5715	18.6434	17.3663	16.2829 (90)
Living area fraction	16.5953	17.1441	17.8701	18.7404	19.4285	19.8720	20.0346	20.0117	19.7065	18.7960	17.5530	16.5012 (92)
MIT	16.5953	17.1441	17.8701	18.7404	19.4285	19.8720	20.0346	20.0117	19.7065	18.7960	17.5530	16.5012 (93)
Temperature adjustment												0.0000
adjusted MIT	16.5953	17.1441	17.8701	18.7404	19.4285	19.8720	20.0346	20.0117	19.7065	18.7960	17.5530	16.5012 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8952	0.8510	0.7954	0.7078	0.5952	0.4563	0.3310	0.3674	0.5516	0.7458	0.8579	0.9051 (94)
Useful gains	916.6263	1078.6238	1161.8101	1176.2124	1060.7200	804.6689	559.9555	578.4865	798.5441	919.3590	896.4382	871.6732 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2187.5293	2173.9878	2014.7871	1727.3612	1354.2400	916.1703	596.8598	626.6711	977.4265	1436.1681	1838.2225	2171.3385 (97)
Space heating	945.5518	736.0847	634.6149	396.8271	218.3789	0.0000	0.0000	0.0000	0.0000	384.5060	678.0847	966.9510 (98a)
Space heating requirement - total per year (kWh/year)												4960.9990
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	945.5518	736.0847	634.6149	396.8271	218.3789	0.0000	0.0000	0.0000	0.0000	384.5060	678.0847	966.9510 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4960.9990
Space heating per m2										(98c) / (4) =		32.5888 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	945.5518	736.0847	634.6149	396.8271	218.3789	0.0000	0.0000	0.0000	0.0000	384.5060	678.0847	966.9510 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	1024.4332	797.4915	687.5568	429.9318	236.5969	0.0000	0.0000	0.0000	0.0000	416.5828	734.6530	1047.6175 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	258.7345	228.7945	243.2903	214.7601	208.6885	188.6220	186.7116	193.8936	195.7344	217.5384	230.3757	256.0499 (64)
Efficiency of water heater	79.8000	79.8000	79.8000	79.8000	79.8000	79.8000	79.8000	79.8000	79.8000	79.8000	79.8000	79.8000 (216)
(217)m	86.6992	86.4871	86.1087	85.4172	84.1617	79.8000	79.8000	79.8000	79.8000	85.3229	86.3309	86.7516 (217)
Fuel for water heating, kWh/month	298.4276	264.5418	282.5386	251.4250	247.9612	236.3684	233.9744	242.9744	245.2812	254.9589	266.8519	295.1529 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	33.8443	27.1511	24.4466	17.9106	13.8347	11.3031	12.6205	16.4046	21.3079	27.9571	31.5775	34.7849 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-66.7341	-91.4457	-127.7690	-139.4456	-146.8080	-135.6370	-133.7868	-127.8989	-117.1848	-102.3589	-72.3488	-57.9947 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233b)m	-46.1847	-96.0365	-188.9159	-281.0150	-369.0743	-370.0645	-365.8650	-311.0512	-229.5918	-136.6110	-61.4048	-36.6223	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												5374.8635	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3120.4564	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												273.1428	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-3811.8492	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5042.6135	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5374.8635	0.2100	1128.7213	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3120.4564	0.2100	655.2958	(264)
Space and water heating			1784.0172	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	273.1428	0.1443	39.4229	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1319.4124	0.1352	-178.4236	
PV Unit electricity exported	-2492.4369	0.1262	-314.4789	
Total			-492.9025	(269)
Total CO2, kg/year			1342.4669	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.8200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5374.8635	1.1300	6073.5958	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3120.4564	1.1300	3526.1157	(278)
Space and water heating			9599.7115	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	273.1428	1.5338	418.9556	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1319.4124	1.4998	-1978.8831	
PV Unit electricity exported	-2492.4369	0.4632	-1154.3831	
Total			-3133.2662	(283)
Total Primary energy kWh/year			7015.5017	(286)
Target Primary Energy Rate (TPER)			46.0800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)	
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

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Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											
Pressure test	Air changes per hour											
Pressure Test Method	40.0000 / (5) = 0.1052 (8)											
Measured/design AP50	Yes											
Infiltration rate	Blower Door											
Number of sides sheltered	5.0000 (17)											
	0.3552 (18)											
	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3019 (21)											
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.3849	0.3774	0.3698	0.3321	0.3245	0.2868	0.2868	0.2792	0.3019	0.3245	0.3396	0.3547 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.5741	0.5712	0.5684	0.5551	0.5527	0.5411	0.5411	0.5390	0.5456	0.5527	0.5577	0.5629 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)					
Solid Doors			1.9500	1.0000	1.9500			(26)					
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)					
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)					
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)					
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400	(30)					
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)					
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400	(30)					
Total net area of external elements Aum(A, m2)			348.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609			(33)					
GF			110.0000			9.0000	990.0000	(32c)					
FF			130.0000			9.0000	1170.0000	(32c)					
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)					
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E12 Gable (insulation at ceiling level)				14.9500	0.0600	0.8970							
E10 Eaves (insulation at ceiling level)				26.1800	0.0600	1.5708							
E14 Flat roof				2.7200	0.0800	0.2176							
E16 Corner (normal)				39.6000	0.0900	3.5640							
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900	-1.7640							
E2 Other lintels (including other steel lintels)				25.4000	0.0500	1.2700							
E3 Sill				24.4700	0.0500	1.2235							
E4 Jamb				57.9000	0.0500	2.8950							
E5 Ground floor (normal)				39.3700	0.1600	6.2992							
E6 Intermediate floor within a dwelling				38.4100	0.0000	0.0000							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1731	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	104.3340	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 72.0599	Feb 71.6989	Mar 71.3450	Apr 69.6827	May 69.3716	Jun 67.9238	Jul 67.9238	Aug 67.6557	Sep 68.4815	Oct 69.3716	Nov 70.0008	Dec 70.6586	(38)
Heat transfer coeff	176.3939	176.0328	175.6789	174.0166	173.7056	172.2578	172.2578	171.9897	172.8155	173.7056	174.3348	174.9926	(39)
Average = Sum(39)m / 12 =												174.0151	
HLP	Jan 1.1587	Feb 1.1564	Mar 1.1540	Apr 1.1431	May 1.1411	Jun 1.1316	Jul 1.1316	Aug 1.1298	Sep 1.1352	Oct 1.1411	Nov 1.1452	Dec 1.1495	(40)
HLP (average)												1.1431	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9376 (42)											
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	31.6122 (42b)
Hot water usage for other uses												
44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	44.7141 (42c)
Average daily hot water use (litres/day)	70.0581 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
76.4336	74.3365	72.0472	69.1980	66.6562	64.0147	63.4661	65.7508	68.0940	70.8067	73.6810	76.3263	76.3263 (44)
Energy conte	121.0521	105.8542	110.7338	94.7287	89.7321	78.7135	76.7568	81.4132	83.9667	96.0840	104.9721	119.5086 (45)
Energy content (annual)	Total = Sum(45)m = 1163.5157											
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823	101.5823 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823 (64)

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12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											988.9883 (64)
Electric shower(s)	989 (64)											
58.8404	52.4273	57.2486	54.6316	55.6568	53.0912	54.8609	55.6568	54.6316	57.2486	56.1721	58.8404 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												669.3063 (64a)
Heat gains from water heating, kWh/month												
40.4337	35.6008	37.8431	33.7878	32.9823	29.9994	30.0260	31.2145	31.5008	34.7300	36.3496	40.1057 (65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.8850	180.3370	162.8850	168.3145	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	54.3463	52.9774	50.8644	46.9274	44.3310	41.6658	40.3576	41.9550	43.7512	46.6801	50.4855	53.9055	(72)
Total internal gains	607.2334	626.6675	598.6579	582.1728	551.4534	532.8891	511.9024	510.1487	525.8191	541.2961	573.2245	592.5436	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	

North					9.8400	10.6334		0.6300	0.7000	0.7700		31.9771 (74)	
East					6.4700	19.6403		0.6300	0.7000	0.7700		38.8350 (76)	
South					13.8100	46.7521		0.6300	0.7000	0.7700		197.3178 (78)	
West					5.8000	19.6403		0.6300	0.7000	0.7700		34.8135 (80)	

Solar gains	302.9434	528.3376	752.7497	978.0790	1133.5858	1141.2278	1093.7400	975.8987	830.8101	592.2506	365.1677	257.7233 (83)	
Total gains	910.1767	1155.0051	1351.4076	1560.2519	1685.0392	1674.1169	1605.6424	1486.0475	1356.6291	1133.5467	938.3922	850.2670 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.9994	19.0384	19.0767	19.2589	19.2934	19.4556	19.4556	19.4859	19.3928	19.2934	19.2238	19.1515
alpha	2.2666	2.2692	2.2718	2.2839	2.2862	2.2970	2.2970	2.2991	2.2929	2.2862	2.2816	2.2768
util living area	0.9507	0.9184	0.8728	0.7915	0.6809	0.5433	0.4235	0.4656	0.6503	0.8362	0.9264	0.9571 (86)
MIT	17.8267	18.2925	18.9098	19.6637	20.2810	20.7027	20.8799	20.8469	20.5224	19.6812	18.6171	17.7453 (87)
Th 2	19.9532	19.9551	19.9569	19.9658	19.9674	19.9751	19.9751	19.9766	19.9722	19.9674	19.9641	19.9606 (88)
util rest of house	0.9443	0.9082	0.8568	0.7648	0.6385	0.4792	0.3389	0.3802	0.5907	0.8090	0.9155	0.9515 (89)
MIT 2	17.0526	17.5105	18.1137	18.8418	19.4141	19.7844	19.9177	19.8991	19.6435	18.8767	17.8424	16.9770 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	17.1593	17.6183	18.2234	18.9551	19.5336	19.9109	20.0503	20.0298	19.7646	18.9876	17.9492	17.0829 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.1593	17.6183	18.2234	18.9551	19.5336	19.9109	20.0503	20.0298	19.7646	18.9876	17.9492	17.0829 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	837.7251	1014.3145	1112.9020	1145.6512	1042.3977	794.9543	554.6615	571.9965	783.0689	881.1840	832.2059	790.2968 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2268.3047	2238.8394	2059.5504	1749.7472	1360.7334	914.8521	594.3391	624.2807	978.9330	1456.9714	1891.3874	2254.4128 (97)
Space heating kWh	1064.3512	822.8808	704.3064	434.9492	236.8418	0.0000	0.0000	0.0000	0.0000	428.3858	762.6107	1089.3024 (98a)
Space heating requirement - total per year (kWh/year)												5543.6281
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1064.3512	822.8808	704.3064	434.9492	236.8418	0.0000	0.0000	0.0000	0.0000	428.3858	762.6107	1089.3024 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5543.6281
Space heating per m ²												(98c) / (4) = 36.4161 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1619.2232	1274.7076	1307.1215	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7478	0.8070	0.7773	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1210.9343	1028.6531	1016.0142	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1885.9933	1809.0606	1672.5372	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	486.0424	580.6232	488.4531	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											1.0000 (105)
Intermittency factor (Table 10b)												

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Space cooling kWh	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	121.5106	145.1558	122.1133	0.0000	0.0000	0.0000 (107)
Energy for space heating											388.7797 (107)
Energy for space cooling											36.4161 (99)
Total											2.5539 (108)
Fabric Energy Efficiency (DFEE)											38.9700 (109)
											39.0 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	Air changes per hour	
Pressure test	40.0000 / (5) =	
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	
Infiltration rate	5.0000 (17)	
Number of sides sheltered	0.3552 (18)	
	2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	
	0.8500 (20)	
	0.3019 (21)	
Wind speed	Jan 5.1000	Feb 5.0000
Wind factor	Mar 4.9000	Apr 4.4000
Adj infilt rate	May 4.3000	Jun 3.8000
	Jul 3.8000	Aug 3.7000
	Sep 4.0000	Oct 4.3000
	Nov 4.5000	Dec 4.7000 (22)
	1.2750	1.2500
	0.3849	0.3774
	0.3698	0.3321
	0.3245	0.2868
	0.2792	0.3019
	0.3245	0.3396
	0.3547 (22b)	0.0000 (23b)
	0.0000 (23c)	0.0000 (23c)
	0.5741	0.5712
	0.5684	0.5551
	0.5527	0.5411
	0.5390	0.5456
	0.5527	0.5577
	0.5629 (25)	

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			35.9200	1.1450	41.1298		(27)
Ground Floor			77.0400	0.1300	10.0152		(28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692		(29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450		(29a)
Joists GF	0.9600		0.9600	0.1100	0.1056		(30)
Joists FF	75.1100		75.1100	0.1100	8.2621		(30)
Flat	0.9600		0.9600	0.1100	0.1056		(30)
Total net area of external elements Aum(A, m ²)			348.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.6825		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.2547 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				14.9500	0.0600	0.8970	
E10 Eaves (insulation at ceiling level)				26.1800	0.0600	1.5708	
E14 Flat roof				2.7200	0.0800	0.2176	
E16 Corner (normal)				39.6000	0.0900	3.5640	
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900	-1.7640	
E2 Other lintels (including other steel lintels)				25.4000	0.0500	1.2700	
E3 Sill				24.4700	0.0500	1.2235	
E4 Jamb				57.9000	0.0500	2.8950	
E5 Ground floor (normal)				39.3700	0.1600	6.2992	
E6 Intermediate floor within a dwelling				38.4100	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						16.1731 (36)	
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	105.8556 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	Jan 72.0599	Feb 71.6989	Mar 71.3450	Apr 69.6827	May 69.3716	Jun 67.9238	Jul 67.9238
Heat transfer coeff	Aug 67.6557	Sep 68.4815	Oct 69.3716	Nov 70.0008	Dec 70.6586 (38)		

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Average = Sum(39)m / 12 =	177.9155	177.5544	177.2005	175.5382	175.2272	173.7794	173.7794	173.5113	174.3371	175.2272	175.8564	176.5142 (39)
	175.5367											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1687	1.1664	1.1640	1.1531	1.1511	1.1416	1.1416	1.1398	1.1452	1.1511	1.1552	1.1595 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9376 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122 (42b)
Hot water usage for other uses	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141 (42c)
Average daily hot water use (litres/day)												70.0581 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	76.4336	74.3365	72.0472	69.1980	66.6562	64.0147	63.4661	65.7508	68.0940	70.8067	73.6810	76.3263 (44)
Energy content (annual)	121.0521	105.8542	110.7338	94.7287	89.7321	78.7135	76.7568	81.4132	83.9667	96.0840	104.9721	119.5086 (45)
Distribution loss (46)m = 0.15 x (45)m												1163.5157
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.8943	89.9761	94.1237	80.5194	76.2722	66.9065	65.2432	69.2013	71.3717	81.6714	89.2263	101.5823 (64)
12Total per year (kWh/year)												988.9883 (64)
Electric shower(s)	58.8404	52.4273	57.2486	54.6316	55.6568	53.0912	54.8609	55.6568	54.6316	57.2486	56.1721	58.8404 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												669.3063 (64a)
Heat gains from water heating, kWh/month	40.4337	35.6008	37.8431	33.7878	32.9823	29.9994	30.0260	31.2145	31.5008	34.7300	36.3496	40.1057 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807	146.8807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.8850	180.3370	162.8850	168.3145	162.8850	168.3145	162.8850	162.8850	168.3145	162.8850	168.3145	162.8850 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.9378	326.2889	317.8442	299.8666	277.1731	255.8445	241.5956	238.2445	246.6891	264.6667	287.3602	308.6889 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881	37.6881 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046 (71)
Water heating gains (Table 5)	54.3463	52.9774	50.8644	46.9274	44.3310	41.6658	40.3576	41.9550	43.7512	46.6801	50.4855	53.9055 (72)
Total internal gains	607.2334	626.6675	598.6579	582.1728	551.4534	532.8891	511.9024	510.1487	525.8191	541.2961	573.2245	592.5436 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North					9.8400	10.6334	0.6300		0.7000	0.7700	31.9771 (74)	
East					6.4700	19.6403	0.6300		0.7000	0.7700	38.8350 (76)	
South					13.8100	46.7521	0.6300		0.7000	0.7700	197.3178 (78)	
West					5.8000	19.6403	0.6300		0.7000	0.7700	34.8135 (80)	
Solar gains	302.9434	528.3376	752.7497	978.0790	1133.5858	1141.2278	1093.7400	975.8987	830.8101	592.2506	365.1677	257.7233 (83)
Total gains	910.1767	1155.0051	1351.4076	1560.2519	1685.0392	1674.1169	1605.6424	1486.0475	1356.6291	1133.5467	938.3922	850.2670 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.8369	18.8752	18.9129	19.0920	19.1259	19.2852	19.2852	19.3150	19.2235	19.1259	19.0575	18.9864
alpha	2.2558	2.2583	2.2609	2.2728	2.2751	2.2857	2.2857	2.2877	2.2816	2.2751	2.2705	2.2658
util living area	0.9509	0.9188	0.8735	0.7929	0.6830	0.5459	0.4261	0.4682	0.6525	0.8373	0.9267	0.9572 (86)
MIT	17.8007	18.2666	18.8859	19.6441	20.2675	20.6954	20.8764	20.8426	20.5128	19.6640	18.5946	17.7193 (87)
Th 2	19.9451	19.9470	19.9489	19.9577	19.9593	19.9670	19.9670	19.9685	19.9641	19.9593	19.9560	19.9525 (88)
util rest of house	0.9445	0.9086	0.8575	0.7661	0.6404	0.4812	0.3405	0.3819	0.5926	0.8101	0.9158	0.9516 (89)
MIT 2	17.0222	17.4801	18.0854	18.8178	19.3960	19.7719	19.9081	19.8891	19.6291	18.8551	17.8154	16.9465 (90)

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Living area fraction									fLA = Living area / (4) =		0.1378 (91)	
MIT	17.1295	17.5885	18.1957	18.9317	19.5161	19.8992	20.0415	20.0205	19.7509	18.9666	17.9228	17.0530 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1295	17.5885	18.1957	18.9317	19.5161	19.8992	20.0415	20.0205	19.7509	18.9666	17.9228	17.0530 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9204	0.8784	0.8240	0.7353	0.6201	0.4766	0.3470	0.3866	0.5788	0.7781	0.8870	0.9295	(94)
Useful gains	837.7702	1014.5971	1113.6131	1147.2157	1044.9215	797.9476	557.2017	574.4428	785.1802	882.0242	832.3885	790.3100	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2282.5618	2252.8987	2072.4880	1760.9411	1369.5925	920.8878	598.0626	628.1994	985.1640	1466.0518	1903.2649	2268.7311	(97)
Space heating kWh	1074.9249	832.1387	713.4030	441.8823	241.5552	0.0000	0.0000	0.0000	0.0000	434.5165	771.0310	1099.9453	(98a)
Space heating requirement - total per year (kWh/year)												5609.3970	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1074.9249	832.1387	713.4030	441.8823	241.5552	0.0000	0.0000	0.0000	0.0000	434.5165	771.0310	1099.9453	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5609.3970	
Space heating per m2										(98c) / (4) =		36.8482	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1633.5263	1285.9675	1318.6857	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7439	0.8034	0.7735	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1215.1975	1033.1582	1020.0126	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1885.9933	1809.0606	1672.5372	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	482.9729	577.2714	485.4783	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	120.7432	144.3179	121.3696	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												386.4307	(107)
Energy for space heating												36.8482	(99)
Energy for space cooling												2.5385	(108)
Total												39.3866	(109)
Fabric Energy Efficiency (TFEE)												39.4	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)	
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	380.3740 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour	60.0000 / (5) = 0.1577 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4077	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3466 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
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Effective ac	0.4419	0.4332	0.4246	0.3812	0.3726	0.3292	0.3292	0.3206	0.3466	0.3726	0.3899	0.4072 (22b)
	0.5976	0.5938	0.5901	0.5727	0.5694	0.5542	0.5542	0.5514	0.5601	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)					
Solid Doors			1.9500	1.0000	1.9500			(26)					
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)					
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)					
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)					
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400	(30)					
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)					
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400	(30)					
Total net area of external elements Aum(A, m2)			348.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609			(33)					
GF			110.0000			9.0000	990.0000	(32c)					
FF			130.0000			9.0000	1170.0000	(32c)					
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)					
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E12 Gable (insulation at ceiling level)				14.9500	0.0600		0.8970						
E10 Eaves (insulation at ceiling level)				26.1800	0.0600		1.5708						
E14 Flat roof				2.7200	0.0800		0.2176						
E16 Corner (normal)				39.6000	0.0900		3.5640						
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900		-1.7640						
E2 Other lintels (including other steel lintels)				25.4000	0.0500		1.2700						
E3 Sill				24.4700	0.0500		1.2235						
E4 Jamb				57.9000	0.0500		2.8950						
E5 Ground floor (normal)				39.3700	0.1600		6.2992						
E6 Intermediate floor within a dwelling				38.4100	0.0000		0.0000						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.1731 (36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	104.3340	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 75.0169	Feb 74.5410	Mar 74.0745	Apr 71.8836	May 71.4737	Jun 69.5654	Jul 69.5654	Aug 69.2120	Sep 70.3004	Oct 71.4737	Nov 72.3029	Dec 73.1699	(38)
Heat transfer coeff	179.3508	178.8749	178.4085	176.2175	175.8076	173.8994	173.8994	173.5460	174.6344	175.8076	176.6369	177.5038	(39)
Average = Sum(39)m / 12 =												176.2156	
HLP	Jan 1.1782	Feb 1.1750	Mar 1.1720	Apr 1.1576	May 1.1549	Jun 1.1423	Jul 1.1423	Aug 1.1400	Sep 1.1472	Oct 1.1549	Nov 1.1603	Dec 1.1660	(40)
HLP (average)												1.1576	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9376 (42)
Hot water usage for mixer showers													
	91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906	(42a)
Hot water usage for baths													
	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	(42b)
Hot water usage for other uses													
	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	(42c)
Average daily hot water use (litres/day)												154.7338	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169	(44)
Energy conte	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607	(45)
Energy content (annual)										Total = Sum(45)m =		2570.1301	
Distribution loss (46)m = 0.15 x (45)m													
	39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141	(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage													
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(64)
								Total per year (kWh/year) = Sum(64)m =				3240.9655	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month													
	134.1940	119.1973	127.6011	114.1162	112.0138	102.4158	101.9836	105.0890	105.2309	115.6003	120.8466	132.9480	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	180.3683	177.3769	171.5068	158.4947	150.5562	142.2441	137.0748	141.2486	146.1541	155.3768	167.8425	178.6935	(72)
Total internal gains	819.2424	816.8293	791.7934	745.0068	697.7350	652.0701	626.7333	630.3289	654.4003	700.3975	752.1965	797.4003	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					9.8400	10.6334		0.6300	0.7000	0.7700		31.9771 (74)	
East					6.4700	19.6403		0.6300	0.7000	0.7700		38.8350 (76)	
South					13.8100	46.7521		0.6300	0.7000	0.7700		197.3178 (78)	
West					5.8000	19.6403		0.6300	0.7000	0.7700		34.8135 (80)	
Solar gains	302.9434	528.3376	752.7497	978.0790	1133.5858	1141.2278	1093.7400	975.8987	830.8101	592.2506	365.1677	257.7233	(83)
Total gains	1122.1858	1345.1669	1544.5431	1723.0858	1831.3207	1793.2979	1720.4734	1606.2277	1485.2103	1292.6482	1117.3642	1055.1236	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	18.6861	18.7359	18.7848	19.0184	19.0627	19.2719	19.2719	19.3112	19.1908	19.0627	18.9732	18.8806	
alpha	2.2457	2.2491	2.2523	2.2679	2.2708	2.2848	2.2848	2.2874	2.2794	2.2708	2.2649	2.2587	
util living area	0.9281	0.8950	0.8449	0.7640	0.6541	0.5206	0.4030	0.4409	0.6198	0.8034	0.9008	0.9360	(86)
MIT	18.0427	18.4599	19.0548	19.7551	20.3321	20.7246	20.8899	20.8614	20.5641	19.7934	18.7916	17.9666	(87)
Th 2	19.9375	19.9400	19.9425	19.9541	19.9563	19.9664	19.9664	19.9683	19.9625	19.9563	19.9519	19.9473	(88)
util rest of house	0.9192	0.8825	0.8264	0.7353	0.6105	0.4568	0.3206	0.3575	0.5592	0.7728	0.8869	0.9281	(89)
MIT 2	16.4961	17.0186	17.7594	18.6214	19.3028	19.7419	19.8997	19.8796	19.5826	18.6906	17.4509	16.4051	(90)
Living area fraction	16.7092	17.2173	17.9380	18.7776	19.4446	19.8774	20.0361	20.0149	19.7179	18.8426	17.6357	16.6203	(91)
MIT	16.7092	17.2173	17.9380	18.7776	19.4446	19.8774	20.0361	20.0149	19.7179	18.8426	17.6357	16.6203	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.7092	17.2173	17.9380	18.7776	19.4446	19.8774	20.0361	20.0149	19.7179	18.8426	17.6357	16.6203	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8805	0.8393	0.7821	0.6975	0.5868	0.4510	0.3264	0.3615	0.5433	0.7329	0.8448	0.8915	(94)
Useful gains	988.1229	1128.9484	1208.0048	1201.8464	1074.5313	808.6880	561.6190	580.7231	806.9681	947.3531	943.9650	940.6097	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2225.6071	2203.2528	2040.6321	1740.6125	1361.5623	917.7301	597.5438	627.3586	981.0730	1449.1111	1860.9956	2204.6453	(97)
Space heating kWh	920.6882	721.9326	619.4747	387.9116	213.5510	0.0000	0.0000	0.0000	0.0000	373.3079	660.2620	940.4425	(98a)
Space heating requirement - total per year (kWh/year)												4837.5705	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	920.6882	721.9326	619.4747	387.9116	213.5510	0.0000	0.0000	0.0000	0.0000	373.3079	660.2620	940.4425	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4837.5705	
Space heating per m ²										(98c) / (4) =		31.7780	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	920.6882	721.9326	619.4747	387.9116	213.5510	0.0000	0.0000	0.0000	0.0000	373.3079	660.2620	940.4425	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	368.4227	288.8886	247.8890	155.2267	85.4546	0.0000	0.0000	0.0000	0.0000	149.3829	264.2105	376.3275	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(217)
Fuel for water heating, kWh/month													

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	184.7420	163.4110	173.4179	151.7321	146.6453	131.6355	129.4174	134.7511	136.4708	152.8055	163.2922	182.6018	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1935.8025	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1850.9226	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												279.4701	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												4066.1952	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1935.8025	16.4900	319.2138	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1850.9226	16.4900	305.2171	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	279.4701	16.4900	46.0846	(250)
Additional standing charges			0.0000	(251)
Total energy cost			670.5156	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2239	(257)
SAP value		80.1609	
SAP rating (Section 12)		80	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1935.8025	0.1546	299.2328	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1850.9226	0.1410	260.9524	(264)
Space and water heating			560.1852	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	279.4701	0.1443	40.3362	(268)
Total CO2, kg/year			600.5214	(272)
CO2 emissions per m2			3.9400	(273)
EI value			95.9200	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)

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Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 380.3740 (5)

2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											5 * 10 =	50.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											60.0000 / (5) =	0.1577 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											5.0000 (17)	
Infiltration rate											0.4077 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3466 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3119	0.2859	0.2773	0.2773	0.2859	0.2513	0.2686	0.2426	0.2426	0.2599	0.2426	0.2773 (22b)
Effective ac	0.5486	0.5409	0.5384	0.5384	0.5409	0.5316	0.5361	0.5294	0.5294	0.5338	0.5294	0.5384 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)					
Solid Doors			1.9500	1.0000	1.9500			(26)					
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)					
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)					
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)					
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400	(30)					
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)					
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400	(30)					
Total net area of external elements Aum(A, m2)			348.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609			(33)					
GF			110.0000			9.0000	990.0000	(32c)					
FF			130.0000			9.0000	1170.0000	(32c)					
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)					
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E12 Gable (insulation at ceiling level)				14.9500	0.0600		0.8970						
E10 Eaves (insulation at ceiling level)				26.1800	0.0600		1.5708						
E14 Flat roof				2.7200	0.0800		0.2176						
E16 Corner (normal)				39.6000	0.0900		3.5640						
E17 Corner (inverted - internal area greater than external area)				19.6000	-0.0900		-1.7640						
E2 Other lintels (including other steel lintels)				25.4000	0.0500		1.2700						
E3 Sill				24.4700	0.0500		1.2235						
E4 Jamb				57.9000	0.0500		2.8950						
E5 Ground floor (normal)				39.3700	0.1600		6.2992						
E6 Intermediate floor within a dwelling				38.4100	0.0000		0.0000						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1731	(36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	104.3340	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 68.8681	Feb 67.8928	Mar 67.5865	Apr 67.5865	May 67.8928	Jun 66.7243	Jul 67.2897	Aug 66.4557	Sep 66.4557	Oct 67.0022	Nov 66.4557	Dec 67.5865	(38)
Heat transfer coeff	173.2021	172.2267	171.9205	171.9205	172.2267	171.0582	171.6236	170.7897	170.7897	171.3362	170.7897	171.9205	(39)
Average = Sum(39)m / 12 =												171.6503	
HLP	Jan 1.1378	Feb 1.1314	Mar 1.1293	Apr 1.1293	May 1.1314	Jun 1.1237	Jul 1.1274	Aug 1.1219	Sep 1.1219	Oct 1.1255	Nov 1.1219	Dec 1.1293	(40)
HLP (average)												1.1276	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9376 (42)											
Hot water usage for mixer showers												
Hot water usage for baths	91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906 (42a)
Hot water usage for other uses	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122 (42b)
Average daily hot water use (litres/day)	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141 (42c)
												154.7338 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169 (44)
Energy content (annual)	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607 (45)
										Total = Sum(45)m =		2570.1301

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Distribution loss (46)m = 0.15 x (45)m	39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)	
If cylinder contains dedicated solar storage												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (64)	
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
134.1940	119.1973	127.6011	114.1162	112.0138	102.4158	101.9836	105.0890	105.2309	115.6003	120.8466	132.9480 (65)	

5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts												
(66)m	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633 (69)	
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046 (71)
Water heating gains (Table 5)												
180.3683	177.3769	171.5068	158.4947	150.5562	142.2441	137.0748	141.2486	146.1541	155.3768	167.8425	178.6935 (72)	
Total internal gains												
819.2424	816.8293	791.7934	745.0068	697.7350	652.0701	626.7333	630.3289	654.4003	700.3975	752.1965	797.4003 (73)	

6. Solar gains												

[Jan]			Area		Solar flux		g		FF		Access	Gains
			m2		Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
North			9.8400		13.0723		0.6300		0.7000		0.7700	39.3114 (74)
East			6.4700		24.4329		0.6300		0.7000		0.7700	48.3115 (76)
South			13.8100		54.9219		0.6300		0.7000		0.7700	231.7988 (78)
West			5.8000		24.4329		0.6300		0.7000		0.7700	43.3086 (80)

Solar gains	362.7303	555.4650	785.9603	1060.1855	1201.8237	1312.9471	1232.3026	1106.3415	928.9679	664.0606	438.6982	300.9047 (83)
Total gains	1181.9727	1372.2943	1577.7537	1805.1923	1899.5586	1965.0173	1859.0360	1736.6705	1583.3682	1364.4581	1190.8947	1098.3050 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.3495	19.4591	19.4938	19.4938	19.4591	19.5920	19.5275	19.6228	19.6228	19.5602	19.6228	19.4938
alpha	2.2900	2.2973	2.2996	2.2996	2.2973	2.3061	2.3018	2.3082	2.3082	2.3040	2.3082	2.2996
util living area												
0.9113	0.8814	0.8209	0.7221	0.5887	0.4225	0.3143	0.3244	0.5437	0.7459	0.8706	0.9218 (86)	
MIT	18.4478	18.7488	19.3639	20.0136	20.5467	20.8553	20.9482	20.9467	20.7200	20.1367	19.2212	18.3706 (87)
Th 2	19.9701	19.9753	19.9769	19.9769	19.9753	19.9815	19.9785	19.9830	19.9830	19.9801	19.9830	19.9769 (88)
util rest of house												
0.9003	0.8674	0.7997	0.6894	0.5388	0.3548	0.2313	0.2370	0.4766	0.7066	0.8524	0.9119 (89)	
MIT 2	17.0221	17.3982	18.1598	18.9428	19.5554	19.8776	19.9538	19.9582	19.7576	19.1127	18.0023	16.9300 (90)
Living area fraction												
MIT	17.2186	17.5843	18.3258	19.0904	19.6920	20.0123	20.0908	20.0944	19.8902	19.2538	18.1703	17.1285 (91)
Temperature adjustment												0.0000
adjusted MIT	17.2186	17.5843	18.3258	19.0904	19.6920	20.0123	20.0908	20.0944	19.8902	19.2538	18.1703	17.1285 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.8600	0.8248	0.7580	0.6572	0.5239	0.3569	0.2408	0.2469	0.4700	0.6740	0.8101	0.8734 (94)	
Useful gains	1016.4943	1131.8230	1195.8633	1186.3009	995.0880	701.3396	447.5946	428.8379	744.1410	919.5902	964.7761	959.2423 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W												
2081.6389	2081.2397	1895.5585	1614.3973	1186.9838	754.7665	461.8054	443.0963	852.2782	1277.1137	1702.8182	2050.7598 (97)	
Space heating kWh												
792.4675	638.0080	520.5732	308.2295	142.7704	0.0000	0.0000	0.0000	0.0000	265.9975	531.3903	812.0890 (98a)	
Space heating requirement - total per year (kWh/year)												4011.5255
Solar heating kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)	
Solar heating contribution - total per year (kWh/year)												0.0000

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Space heating kWh	792.4675	638.0080	520.5732	308.2295	142.7704	0.0000	0.0000	0.0000	0.0000	265.9975	531.3903	812.0890 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4011.5255
Space heating per m2											(98c) / (4) =	26.3517 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	792.4675	638.0080	520.5732	308.2295	142.7704	0.0000	0.0000	0.0000	0.0000	265.9975	531.3903	812.0890 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	317.1139	255.3053	208.3126	123.3411	57.1310	0.0000	0.0000	0.0000	0.0000	106.4416	212.6412	324.9656 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	323.4832	286.1326	303.6548	265.6829	256.7759	230.4937	226.6099	235.9493	238.9603	267.5624	285.9247	319.7358 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	184.7420	163.4110	173.4179	151.7321	146.6453	131.6355	129.4174	134.7511	136.4708	152.8055	163.2922	182.6018 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1605.2523 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1850.9226 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												279.4701 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3735.6450 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1605.2523	26.0600	418.3287 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1850.9226	26.0600	482.3504 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	279.4701	26.0600	72.8299 (250)
Additional standing charges			0.0000 (251)
Total energy cost			973.5091 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1605.2523	0.1552	249.1436 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1850.9226	0.1410	260.9524 (264)
Space and water heating			510.0960 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	279.4701	0.1443	40.3362 (268)
Total CO2, kg/year			550.4322 (272)

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13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	1605.2523	1.5746	2527.6456 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1850.9226	1.5213	2815.8381 (278)
Space and water heating			5343.4838 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	279.4701	1.5338	428.6606 (282)
Total Primary energy kWh/year			5772.1443 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO ₂ change
N Solar water heating	+ 1.6	-£ 103	-49 kg (8.9%)
U Solar photovoltaic panels	+ 4.7	-£ 267	-138 kg (27.5%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£103	0.32 kg/m ²	B 82 A 96
Solar photovoltaic panels	£267	0.90 kg/m ²	B 86 A 97
Total Savings	£370	1.23 kg/m ²	

Potential energy efficiency rating: B 86
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £974	Potential £871	Saving £103
Electricity			
Space heating	£418	£440	-£21
Water heating	£482	£358	£124
Lighting	£73	£73	£0
Generated (PV)	-£0	-£267	£267
Total cost of fuels	£974	£604	£370
Total cost of uses	£973	£604	£370
Delivered energy	25 kWh/m ²	15 kWh/m ²	9 kWh/m ²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO ₂ emissions per m ²	4 kg/m ²	2 kg/m ²	1 kg/m ²
Primary energy	38 kWh/m ²	24 kWh/m ²	14 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	380.3740 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.1577 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.4077 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3466 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4419	0.4332	0.4246	0.3812	0.3726	0.3292	0.3292	0.3206	0.3466	0.3726	0.3899	0.4072	(22b)
Effective ac	0.5976	0.5938	0.5901	0.5727	0.5694	0.5542	0.5542	0.5514	0.5601	0.5694	0.5760	0.5829	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			35.9200	1.1450	41.1298			(27)
Solid Doors			1.9500	1.0000	1.9500			(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000	(28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600	(29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500	(29a)
Joists GF			0.9600	0.1100	0.1056	9.0000	8.6400	(30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900	(30)
Flat			0.9600	0.1300	0.1248	9.0000	8.6400	(30)
Total net area of external elements Aum(A, m2)			348.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609			(33)
GF			110.0000			9.0000	990.0000	(32c)
FF			130.0000			9.0000	1170.0000	(32c)
Internal Floor 1			75.1100			18.0000	1351.9800	(32d)
Internal Ceiling 1			75.1100			9.0000	675.9900	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 12064.9500 (34)
79.2547 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	14.9500	0.0600	0.8970	
E10 Eaves (insulation at ceiling level)	26.1800	0.0600	1.5708	
E14 Flat roof	2.7200	0.0800	0.2176	
E16 Corner (normal)	39.6000	0.0900	3.5640	
E17 Corner (inverted - internal area greater than external area)	19.6000	-0.0900	-1.7640	
E2 Other lintels (including other steel lintels)	25.4000	0.0500	1.2700	
E3 Sill	24.4700	0.0500	1.2235	
E4 Jamb	57.9000	0.0500	2.8950	
E5 Ground floor (normal)	39.3700	0.1600	6.2992	
E6 Intermediate floor within a dwelling	38.4100	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(36a) = 0.0000
(33) + (36) + (36a) = 104.3340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	75.0169	74.5410	74.0745	71.8836	71.4737	69.5654	69.5654	69.2120	70.3004	71.4737	72.3029	73.1699	(38)
Heat transfer coeff	179.3508	178.8749	178.4085	176.2175	175.8076	173.8994	173.8994	173.5460	174.6344	175.8076	176.6369	177.5038	(39)
Average = Sum(39)m / 12 =												176.2156	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1782	1.1750	1.1720	1.1576	1.1549	1.1423	1.1423	1.1400	1.1472	1.1549	1.1603	1.1660	(40)
HLP (average)												1.1576	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9376 (42)
Hot water usage for mixer showers													
91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906	(42a)	
Hot water usage for baths													
31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	(42b)	
Hot water usage for other uses													
44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	(42c)	
Average daily hot water use (litres/day)												154.7338	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169	(44)
Energy conte	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607	(45)
Energy content (annual)										Total = Sum(45)m =		2570.1301	
Distribution loss (46)m = 0.15 x (45)m													
39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141	(46)	
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
323.4832	286.1326	302.2591	258.9293	243.9816	217.8870	213.5830	223.8528	233.5575	266.1667	285.9247	319.7358	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)

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Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												645.6697 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												645.6697
Solar input	-0.0000	-16.1744	-59.5270	-82.8499	-109.6591	-101.3233	-100.7026	-87.2595	-59.3262	-28.8476	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	323.4832	269.9582	242.7320	176.0794	134.3224	116.5637	112.8804	136.5933	174.2313	237.3191	285.9247	319.7358 (64)
												Total per year (kWh/year) = Sum(64)m = 2529.8234 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	134.1940	119.1973	126.4845	108.7133	101.7784	92.3304	91.5621	95.4118	100.9086	114.4837	120.8466	132.9480 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)
Water heating gains (Table 5)	180.3683	177.3769	170.0060	150.9907	136.7989	128.2367	123.0673	128.2417	140.1509	153.8760	167.8425	178.6935	(72)
Total internal gains	819.2424	816.8293	790.2926	737.5028	683.9776	638.0627	612.7259	617.3220	648.3971	698.8967	752.1965	797.4003	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				9.8400	10.6334		0.6300		0.7000		0.7700		31.9771 (74)
East				6.4700	19.6403		0.6300		0.7000		0.7700		38.8350 (76)
South				13.8100	46.7521		0.6300		0.7000		0.7700		197.3178 (78)
West				5.8000	19.6403		0.6300		0.7000		0.7700		34.8135 (80)
Solar gains	302.9434	528.3376	752.7497	978.0790	1133.5858	1141.2278	1093.7400	975.8987	830.8101	592.2506	365.1677	257.7233	(83)
Total gains	1122.1858	1345.1669	1543.0423	1715.5818	1817.5634	1779.2905	1706.4659	1593.2207	1479.2071	1291.1474	1117.3642	1055.1236	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.6861	18.7359	18.7848	19.0184	19.0627	19.2719	19.2719	19.3112	19.1908	19.0627	18.9732	18.8806	
alpha	2.2457	2.2491	2.2523	2.2679	2.2708	2.2848	2.2848	2.2874	2.2794	2.2708	2.2649	2.2587	
util living area	0.9281	0.8950	0.8451	0.7654	0.6568	0.5235	0.4058	0.4437	0.6213	0.8038	0.9008	0.9360	(86)
MIT	18.0427	18.4599	19.0534	19.7499	20.3259	20.7213	20.8883	20.8595	20.5618	19.7922	18.7916	17.9666	(87)
Th 2	19.9375	19.9400	19.9425	19.9541	19.9563	19.9664	19.9664	19.9683	19.9625	19.9563	19.9519	19.9473	(88)
util rest of house	0.9192	0.8825	0.8266	0.7368	0.6133	0.4596	0.3229	0.3600	0.5607	0.7732	0.8869	0.9281	(89)
MIT 2	16.4961	17.0186	17.7578	18.6154	19.2962	19.7390	19.8987	19.8783	19.5804	18.6892	17.4509	16.4051	(90)
Living area fraction									FLA = Living area / (4) =			0.1378	(91)
MIT	16.7092	17.2173	17.9363	18.7717	19.4381	19.8744	20.0350	20.0135	19.7156	18.8412	17.6357	16.6203	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.7092	17.2173	17.9363	18.7717	19.4381	19.8744	20.0350	20.0135	19.7156	18.8412	17.6357	16.6203	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8805	0.8393	0.7824	0.6988	0.5892	0.4535	0.3287	0.3639	0.5447	0.7332	0.8448	0.8915	(94)
Useful gains	988.1229	1128.9484	1207.2061	1198.8423	1070.9891	806.9242	560.9119	579.8446	805.7146	946.6750	943.9650	940.6097	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2225.6071	2203.2528	2040.3409	1739.5699	1360.4225	917.2178	597.3526	627.1171	980.6845	1448.8717	1860.9956	2204.6453	(97)
Space heating kWh	920.6882	721.9326	619.8523	389.3238	215.3385	0.0000	0.0000	0.0000	0.0000	373.6343	660.2620	940.4425	(98a)
Space heating requirement - total per year (kWh/year)												4841.4742	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	920.6882	721.9326	619.8523	389.3238	215.3385	0.0000	0.0000	0.0000	0.0000	373.6343	660.2620	940.4425	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4841.4742	
Space heating per m ²												(98c) / (4) = 31.8037	(99)

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	920.6882	721.9326	619.8523	389.3238	215.3385	0.0000	0.0000	0.0000	0.0000	373.6343	660.2620	940.4425	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	368.4227	288.8886	248.0402	155.7918	86.1698	0.0000	0.0000	0.0000	0.0000	149.5135	264.2105	376.3275	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	323.4832	269.9582	242.7320	176.0794	134.3224	116.5637	112.8804	136.5933	174.2313	237.3191	285.9247	319.7358	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	184.7420	154.1737	138.6248	100.5593	76.7118	66.5698	64.4662	78.0087	99.5039	135.5334	163.2922	182.6018	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.9669	-60.7172	-92.7974	-108.7852	-117.9593	-104.0971	-102.5408	-95.8168	-83.5804	-70.6381	-45.2074	-34.0749	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1937.3646	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1444.7878	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												279.4701	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-956.1815	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2785.4410	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1937.3646	16.4900	319.4714	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1444.7878	16.4900	238.2455	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	279.4701	16.4900	46.0846	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-956.1815	16.4900	-157.6743	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-157.6743	(252)
Total energy cost			459.3192	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF)	0.8384	(257)
SAP value	86.4098	
SAP rating (Section 12)	86	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1937.3646	0.1546	299.4489 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1444.7878	0.1449	209.3706 (264)
Space and water heating			508.8195 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	279.4701	0.1443	40.3362 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.1815	0.1342	-128.3436
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-128.3436 (269)
Total CO2, kg/year			431.9091 (272)
CO2 emissions per m2			2.8400 (273)
EI value			97.0656
EI rating			97 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	77.1200 (1b)	x 2.4000 (2b)	= 185.0880 (1b) - (3b)
First floor	75.1100 (1c)	x 2.6000 (2c)	= 195.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 380.3740 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.1577 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4077 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3466 (21)

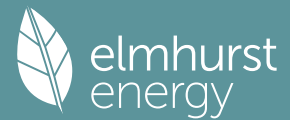
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3119	0.2859	0.2773	0.2773	0.2859	0.2513	0.2686	0.2426	0.2426	0.2599	0.2426	0.2773 (22b)
Effective ac	0.5486	0.5409	0.5384	0.5384	0.5409	0.5316	0.5361	0.5294	0.5294	0.5338	0.5294	0.5384 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			35.9200	1.1450	41.1298		(27)
Solid Doors			1.9500	1.0000	1.9500		(26)
Ground Floor			77.0400	0.1100	8.4744	75.0000	5778.0000 (28a)
Brick	128.3500	32.4100	95.9400	0.1800	17.2692	9.0000	863.4600 (29a)
Tile/Cladding	65.7100	5.4600	60.2500	0.1800	10.8450	9.0000	542.2500 (29a)
Joists GF	0.9600		0.9600	0.1100	0.1056	9.0000	8.6400 (30)
Joists FF	75.1100		75.1100	0.1100	8.2621	9.0000	675.9900 (30)
Flat	0.9600		0.9600	0.1300	0.1248	9.0000	8.6400 (30)
Total net area of external elements Aum(A, m2)			348.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.1609		(33)
GF			110.0000			9.0000	990.0000 (32c)
FF			130.0000			9.0000	1170.0000 (32c)
Internal Floor 1			75.1100			18.0000	1351.9800 (32d)
Internal Ceiling 1			75.1100			9.0000	675.9900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12064.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							79.2547 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	14.9500	0.0600	0.8970
E12 Gable (insulation at ceiling level)	26.1800	0.0600	1.5708
E10 Eaves (insulation at ceiling level)	2.7200	0.0800	0.2176
E14 Flat roof	39.6000	0.0900	3.5640
E16 Corner (normal)	19.6000	-0.0900	-1.7640
E17 Corner (inverted - internal area greater than external area)			

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E2 Other lintels (including other steel lintels)	25.4000	0.0500	1.2700	
E3 Sill	24.4700	0.0500	1.2235	
E4 Jamb	57.9000	0.0500	2.8950	
E5 Ground floor (normal)	39.3700	0.1600	6.2992	
E6 Intermediate floor within a dwelling	38.4100	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.1731	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	104.3340 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	68.8681	67.8928	67.5865	67.5865	67.8928	66.7243	67.2897	66.4557	66.4557	67.0022	66.4557	67.5865	(38)
Average = Sum(39)m / 12 =	173.2021	172.2267	171.9205	171.9205	172.2267	171.0582	171.6236	170.7897	170.7897	171.3362	170.7897	171.9205	(39)
												171.6503	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1378	1.1314	1.1293	1.1293	1.1314	1.1237	1.1274	1.1219	1.1219	1.1255	1.1219	1.1293	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9376	(42)
Hot water usage for mixer showers														
Hot water usage for baths	91.8425	90.4623	88.4510	84.6029	81.7630	78.5961	76.7960	78.7920	80.9800	84.3804	88.3112	91.4906	(42a)	
Hot water usage for other uses	31.7194	31.2484	30.5850	29.3618	28.4460	27.4304	26.8818	27.5406	28.2578	29.3445	30.5928	31.6122	(42b)	
Average daily hot water use (litres/day)	44.7141	43.0881	41.4622	39.8362	38.2102	36.5843	36.5843	38.2102	39.8362	41.4622	43.0881	44.7141	(42c)	
												154.7338	(43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy content (annual)	168.2760	164.7988	160.4982	153.8009	148.4192	142.6107	140.2621	144.5428	149.0740	155.1870	161.9922	167.8169	(44)	
Distribution loss (46)m = 0.15 x (45)m	266.5081	234.6713	246.6797	210.5458	199.8008	175.3566	169.6348	178.9742	183.8232	210.5874	230.7875	262.7607	(45)	
Water storage loss:														
Store volume	39.9762	35.2007	37.0020	31.5819	29.9701	26.3035	25.4452	26.8461	27.5735	31.5881	34.6181	39.4141	(46)	
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.7830	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)	
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	323.4832	286.1326	302.2591	258.9293	243.9816	217.8870	213.5830	223.8528	233.5575	266.1667	285.9247	319.7358	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Aperture area of solar collector													3.0000	(H1)
Zero-loss collector efficiency													0.8000	(H2)
Collector linear heat loss coefficient													1.8000	(H3)
Collector 2nd order heat loss coefficient													0.0000	(H4)
Collector loop efficiency													0.9000	(H5)
Incidence angle modifier													1.0000	(H6)
Overshading factor													0.8000	(H8)
Overall heat loss coefficient of system													6.5000	(H10)
Heat loss coefficient of collector loop													3.9667	(H11)
Dedicated solar storage volume													75.0000	(H12)
Effective solar volume													75.0000	(H14)
Reference volume													225.0000	(H15)
Storage tank correction coefficient													1.3161	(H16)
Heat delivered to hot water													766.9681	(H24)
Heat delivered to space heating													0.0000	(H29)
Solar input													766.9681	
Solar input	-1.7466	-20.9163	-66.5500	-94.6101	-119.5844	-120.4956	-117.0516	-104.5221	-72.9819	-40.9657	-7.5439	-0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h	321.7366	265.2163	235.7091	164.3193	124.3972	97.3914	96.5314	119.3307	160.5756	225.2009	278.3808	319.7358	(64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)	
Heat gains from water heating, kWh/month	134.1940	119.1973	126.4845	108.7133	101.7784	92.3304	91.5621	95.4118	100.9086	114.4837	120.8466	132.9480	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	176.2569	(66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	39.5619	35.1385	28.5766	21.6343	16.1719	13.6530	14.7525	19.1759	25.7379	32.6801	38.1425	40.6614	(67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	481.9967	486.9983	474.3944	447.5622	413.6913	381.8574	360.5904	355.5888	368.1927	395.0250	428.8959	460.7297	(68)	
Pumps, fans	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	55.5633	(69)	
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)	
Water heating gains (Table 5)	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	-117.5046	(71)	
Total internal gains	180.3683	177.3769	170.0060	150.9907	136.7989	128.2367	123.0673	128.2417	140.1509	153.8760	167.8425	178.6935	(72)	
	819.2424	816.8293	790.2926	737.5028	683.9776	638.0627	612.7259	617.3220	648.3971	698.8967	752.1965	797.4003	(73)	

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6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					9.8400	13.0723		0.6300	0.7000	0.7700		39.3114 (74)
East					6.4700	24.4329		0.6300	0.7000	0.7700		48.3115 (76)
South					13.8100	54.9219		0.6300	0.7000	0.7700		231.7988 (78)
West					5.8000	24.4329		0.6300	0.7000	0.7700		43.3086 (80)
Solar gains	362.7303	555.4650	785.9603	1060.1855	1201.8237	1312.9471	1232.3026	1106.3415	928.9679	664.0606	438.6982	300.9047 (83)
Total gains	1181.9727	1372.2943	1576.2529	1797.6883	1885.8013	1951.0098	1845.0285	1723.6635	1577.3650	1362.9573	1190.8947	1098.3050 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.3495	19.4591	19.4938	19.4938	19.4591	19.5920	19.5275	19.6228	19.6228	19.5602	19.6228	19.4938
alpha	2.2900	2.2973	2.2996	2.2996	2.2973	2.3061	2.3018	2.3082	2.3082	2.3040	2.3082	2.2996
util living area	0.9113	0.8814	0.8211	0.7235	0.5914	0.4249	0.3164	0.3265	0.5452	0.7462	0.8706	0.9218 (86)
MIT	18.4478	18.7488	19.3626	20.0091	20.5421	20.8535	20.9474	20.9459	20.7184	20.1357	19.2212	18.3706 (87)
Th 2	19.9701	19.9753	19.9769	19.9769	19.9753	19.9815	19.9785	19.9830	19.9830	19.9801	19.9830	19.9769 (88)
util rest of house	0.9003	0.8674	0.7999	0.6909	0.5415	0.3570	0.2330	0.2387	0.4780	0.7070	0.8524	0.9119 (89)
MIT 2	17.0221	17.3982	18.1583	18.9378	19.5508	19.8762	19.9534	19.9578	19.7562	19.1116	18.0023	16.9300 (90)
Living area fraction	17.2186	17.5843	18.3243	19.0854	19.6874	20.0109	20.0904	20.0940	fLA = Living area / (4) =	19.2528	18.1703	17.1285 (91)
MIT	17.2186	17.5843	18.3243	19.0854	19.6874	20.0109	20.0904	20.0940	19.8888	19.2528	18.1703	17.1285 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2186	17.5843	18.3243	19.0854	19.6874	20.0109	20.0904	20.0940	19.8888	19.2528	18.1703	17.1285 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8600	0.8248	0.7582	0.6585	0.5263	0.3590	0.2424	0.2486	0.4712	0.6743	0.8101	0.8734 (94)
Useful gains	1016.4943	1131.8230	1195.1300	1183.7401	992.4971	700.4422	447.3105	428.5553	743.3084	919.0456	964.7761	959.2423 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	2081.6389	2081.2397	1895.3000	1613.5450	1186.1971	754.5224	461.7314	443.0226	852.0362	1276.9312	1702.8182	2050.7598 (97)
Space heating kWh	792.4675	638.0080	520.9265	309.4595	144.1128	0.0000	0.0000	0.0000	0.0000	266.2669	531.3903	812.0890 (98a)
Space heating requirement - total per year (kWh/year)												4014.7205
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	792.4675	638.0080	520.9265	309.4595	144.1128	0.0000	0.0000	0.0000	0.0000	266.2669	531.3903	812.0890 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4014.7205
Space heating per m2										(98c) / (4) =		26.3727 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	792.4675	638.0080	520.9265	309.4595	144.1128	0.0000	0.0000	0.0000	0.0000	266.2669	531.3903	812.0890	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	317.1139	255.3053	208.4540	123.8333	57.6682	0.0000	0.0000	0.0000	0.0000	106.5494	212.6412	324.9656	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	321.7366	265.2163	235.7091	164.3193	124.3972	97.3914	96.5314	119.3307	160.5756	225.2009	278.3808	319.7358	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	183.7445	151.4656	134.6140	93.8431	71.0435	55.6204	55.1293	68.1500	91.7051	128.6128	158.9839	182.6018	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	34.6283	27.7801	25.0129	18.3255	14.1552	11.5649	12.9128	16.7846	21.8015	28.6047	32.3090	35.5907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-47.2626	-63.8136	-95.9377	-113.7759	-119.7937	-111.6342	-108.9214	-102.9130	-90.3334	-76.8823	-53.1131	-39.5071	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1											1606.5308	(211)
Space heating fuel - main system 2											0.0000	(213)
Space heating fuel - secondary											0.0000	(215)
Efficiency of water heater											175.1000	
Water heating fuel used											1375.5140	(219)
Space cooling fuel											0.0000	(221)

Electricity for pumps and fans:												
pump for solar water heating											80.0000	(230g)
Total electricity for the above, kWh/year											80.0000	(231)
Electricity for lighting (calculated in Appendix L)											279.4701	(232)

Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation											-1023.8881	(233)
Wind generation											0.0000	(234)
Hydro-electric generation (Appendix N)											0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)											0.0000	(235)
Appendix Q - special features												
Energy saved or generated											-0.0000	(236)
Energy used											0.0000	(237)
Total delivered energy for all uses											2317.6268	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1606.5308	26.0600	418.6619	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1375.5140	26.0600	358.4589	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	279.4701	26.0600	72.8299	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1023.8881	26.0600	-266.8252	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-266.8252	(252)
Total energy cost			603.9735	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1606.5308	0.1552	249.3212	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1375.5140	0.1457	200.4547	(264)
Space and water heating			449.7759	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	279.4701	0.1443	40.3362	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1023.8881	0.1344	-137.6242	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-137.6242	(269)
Total CO2, kg/year			363.5848	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1606.5308	1.5746	2529.5812	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1375.5140	1.5391	2117.0215	(278)
Space and water heating			4646.6027	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	279.4701	1.5338	428.6606	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1023.8881	1.4968	-1532.5143	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1532.5143	(283)
Total Primary energy kWh/year			3663.7730	(286)

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Property Reference	FURNERS LANE 23				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 23, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	79 C	DER	4.25	TER	8.70	
Environmental	96 A	% DER < TER				51.15
CO ₂ Emissions (t/year)	0.55	DFEE	41.12	TFEE	41.52	
Compliance Check	See BREL	% DFEE < TFEE				0.96
% DPER < TPER	3.28	DPER	44.45	TPER	45.96	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 344.1250 (5)

2. Ventilation rate

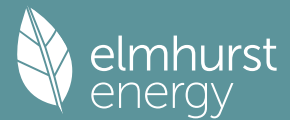
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1162 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3662 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3113 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3346	0.2957	0.2957	0.2880	0.3113	0.3346	0.3502	0.3658 (22b)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			29.0200	1.1450	33.2290		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Ground Floor			94.6100	0.1100	10.4071	75.0000	7095.7500 (28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180	9.0000	855.9000 (29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636	9.0000	18.1800 (29a)
Ashlar	17.3000		17.3000	0.1800	3.1140	9.0000	155.7000 (29a)
Joists GF	46.8300		46.8300	0.1100	5.1513	9.0000	421.4700 (30)
Joists FF	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000 (30)
Rafters	29.6100		29.6100	0.1300	3.8493	9.0000	266.4900 (30)
Total net area of external elements Aum(A, m ²)			341.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.0823		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			70.0000			9.0000	630.0000 (32c)
Internal Floor 1			47.7800			18.0000	860.0400 (32d)
Internal Ceiling 1			47.7800			9.0000	430.0200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11858.5500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.2822 (35)
List of Thermal Bridges							

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K1 Element	Length	Psi-value	Total
E16 Corner (normal)	16.8000	0.0900	1.5120
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652
R6 Flat ceiling	39.5000	0.0600	2.3700
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	47.1000	0.0500	2.3550
E5 Ground floor (normal)	47.0200	0.1600	7.5232
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.7984 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	97.8807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.7257	65.3783	65.0379	63.4387	63.1395	61.7467	61.7467	61.4887	62.2832	63.1395	63.7448	64.3775	(38)
Heat transfer coeff	163.6064	163.2590	162.9186	161.3194	161.0202	159.6274	159.6274	159.3694	160.1639	161.0202	161.6255	162.2583	(39)
Average = Sum(39)m / 12 =												161.3180	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1490	1.1466	1.1442	1.1329	1.1308	1.1211	1.1211	1.1192	1.1248	1.1308	1.1351	1.1395	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9215 (42)
Hot water usage for mixer showers	91.5048	90.1296	88.1258	84.2918	81.4624	78.3071	76.5136	78.5023	80.6822	84.0701	87.9864	91.1542	(42a)
Hot water usage for baths	31.6033	31.1339	30.4730	29.2543	28.3418	27.3299	26.7834	27.4397	28.1543	29.2370	30.4808	31.4964	(42b)
Hot water usage for other uses	44.5491	42.9291	41.3092	39.6892	38.0692	36.4493	36.4493	38.0692	39.6892	41.3092	42.9291	44.5491	(42c)
Average daily hot water use (litres/day)												154.1647	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	167.6571	164.1927	159.9079	153.2353	147.8734	142.0863	139.7462	144.0112	148.5257	154.6163	161.3964	167.1997	(44)
Energy content (annual)	265.5279	233.8082	245.7725	209.7714	199.0660	174.7116	169.0109	178.3159	183.1471	209.8128	229.9387	261.7943	(45)
Distribution loss (46)m = 0.15 x (45)m													
	39.8292	35.0712	36.8659	31.4657	29.8599	26.2067	25.3516	26.7474	27.4721	31.4719	34.4908	39.2691	(46)
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694	(64)
12Total per year (kWh/year)													
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	133.8681	118.9103	127.2994	113.8587	111.7695	102.2013	101.7762	104.8701	105.0061	115.3428	120.5643	132.6267	(65)

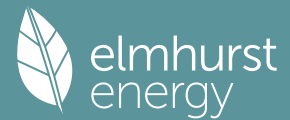
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	158.2412	175.1956	158.2412	163.5159	158.2412	163.5159	158.2412	158.2412	163.5159	158.2412	163.5159	158.2412	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.1134	315.3522	307.1906	289.8156	267.8827	247.2690	233.4977	230.2589	238.4205	255.7955	277.7284	298.3421	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	(71)
Water heating gains (Table 5)	179.9302	176.9498	171.1013	158.1371	150.2278	141.9463	136.7959	140.9544	145.8418	155.0307	167.4505	178.2616	(72)
Total internal gains	720.1074	737.3202	706.3557	681.2911	646.1743	619.5537	595.3574	596.2771	614.6008	638.8899	678.5173	704.6675	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W

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		W/m2	or Table 6b	or Table 6c	Table 6d	

North	7.0900	10.6334	0.6300	0.7000	0.7700	23.0404 (74)
East	11.9700	19.6403	0.6300	0.7000	0.7700	71.8478 (76)
South	2.5800	46.7521	0.6300	0.7000	0.7700	36.8631 (78)
West	7.3800	19.6403	0.6300	0.7000	0.7700	44.2971 (80)

Solar gains	176.0484	331.6077	525.8964	752.8066	921.2538	945.0988	898.7622	770.9583	605.4712	387.1276	216.9377	146.5727	(83)
Total gains	896.1558	1068.9279	1232.2521	1434.0977	1567.4281	1564.6525	1494.1196	1367.2354	1220.0720	1026.0175	895.4550	851.2402	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.1339	20.1768	20.2189	20.4194	20.4573	20.6358	20.6358	20.6692	20.5667	20.4573	20.3807	20.3012	
alpha	2.3423	2.3451	2.3479	2.3613	2.3638	2.3757	2.3757	2.3779	2.3711	2.3638	2.3587	2.3534	
util living area	0.9494	0.9243	0.8830	0.8014	0.6865	0.5450	0.4251	0.4719	0.6678	0.8494	0.9280	0.9546	(86)
MIT	18.0032	18.3846	18.9664	19.7136	20.3240	20.7281	20.8918	20.8583	20.5332	19.7116	18.7330	17.9412	(87)
Th 2	19.9610	19.9630	19.9649	19.9740	19.9757	19.9837	19.9837	19.9851	19.9806	19.9757	19.9723	19.9687	(88)
util rest of house	0.9428	0.9146	0.8677	0.7751	0.6439	0.4805	0.3402	0.3857	0.6083	0.8232	0.9171	0.9487	(89)
MIT 2	16.4508	16.9320	17.6622	18.5861	19.3102	19.7615	19.9180	19.8940	19.5685	18.6068	17.3846	16.3765	(90)
Living area fraction	FLA = Living area / (4) =												
MIT	16.9183	17.3694	18.0550	18.9257	19.6155	20.0526	20.2113	20.1844	19.8590	18.9395	17.7907	16.8477	(92)
Temperature adjustment	0.0000												
adjusted MIT	16.9183	17.3694	18.0550	18.9257	19.6155	20.0526	20.2113	20.1844	19.8590	18.9395	17.7907	16.8477	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9146	0.8814	0.8315	0.7435	0.6273	0.4852	0.3601	0.4035	0.6003	0.7903	0.8852	0.9222	(94)
Useful gains	819.6300	942.1726	1024.6264	1066.1996	983.2140	759.1476	538.0672	551.7406	732.4664	810.8484	792.6255	784.9741	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2064.4304	2035.7478	1882.5171	1617.3342	1274.5595	870.3847	576.4577	603.1160	922.3867	1342.8279	1727.8821	2052.1899	(97)
Space heating kWh	926.1315	734.8826	638.2707	396.8169	216.7611	0.0000	0.0000	0.0000	0.0000	395.7928	673.3847	942.8086	(98a)
Space heating requirement - total per year (kWh/year)													4924.8488
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)													0.0000
Space heating kWh	926.1315	734.8826	638.2707	396.8169	216.7611	0.0000	0.0000	0.0000	0.0000	395.7928	673.3847	942.8086	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													4924.8488
Space heating per m2													(98c) / (4) = 34.5870 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	926.1315	734.8826	638.2707	396.8169	216.7611	0.0000	0.0000	0.0000	0.0000	395.7928	673.3847	942.8086	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	370.6008	294.0707	255.4104	158.7903	86.7391	0.0000	0.0000	0.0000	0.0000	158.3805	269.4617	377.2743	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	184.1822	162.9180	172.8998	151.2899	146.2256	131.2671	129.0611	134.3752	136.0847	152.3632	162.8075	182.0499	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	34.2464	27.4737	24.7370	18.1234	13.9991	11.4373	12.7704	16.5995	21.5611	28.2893	31.9527	35.1982	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													1970.7278 (211)
Space heating fuel - main system 2													0.0000 (213)

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	175.1000
Water heating fuel used	1845.5241 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	276.3880 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4092.6400 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1970.7278	0.1545	304.4178 (261)	
Total CO2 associated with community systems			0.0000 (373)	
Water heating (other fuel)	1845.5241	0.1410	260.1881 (264)	
Space and water heating			564.6059 (265)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)	
Energy for lighting	276.3880	0.1443	39.8913 (268)	
Total CO2, kg/year			604.4972 (272)	
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.2500 (273)	

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1970.7278	1.5719	3097.7444 (275)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1845.5241	1.5213	2807.6133 (278)	
Space and water heating			5905.3578 (279)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)	
Energy for lighting	276.3880	1.5338	423.9332 (282)	
Total Primary energy kWh/year			6329.2910 (286)	
Dwelling Primary energy Rate (DPER)			44.4500 (287)	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)	
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 344.1250 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1162 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3662 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3113 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3346	0.2957	0.2957	0.2880	0.3113	0.3346	0.3502	0.3658 (22b)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Opening Type (Uw = 1.20)			29.0200	1.1450	33.2290			(27)
Ground Floor			94.6100	0.1300	12.2993			(28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180			(29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636			(29a)
Ashlar	17.3000		17.3000	0.1800	3.1140			(29a)
Joists GF	46.8300		46.8300	0.1100	5.1513			(30)
Joists FF	25.0000		25.0000	0.1100	2.7500			(30)
Rafters	29.6100		29.6100	0.1100	3.2571			(30)
Total net area of external elements Aum(A, m2)			341.5900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.3823			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

83.2822 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E16 Corner (normal)	16.8000	0.0900	1.5120	
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820	
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560	
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652	
R6 Flat ceiling	39.5000	0.0600	2.3700	
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168	
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392	
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800	
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800	
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405	
E3 Sill	19.8100	0.0500	0.9905	
E4 Jamb	47.1000	0.0500	2.3550	
E5 Ground floor (normal)	47.0200	0.1600	7.5232	
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				19.7984 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	99.1807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.7257	65.3783	65.0379	63.4387	63.1395	61.7467	61.7467	61.4887	62.2832	63.1395	63.7448	64.3775	(38)
Heat transfer coeff	164.9064	164.5590	164.2186	162.6194	162.3202	160.9274	160.9274	160.6694	161.4639	162.3202	162.9255	163.5583	(39)
Average = Sum(39)m / 12 =													162.6180

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1581	1.1557	1.1533	1.1421	1.1400	1.1302	1.1302	1.1284	1.1340	1.1400	1.1442	1.1487	(40)
HLP (average)												1.1421	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

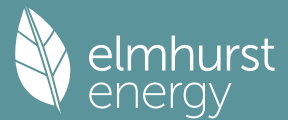
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9215 (42)
Hot water usage for mixer showers													
73.2038	72.1037	70.5006	67.4334	65.1699	62.6457	61.2109	62.8018	64.5458	67.2561	70.3892	72.9233	72.9233	(42a)
Hot water usage for baths													
31.6033	31.1339	30.4730	29.2543	28.3418	27.3299	26.7834	27.4397	28.1543	29.2370	30.4808	31.4964	31.4964	(42b)
Hot water usage for other uses													
44.5491	42.9291	41.3092	39.6892	38.0692	36.4493	36.4493	38.0692	39.6892	41.3092	42.9291	44.5491	44.5491	(42c)
Average daily hot water use (litres/day)													137.2918 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.3562	146.1667	142.2827	136.3769	131.5809	126.4248	124.4435	128.3107	132.3893	137.8023	143.7991	148.9689	(44)
Energy conte	236.5437	208.1395	218.6833	186.6932	177.1332	155.4541	150.5036	158.8755	163.2492	186.9964	204.8681	233.2492	(45)
Energy content (annual)										Total = Sum(45)m =		2280.3890	
Distribution loss (46)m = 0.15 x (45)m													
35.4815	31.2209	32.8025	28.0040	26.5700	23.3181	22.5755	23.8313	24.4874	28.0495	30.7302	34.9874	34.9874	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8903 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0208 (55)
Total storage loss													
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	(56)
If cylinder contains dedicated solar storage													
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
291.4505	257.7327	273.5901	239.8288	232.0400	208.5897	205.4104	213.7823	216.3848	241.9031	258.0037	288.1560	288.1560	(62)
WWHRS	-33.4657	-29.5974	-30.9927	-25.6631	-23.9171	-20.4661	-19.1837	-20.3999	-21.1750	-24.9630	-28.2800	-32.8460	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
257.9847	228.1354	242.5974	214.1656	208.1229	188.1236	186.2268	193.3824	195.2099	216.9402	229.7237	255.3100	255.3100	(64)
12Total per year (kWh/year)													2615.9226 (64)
Electric shower(s)													2616 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													
Heat gains from water heating, kWh/month													
122.5762	108.8810	116.6376	104.5840	102.8222	94.1970	93.9679	96.7515	96.7889	106.1017	110.6271	121.4808	121.4808	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
158.2412	175.1956	158.2412	163.5159	158.2412	163.5159	158.2412	158.2412	163.5159	158.2412	163.5159	158.2412	158.2412	(67)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.1134	315.3522	307.1906	289.8156	267.8827	247.2690	233.4977	230.2589	238.4205	255.7955	277.7284	298.3421 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601 (71)
Water heating gains (Table 5)	164.7530	162.0252	156.7710	145.2555	138.2019	130.8291	126.3009	130.0424	134.4290	142.6098	153.6488	163.2806 (72)
Total internal gains	704.9301	722.3956	692.0253	668.4095	634.1484	608.4365	584.8624	585.3651	603.1879	626.4691	664.7156	689.6865 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	

North					7.0900	10.6334	0.6300	0.7000			0.7700	23.0404 (74)	
East					11.9700	19.6403	0.6300	0.7000			0.7700	71.8478 (76)	
South					2.5800	46.7521	0.6300	0.7000			0.7700	36.8631 (78)	
West					7.3800	19.6403	0.6300	0.7000			0.7700	44.2971 (80)	

Solar gains	176.0484	331.6077	525.8964	752.8066	921.2538	945.0988	898.7622	770.9583	605.4712	387.1276	216.9377	146.5727 (83)	
Total gains	880.9785	1054.0033	1217.9217	1421.2161	1555.4022	1553.5353	1483.6246	1356.3234	1208.6591	1013.5967	881.6533	836.2592 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.9752	20.0174	20.0589	20.2561	20.2935	20.4691	20.4691	20.5020	20.4011	20.2935	20.2181	20.1399
alpha	2.3317	2.3345	2.3373	2.3504	2.3529	2.3646	2.3646	2.3668	2.3601	2.3529	2.3479	2.3427
util living area	0.9512	0.9266	0.8859	0.8053	0.6912	0.5501	0.4299	0.4772	0.6733	0.8531	0.9304	0.9563 (86)
MIT	17.9589	18.3423	18.9291	19.6851	20.3055	20.7187	20.8873	20.8526	20.5188	19.6838	18.6950	17.8966 (87)
Th 2	19.9536	19.9556	19.9575	19.9666	19.9683	19.9763	19.9763	19.9777	19.9732	19.9683	19.9649	19.9613 (88)
util rest of house	0.9448	0.9171	0.8708	0.7791	0.6485	0.4851	0.3439	0.3899	0.6136	0.8273	0.9197	0.9505 (89)
MIT 2	16.3911	16.8753	17.6121	18.5477	19.2844	19.7464	19.9080	19.8830	19.5482	18.5692	17.3333	16.3164 (90)
Living area fraction									fLA = Living area / (4) =			0.3011 (91)
MIT	16.8632	17.3171	18.0087	18.8902	19.5919	20.0392	20.2029	20.1750	19.8405	18.9049	17.7434	16.7923 (92)
Temperature adjustment												0.0000
adjusted MIT	16.8632	17.3171	18.0087	18.8902	19.5919	20.0392	20.2029	20.1750	19.8405	18.9049	17.7434	16.7923 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	807.7911	931.7430	1016.3301	1061.4727	981.7777	760.2013	539.8161	553.0534	731.1718	804.7602	782.8482	773.0193 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2071.7596	2043.3388	1889.9414	1624.6061	1281.0188	875.3218	579.8101	606.5238	926.8837	1348.0483	1734.0752	2059.5708 (97)
Space heating kWh	940.3925	746.9924	649.9668	405.4560	222.6354	0.0000	0.0000	0.0000	0.0000	404.2063	684.8834	957.1943 (98a)
Space heating requirement - total per year (kWh/year)												5011.7272
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	940.3925	746.9924	649.9668	405.4560	222.6354	0.0000	0.0000	0.0000	0.0000	404.2063	684.8834	957.1943 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5011.7272
Space heating per m2										(98c) / (4) =		35.1972 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
940.3925	746.9924	649.9668	405.4560	222.6354	0.0000	0.0000	0.0000	0.0000	0.0000	404.2063	684.8834	957.1943 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	1018.8435	809.3092	704.1894	439.2807	241.2084	0.0000	0.0000	0.0000	0.0000	437.9266	742.0189	1037.0469 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	257.9847	228.1354	242.5974	214.1656	208.1229	188.1236	186.2268	193.3824	195.2099	216.9402	229.7237	255.3100 (64)
Efficiency of water heater (217)m	86.6951	86.5172	86.1589	85.4683	84.2112	79.8000	79.8000	79.8000	79.8000	85.4347	86.3538	79.8000 (216)
Fuel for water heating, kWh/month	297.5771	263.6879	281.5698	250.5791	247.1438	235.7439	233.3669	242.3338	244.6239	253.9251	266.0262	294.3391 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)

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Lighting	32.8794	26.3771	23.7496	17.4000	13.4403	10.9808	12.2607	15.9369	20.7004	27.1601	30.6772	33.7932 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-76.5314	-102.3197	-139.5278	-148.5088	-153.3291	-140.6111	-138.6792	-134.0225	-125.1400	-112.6642	-82.0412	-66.8225 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-61.9962	-127.6814	-248.9778	-367.3077	-479.5498	-479.7781	-474.2884	-404.4769	-300.2819	-180.5015	-82.0462	-49.2526 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1												5429.8237 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												3110.9166 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												265.3556 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-4676.3363 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												4215.7595 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5429.8237	0.2100	1140.2630 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3110.9166	0.2100	653.2925 (264)
Space and water heating			1793.5554 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	265.3556	0.1443	38.2990 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1420.1976	0.1358	-192.8167
PV Unit electricity exported	-3256.1387	0.1264	-411.6580
Total			-604.4747 (269)
Total CO2, kg/year			1239.3090 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.7000 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	5429.8237	1.1300	6135.7007 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3110.9166	1.1300	3515.3357 (278)
Space and water heating			9651.0365 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	265.3556	1.5338	407.0113 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1420.1976	1.5018	-2132.9076
PV Unit electricity exported	-3256.1387	0.4641	-1511.1429
Total			-3644.0505 (283)
Total Primary energy kWh/year			6544.0980 (286)
Target Primary Energy Rate (TPER)			45.9600 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

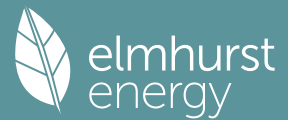
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 344.1250 (5)

2. Ventilation rate

m³ per hour

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Number of open chimneys 0 * 80 = 0.0000 (6a)
Number of open flues 0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire 0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler 0 * 20 = 0.0000 (6d)
Number of flues attached to other heater 0 * 35 = 0.0000 (6e)
Number of blocked chimneys 0 * 20 = 0.0000 (6f)
Number of intermittent extract fans 4 * 10 = 40.0000 (7a)
Number of passive vents 0 * 10 = 0.0000 (7b)
Number of flueless gas fires 0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1162 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3662 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3113 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Adj infilt rate												
	0.3969	0.3891	0.3813	0.3424	0.3346	0.2957	0.2957	0.2880	0.3113	0.3346	0.3502	0.3658
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			29.0200	1.1450	33.2290		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Ground Floor			94.6100	0.1100	10.4071	75.0000	7095.7500 (28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180	9.0000	855.9000 (29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636	9.0000	18.1800 (29a)
Ashlar	17.3000		17.3000	0.1800	3.1140	9.0000	155.7000 (29a)
Joists GF	46.8300		46.8300	0.1100	5.1513	9.0000	421.4700 (30)
Joists FF	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000 (30)
Rafters	29.6100		29.6100	0.1300	3.8493	9.0000	266.4900 (30)
Total net area of external elements Aum(A, m2)			341.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.0823		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			70.0000			9.0000	630.0000 (32c)
Internal Floor 1			47.7800			18.0000	860.0400 (32d)
Internal Ceiling 1			47.7800			9.0000	430.0200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 11858.5500 (34)
List of Thermal Bridges 83.2822 (35)

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	16.8000	0.0900	1.5120
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652
R6 Flat ceiling	39.5000	0.0600	2.3700
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	47.1000	0.0500	2.3550
E5 Ground floor (normal)	47.0200	0.1600	7.5232
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.7984 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 97.8807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Heat transfer coeff 65.7257 65.3783 65.0379 63.4387 63.1395 61.7467 61.7467 61.4887 62.2832 63.1395 63.7448 64.3775 (38)
Average = Sum(39)m / 12 = 163.6064 163.2590 162.9186 161.3194 161.0202 159.6274 159.6274 159.3694 160.1639 161.0202 161.6255 162.2583 (39)
161.3180
HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
HLP (average) 1.1490 1.1466 1.1442 1.1329 1.1308 1.1211 1.1211 1.1192 1.1248 1.1308 1.1351 1.1395 (40)
Days in mont 31 28 31 30 31 30 31 31 30 31 30 31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9215 (42)
Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)
Hot water usage for baths 31.6033 31.1339 30.4730 29.2543 28.3418 27.3299 26.7834 27.4397 28.1543 29.2370 30.4808 31.4964 (42b)
Hot water usage for other uses 44.5491 42.9291 41.3092 39.6892 38.0692 36.4493 36.4493 38.0692 39.6892 41.3092 42.9291 44.5491 (42c)
Average daily hot water use (litres/day) 69.8004 (43)
Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Energy conte 76.1524 74.0630 71.7821 68.9435 66.4110 63.7792 63.2326 65.5089 67.8435 70.5462 73.4099 76.0455 (44)
Energy content (annual) 120.6067 105.4648 110.3264 94.3802 89.4020 78.4239 76.4744 81.1137 83.6578 95.7305 104.5859 119.0689 (45)
Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 1159.2353
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (46)

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Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
	102.5157	89.6451	93.7775	80.2232	75.9917	66.6604	65.0032	68.9467	71.1092	81.3709	88.8980	101.2086 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.5157	89.6451	93.7775	80.2232	75.9917	66.6604	65.0032	68.9467	71.1092	81.3709	88.8980	101.2086 (64)
12Total per year (kWh/year)												
Electric shower(s)	58.6241	52.2345	57.0381	54.4307	55.4521	52.8959	54.6591	55.4521	54.4307	57.0381	55.9656	58.6241 (64a)
												985.3500 (64)
												985 (64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												666.8452 (64a)
Heat gains from water heating, kWh/month												
	40.2849	35.4699	37.7039	33.6635	32.8609	29.8891	29.9156	31.0997	31.3850	34.6023	36.2159	39.9582 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	158.2412	175.1956	158.2412	163.5159	158.2412	163.5159	158.2412	158.2412	163.5159	158.2412	163.5159	158.2412 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	312.1134	315.3522	307.1906	289.8156	267.8827	247.2690	233.4977	230.2589	238.4205	255.7955	277.7284	298.3421 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601 (71)
Water heating gains (Table 5)												
	54.1464	52.7826	50.6773	46.7548	44.1679	41.5126	40.2091	41.8007	43.5902	46.5084	50.2998	53.7072 (72)
Total internal gains	591.3236	610.1529	582.9316	566.9089	537.1144	519.1200	498.7706	497.1233	512.3492	527.3677	558.3667	577.1131 (73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	7.0900				10.6334		0.6300		0.7000		0.7700		23.0404 (74)	
East	11.9700				19.6403		0.6300		0.7000		0.7700		71.8478 (76)	
South	2.5800				46.7521		0.6300		0.7000		0.7700		36.8631 (78)	
West	7.3800				19.6403		0.6300		0.7000		0.7700		44.2971 (80)	
Solar gains	176.0484	331.6077	525.8964	752.8066	921.2538	945.0988	898.7622	770.9583	605.4712	387.1276	216.9377	146.5727 (83)		
Total gains	767.3720	941.7607	1108.8280	1319.7154	1458.3682	1464.2188	1397.5328	1268.0817	1117.8204	914.4952	775.3044	723.6857 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.1339	20.1768	20.2189	20.4194	20.4573	20.6358	20.6358	20.6692	20.5667	20.4573	20.3807	20.3012
alpha	2.3423	2.3451	2.3479	2.3613	2.3638	2.3757	2.3757	2.3779	2.3711	2.3638	2.3587	2.3534
util living area	0.9627	0.9403	0.9024	0.8243	0.7120	0.5702	0.4485	0.4995	0.6993	0.8751	0.9452	0.9672 (86)
MIT	17.8247	18.2211	18.8269	19.6151	20.2634	20.6993	20.8784	20.8394	20.4800	19.5974	18.5758	17.7611 (87)
Th 2	19.9610	19.9630	19.9649	19.9740	19.9757	19.9837	19.9837	19.9851	19.9806	19.9757	19.9723	19.9687 (88)
util rest of house	0.9577	0.9323	0.8890	0.7999	0.6704	0.5050	0.3607	0.4107	0.6411	0.8521	0.9366	0.9627 (89)
MIT 2	17.0503	17.4420	18.0373	18.8026	19.4065	19.7905	19.9256	19.9037	19.6185	18.8040	17.8033	16.9921 (90)
Living area fraction									FLA = Living area / (4) =			0.3011 (91)
MIT	17.2835	17.6766	18.2751	19.0473	19.6646	20.0642	20.2125	20.1854	19.8780	19.0429	18.0359	17.2237 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2835	17.6766	18.2751	19.0473	19.6646	20.0642	20.2125	20.1854	19.8780	19.0429	18.0359	17.2237 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9391	0.9086	0.8614	0.7738	0.6564	0.5105	0.3815	0.4293	0.6346	0.8259	0.9142	0.9457 (94)
Useful gains	720.6721	855.7160	955.1186	1021.2391	957.2568	747.5310	533.1073	544.4380	709.3268	755.2919	708.8209	684.3916 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2124.1787	2085.8982	1918.3821	1636.9548	1282.4584	872.2380	576.6523	603.2832	925.4227	1359.4769	1767.5239	2113.1956 (97)
Space heating kWh	1044.2089	826.6824	716.6680	443.3153	241.9499	0.0000	0.0000	0.0000	0.0000	449.5137	762.2662	1063.0302 (98a)
Space heating requirement - total per year (kWh/year)												5547.6347
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1044.2089	826.6824	716.6680	443.3153	241.9499	0.0000	0.0000	0.0000	0.0000	449.5137	762.2662	1063.0302 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5547.6347
Space heating per m ²												38.9608 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1500.4972	1181.2425	1211.2077	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7350	0.7956	0.7576	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1102.8196	939.7699	917.6290	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1642.9577	1568.0555	1419.9176	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	388.8994	467.4445	373.7027	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	97.2248	116.8611	93.4257	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												307.5117 (107)
Energy for space heating												38.9608 (99)
Energy for space cooling												2.1596 (108)
Total												41.1205 (109)
Fabric Energy Efficiency (DFEE)												41.1 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 344.1250 (5)

2. Ventilation rate

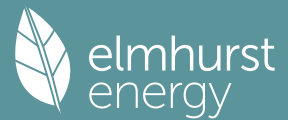
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1162 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3662 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3113 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3346	0.2957	0.2957	0.2880	0.3113	0.3346	0.3502	0.3658 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.20)			29.0200	1.1450	33.2290		(27)
Ground Floor			94.6100	0.1300	12.2993		(28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180		(29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636		(29a)
Ashlar	17.3000		17.3000	0.1800	3.1140		(29a)
Joists GF	46.8300		46.8300	0.1100	5.1513		(30)
Joists FF	25.0000		25.0000	0.1100	2.7500		(30)
Rafters	29.6100		29.6100	0.1100	3.2571		(30)
Total net area of external elements Aum(A, m ²)			341.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.3823		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.2822 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				16.8000	0.0900	1.5120	
E10 Eaves (insulation at ceiling level)				24.7000	0.0600	1.4820	

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E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652
R6 Flat ceiling	39.5000	0.0600	2.3700
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	47.1000	0.0500	2.3550
E5 Ground floor (normal)	47.0200	0.1600	7.5232
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.7984 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	99.1807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 65.7257	Feb 65.3783	Mar 65.0379	Apr 63.4387	May 63.1395	Jun 61.7467	Jul 61.7467	Aug 61.4887	Sep 62.2832	Oct 63.1395	Nov 63.7448	Dec 64.3775 (38)
Heat transfer coeff	164.9064	164.5590	164.2186	162.6194	162.3202	160.9274	160.9274	160.6694	161.4639	162.3202	162.9255	163.5583 (39)
Average = Sum(39)m / 12 =												162.6180
HLP	Jan 1.1581	Feb 1.1557	Mar 1.1533	Apr 1.1421	May 1.1400	Jun 1.1302	Jul 1.1302	Aug 1.1284	Sep 1.1340	Oct 1.1400	Nov 1.1442	Dec 1.1487 (40)
HLP (average)												1.1421
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.9215 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.6033	31.1339	30.4730	29.2543	28.3418	27.3299	26.7834	27.4397	28.1543	29.2370	30.4808	31.4964 (42b)
Hot water usage for other uses	44.5491	42.9291	41.3092	39.6892	38.0692	36.4493	36.4493	38.0692	39.6892	41.3092	42.9291	44.5491 (42c)
Average daily hot water use (litres/day)												69.8004 (43)
Daily hot water use	Jan 76.1524	Feb 74.0630	Mar 71.7821	Apr 68.9435	May 66.4110	Jun 63.7792	Jul 63.2326	Aug 65.5089	Sep 67.8435	Oct 70.5462	Nov 73.4099	Dec 76.0455 (44)
Energy conte	120.6067	105.4648	110.3264	94.3802	89.4020	78.4239	76.4744	81.1137	83.6578	95.7305	104.5859	119.0689 (45)
Energy content (annual)										Total = Sum(45)m =		1159.2353
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	102.5157	89.6451	93.7775	80.2232	75.9917	66.6604	65.0032	68.9467	71.1092	81.3709	88.8980	101.2086 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.5157	89.6451	93.7775	80.2232	75.9917	66.6604	65.0032	68.9467	71.1092	81.3709	88.8980	101.2086 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		985.3500 (64)
Electric shower(s)	58.6241	52.2345	57.0381	54.4307	55.4521	52.8959	54.6591	55.4521	54.4307	57.0381	55.9656	58.6241 (64a)
												666.8452 (64a)
Heat gains from water heating, kWh/month	40.2849	35.4699	37.7039	33.6635	32.8609	29.8891	29.9156	31.0997	31.3850	34.6023	36.2159	39.9582 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan 146.0751	Feb 146.0751	Mar 146.0751	Apr 146.0751	May 146.0751	Jun 146.0751	Jul 146.0751	Aug 146.0751	Sep 146.0751	Oct 146.0751	Nov 146.0751	Dec 146.0751 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	158.2412	175.1956	158.2412	163.5159	158.2412	163.5159	158.2412	158.2412	163.5159	158.2412	163.5159	158.2412 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.1134	315.3522	307.1906	289.8156	267.8827	247.2690	233.4977	230.2589	238.4205	255.7955	277.7284	298.3421 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601 (71)
Water heating gains (Table 5)	54.1464	52.7826	50.6773	46.7548	44.1679	41.5126	40.2091	41.8007	43.5902	46.5084	50.2998	53.7072 (72)
Total internal gains	591.3236	610.1529	582.9316	566.9089	537.1144	519.1200	498.7706	497.1233	512.3492	527.3677	558.3667	577.1131 (73)

6. Solar gains												
[Jan]												
		Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North		7.0900		10.6334		0.6300		0.7000		0.7700		23.0404 (74)
East		11.9700		19.6403		0.6300		0.7000		0.7700		71.8478 (76)
South		2.5800		46.7521		0.6300		0.7000		0.7700		36.8631 (78)
West		7.3800		19.6403		0.6300		0.7000		0.7700		44.2971 (80)
Solar gains	176.0484	331.6077	525.8964	752.8066	921.2538	945.0988	898.7622	770.9583	605.4712	387.1276	216.9377	146.5727 (83)

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Total gains 767.3720 941.7607 1108.8280 1319.7154 1458.3682 1464.2188 1397.5328 1268.0817 1117.8204 914.4952 775.3044 723.6857 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.9752	20.0174	20.0589	20.2561	20.2935	20.4691	20.4691	20.5020	20.4011	20.2935	20.2181	20.1399
alpha	2.3317	2.3345	2.3373	2.3504	2.3529	2.3646	2.3646	2.3668	2.3601	2.3529	2.3479	2.3427
util living area	0.9628	0.9405	0.9029	0.8254	0.7138	0.5725	0.4509	0.5019	0.7012	0.8758	0.9454	0.9673 (86)
MIT	17.8015	18.1979	18.8054	19.5971	20.2509	20.6926	20.8750	20.8353	20.4709	19.5818	18.5557	17.7377 (87)
Th 2	19.9536	19.9556	19.9575	19.9666	19.9683	19.9763	19.9763	19.9777	19.9732	19.9683	19.9649	19.9613 (88)
util rest of house	0.9577	0.9325	0.8895	0.8009	0.6721	0.5069	0.3622	0.4124	0.6428	0.8528	0.9367	0.9628 (89)
MIT 2	17.0228	17.4146	18.0117	18.7806	19.3898	19.7790	19.9167	19.8943	19.6051	18.7842	17.7790	16.9645 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.2573	17.6505	18.2507	19.0265	19.6491	20.0541	20.2053	20.1777	19.8658	19.0244	18.0129	17.1973 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.2573	17.6505	18.2507	19.0265	19.6491	20.0541	20.2053	20.1777	19.8658	19.0244	18.0129	17.1973 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9391	0.9088	0.8617	0.7746	0.6577	0.5123	0.3831	0.4310	0.6359	0.8264	0.9143	0.9457 (94)
Useful gains	720.6701	855.8282	955.4995	1022.3007	959.2166	750.0727	535.4211	546.5799	710.8584	755.7560	708.8913	684.3750 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2136.7378	2098.2096	1929.6847	1646.7586	1290.2983	877.7151	580.1911	606.9624	930.9674	1367.4440	1777.9893	2125.8231 (97)
Space heating kWh	1053.5544	834.8803	724.7938	449.6097	246.3247	0.0000	0.0000	0.0000	0.0000	455.0959	769.7506	1072.4374 (98a)
Space heating requirement - total per year (kWh/year)	5606.4468											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	1053.5544	834.8803	724.7938	449.6097	246.3247	0.0000	0.0000	0.0000	0.0000	455.0959	769.7506	1072.4374 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5606.4468											
Space heating per m2	(98c) / (4) = 39.3739 (99)											

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1512.7172	1190.8625	1221.0877	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7312	0.7922	0.7540	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1106.1404	943.3423	920.6521	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1642.9577	1568.0555	1419.9176	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	386.5084	464.7866	371.4536	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	96.6271	116.1967	92.8634	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	305.6872 (107)											
Energy for space heating	39.3739 (99)											
Energy for space cooling	2.1468 (108)											
Total	41.5207 (109)											
Fabric Energy Efficiency (TFEE)	41.5 (109)											

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)	
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 344.1250 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)

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Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1162 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3662	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3113 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000	(22)
Wind factor	Jan 1.2750 Feb 1.2500 Mar 1.2250 Apr 1.1000 May 1.0750 Jun 0.9500 Jul 0.9500 Aug 0.9250 Sep 1.0000 Oct 1.0750 Nov 1.1250 Dec 1.1750	(22a)
Adj infilt rate	0.3969 0.3891 0.3813 0.3424 0.3346 0.2957 0.2957 0.2880 0.3113 0.3346 0.3502 0.3658	(22b)
Effective ac	0.5788 0.5757 0.5727 0.5586 0.5560 0.5437 0.5437 0.5415 0.5485 0.5560 0.5613 0.5669	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			29.0200	1.1450	33.2290		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Ground Floor			94.6100	0.1100	10.4071	75.0000	7095.7500 (28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180	9.0000	855.9000 (29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636	9.0000	18.1800 (29a)
Ashlar	17.3000		17.3000	0.1800	3.1140	9.0000	155.7000 (29a)
Joists GF	46.8300		46.8300	0.1100	5.1513	9.0000	421.4700 (30)
Joists FF	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000 (30)
Rafters	29.6100		29.6100	0.1300	3.8493	9.0000	266.4900 (30)
Total net area of external elements Aum(A, m2)			341.5900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.0823		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			70.0000			9.0000	630.0000 (32c)
Internal Floor 1			47.7800			18.0000	860.0400 (32d)
Internal Ceiling 1			47.7800			9.0000	430.0200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 11858.5500 (34)
List of Thermal Bridges
83.2822 (35)

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	16.8000	0.0900	1.5120
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652
R6 Flat ceiling	39.5000	0.0600	2.3700
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	47.1000	0.0500	2.3550
E5 Ground floor (normal)	47.0200	0.1600	7.5232
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.7984 (36)
Point Thermal Bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	97.8807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 65.7257	Feb 65.3783	Mar 65.0379	Apr 63.4387	May 63.1395	Jun 61.7467	Jul 61.7467	Aug 61.4887	Sep 62.2832	Oct 63.1395	Nov 63.7448	Dec 64.3775 (38)
Heat transfer coeff	163.6064	163.2590	162.9186	161.3194	161.0202	159.6274	159.6274	159.3694	160.1639	161.0202	161.6255	162.2583 (39)
Average = Sum(39)m / 12 =												161.3180
HLP	Jan 1.1490	Feb 1.1466	Mar 1.1442	Apr 1.1329	May 1.1308	Jun 1.1211	Jul 1.1211	Aug 1.1192	Sep 1.1248	Oct 1.1308	Nov 1.1351	Dec 1.1395 (40)
HLP (average)												1.1329
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9215 (42)
Hot water usage for mixer showers	91.5048	90.1296	88.1258	84.2918	81.4624	78.3071	76.5136	78.5023	80.6822	84.0701	87.9864	91.1542 (42a)
Hot water usage for baths	31.6033	31.1339	30.4730	29.2543	28.3418	27.3299	26.7834	27.4397	28.1543	29.2370	30.4808	31.4964 (42b)
Hot water usage for other uses	44.5491	42.9291	41.3092	39.6892	38.0692	36.4493	36.4493	38.0692	39.6892	41.3092	42.9291	44.5491 (42c)
Average daily hot water use (litres/day)												154.1647 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	167.6571	164.1927	159.9079	153.2353	147.8734	142.0863	139.7462	144.0112	148.5257	154.6163	161.3964	167.1997 (44)
Energy content (annual)	265.5279	233.8082	245.7725	209.7714	199.0660	174.7116	169.0109	178.3159	183.1471	209.8128	229.9387	261.7943 (45)
Distribution loss (46)m = 0.15 x (45)m											Total = Sum(45)m =	2560.6774
Water storage loss:	39.8292	35.0712	36.8659	31.4657	29.8599	26.2067	25.3516	26.7474	27.4721	31.4719	34.4908	39.2691 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)

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If cylinder contains dedicated solar storage												
Primary loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
WWHRS	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694 (64)
	Total per year (kWh/year) = Sum(64a)m =											3231.5127 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	133.8681	118.9103	127.2994	113.8587	111.7695	102.2013	101.7762	104.8701	105.0061	115.3428	120.5643	132.6267 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1256	34.7510	28.2614	21.3957	15.9935	13.5024	14.5898	18.9644	25.4540	32.3197	37.7219	40.2130 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	465.8409	470.6749	458.4934	432.5606	399.8250	369.0581	348.5040	343.6700	355.8515	381.7843	414.5199	445.2868 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601 (71)
Water heating gains (Table 5)	179.9302	176.9498	171.1013	158.1371	150.2278	141.9463	136.7959	140.9544	145.8418	155.0307	167.4505	178.2616 (72)
Total internal gains	801.7772	799.2562	774.7367	728.9739	682.9269	638.3874	613.7703	617.4694	641.0279	686.0153	736.5728	780.6419 (73)

6. Solar gains

[Jan]														
	Area				Solar flux		g		FF		Access		Gains	
	m2				Table 6a		Specific data		Specific data		factor		W	
					W/m2		or Table 6b		or Table 6c		Table 6d			
North	7.0900				10.6334		0.6300		0.7000		0.7700		23.0404 (74)	
East	11.9700				19.6403		0.6300		0.7000		0.7700		71.8478 (76)	
South	2.5800				46.7521		0.6300		0.7000		0.7700		36.8631 (78)	
West	7.3800				19.6403		0.6300		0.7000		0.7700		44.2971 (80)	
Solar gains	176.0484	331.6077	525.8964	752.8066	921.2538	945.0988	898.7622	770.9583	605.4712	387.1276	216.9377	146.5727	(83)	
Total gains	977.8257	1130.8640	1300.6331	1481.7805	1604.1807	1583.4862	1512.5326	1388.4277	1246.4991	1073.1428	953.5105	927.2146	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	20.1339	20.1768	20.2189	20.4194	20.4573	20.6358	20.6358	20.6692	20.5667	20.4573	20.3807	20.3012
util living area	2.3423	2.3451	2.3479	2.3613	2.3638	2.3757	2.3757	2.3779	2.3711	2.3638	2.3587	2.3534
MIT	0.9402	0.9162	0.8719	0.7920	0.6782	0.5405	0.4209	0.4663	0.6600	0.8384	0.9192	0.9464 (86)
Th 2	18.1123	18.4611	19.0399	19.7523	20.3430	20.7331	20.8941	20.8619	20.5459	19.7570	18.8058	18.0449 (87)
util rest of house	19.9610	19.9630	19.9649	19.9740	19.9757	19.9837	19.9837	19.9851	19.9806	19.9757	19.9723	19.9687 (88)
MIT	0.9325	0.9056	0.8556	0.7650	0.6353	0.4762	0.3366	0.3807	0.6001	0.8110	0.9072	0.9395 (89)
Living area fraction	16.5877	17.0271	17.7516	18.6311	19.3304	19.7659	19.9196	19.8966	19.5808	18.6597	17.4746	16.5069 (90)
MIT	17.0468	17.4589	18.1395	18.9688	19.6354	20.0572	20.2130	20.1873	19.8714	18.9901	17.8755	16.9701 (92)
Temperature adjustment	17.0468	17.4589	18.1395	18.9688	19.6354	20.0572	20.2130	20.1873	19.8714	18.9901	17.8755	16.9701 (93)
adjusted MIT	17.0468	17.4589	18.1395	18.9688	19.6354	20.0572	20.2130	20.1873	19.8714	18.9901	17.8755	16.9701 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9021	0.8713	0.8192	0.7340	0.6195	0.4811	0.3565	0.3987	0.5930	0.7786	0.8741	0.9107 (94)
Ext temp.	882.1095	985.3483	1065.5361	1087.6641	993.8167	761.8314	539.1761	553.5115	739.2236	835.5663	833.4366	844.4228 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	2085.4649	2050.3595	1896.2978	1624.2881	1277.7557	871.1167	576.7404	603.5762	924.3735	1350.9767	1741.5966	2072.0493 (97)
Space heating requirement - total per year (kWh/year)	895.2964	715.6875	618.0867	386.3693	211.2506	0.0000	0.0000	0.0000	0.0000	383.4653	653.8752	913.3541 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating contribution - total per year (kWh/year)	895.2964	715.6875	618.0867	386.3693	211.2506	0.0000	0.0000	0.0000	0.0000	383.4653	653.8752	913.3541 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	895.2964	715.6875	618.0867	386.3693	211.2506	0.0000	0.0000	0.0000	0.0000	383.4653	653.8752	913.3541 (98c)
Space heating per m ²	(98c) / (4) =											33.5514 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)

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Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	895.2964	715.6875	618.0867	386.3693	211.2506	0.0000	0.0000	0.0000	0.0000	383.4653	653.8752	913.3541 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	358.2619	286.3896	247.3336	154.6095	84.5340	0.0000	0.0000	0.0000	0.0000	153.4475	261.6547	365.4878 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694 (64)
Efficiency of water heater												175.1000 (216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (217)
Fuel for water heating, kWh/month	184.1822	162.9180	172.8998	151.2899	146.2256	131.2671	129.0611	134.3752	136.0847	152.3632	162.8075	182.0499 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.2464	27.4737	24.7370	18.1234	13.9991	11.4373	12.7704	16.5995	21.5611	28.2893	31.9527	35.1982 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1911.7187 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1845.5241 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												276.3880 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												4033.6309 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1911.7187	16.4900	315.2424 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1845.5241	16.4900	304.3269 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	276.3880	16.4900	45.5764 (250)
Additional standing charges			0.0000 (251)
Total energy cost			665.1457 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		1.2778 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	79.2864
SAP rating (Section 12)		79 (258)
SAP band		C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1911.7187	0.1545	295.2820 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1845.5241	0.1410	260.1881 (264)
Space and water heating			555.4701 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	276.3880	0.1443	39.8913 (268)
Total CO2, kg/year			595.3614 (272)
CO2 emissions per m2			4.1800 (273)
EI value			95.7427

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EI rating
EI band

96 (274)
A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 344.1250 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1162 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3662 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3113 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.2802	0.2568	0.2490	0.2490	0.2568	0.2257	0.2413	0.2179	0.2179	0.2335	0.2179	0.2490 (22b)
Effective ac	0.5392	0.5330	0.5310	0.5310	0.5330	0.5255	0.5291	0.5237	0.5237	0.5273	0.5237	0.5310 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			29.0200	1.1450	33.2290		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Ground Floor			94.6100	0.1100	10.4071	75.0000	7095.7500 (28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180	9.0000	855.9000 (29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636	9.0000	18.1800 (29a)
Ashlar	17.3000		17.3000	0.1800	3.1140	9.0000	155.7000 (29a)
Joists GF	46.8300		46.8300	0.1100	5.1513	9.0000	421.4700 (30)
Joists FF	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000 (30)
Rafters	29.6100		29.6100	0.1300	3.8493	9.0000	266.4900 (30)
Total net area of external elements Aum(A, m ²)			341.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.0823		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			70.0000			9.0000	630.0000 (32c)
Internal Floor 1			47.7800			18.0000	860.0400 (32d)
Internal Ceiling 1			47.7800			9.0000	430.0200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11858.5500 (34)

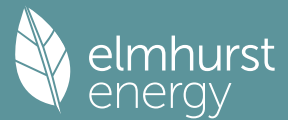
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 83.2822 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	16.8000	0.0900	1.5120
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652
R6 Flat ceiling	39.5000	0.0600	2.3700
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	47.1000	0.0500	2.3550
E5 Ground floor (normal)	47.0200	0.1600	7.5232
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.7984 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 97.8807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

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(38)m 61.2377 60.5258 60.3022 60.3022 60.5258 59.6729 60.0856 59.4769 59.4769 59.8758 59.4769 60.3022 (38)
 Heat transfer coeff 159.1184 158.4065 158.1829 158.1829 158.4065 157.5536 157.9663 157.3576 157.3576 157.7565 157.3576 158.1829 (39)
 Average = Sum(39)m / 12 = 157.9858

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1175	1.1125	1.1109	1.1109	1.1125	1.1065	1.1094	1.1051	1.1051	1.1079	1.1051	1.1109	(40)
HLP (average)												1.1095	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9215 (42)
 Hot water usage for mixer showers 91.5048 90.1296 88.1258 84.2918 81.4624 78.3071 76.5136 78.5023 80.6822 84.0701 87.9864 91.1542 (42a)
 Hot water usage for baths 31.6033 31.1339 30.4730 29.2543 28.3418 27.3299 26.7834 27.4397 28.1543 29.2370 30.4808 31.4964 (42b)
 Hot water usage for other uses 44.5491 42.9291 41.3092 39.6892 38.0692 36.4493 36.4493 38.0692 39.6892 41.3092 42.9291 44.5491 (42c)
 Average daily hot water use (litres/day) 154.1647 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	167.6571	164.1927	159.9079	153.2353	147.8734	142.0863	139.7462	144.0112	148.5257	154.6163	161.3964	167.1997	(44)
Energy conte	265.5279	233.8082	245.7725	209.7714	199.0660	174.7116	169.0109	178.3159	183.1471	209.8128	229.9387	261.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2560.6774	
Distribution loss (46)m = 0.15 x (45)m	39.8292	35.0712	36.8659	31.4657	29.8599	26.2067	25.3516	26.7474	27.4721	31.4719	34.4908	39.2691	(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694	(64)
Total per year (kWh/year) = Sum(64)m =												3231.5127	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	133.8681	118.9103	127.2994	113.8587	111.7695	102.2013	101.7762	104.8701	105.0061	115.3428	120.5643	132.6267	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1256	34.7510	28.2614	21.3957	15.9935	13.5024	14.5898	18.9644	25.4540	32.3197	37.7219	40.2130	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	465.8409	470.6749	458.4934	432.5606	399.8250	369.0581	348.5040	343.6700	355.8515	381.7843	414.5199	445.2868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	(71)
Water heating gains (Table 5)	179.9302	176.9498	171.1013	158.1371	150.2278	141.9463	136.7959	140.9544	145.8418	155.0307	167.4505	178.2616	(72)
Total internal gains	801.7772	799.2562	774.7367	728.9739	682.9269	638.3874	613.7703	617.4694	641.0279	686.0153	736.5728	780.6419	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	7.0900	13.0723	0.6300	0.7000	0.7700	28.3250	(74)						
East	11.9700	24.4329	0.6300	0.7000	0.7700	89.3800	(76)						
South	2.5800	54.9219	0.6300	0.7000	0.7700	43.3049	(78)						
West	7.3800	24.4329	0.6300	0.7000	0.7700	55.1065	(80)						
Solar gains	216.1164	357.7369	562.3130	830.6472	988.4263	1097.4421	1023.2281	887.4481	691.8894	445.2763	267.3113	175.3629	(83)
Total gains	1017.8936	1156.9931	1337.0497	1559.6211	1671.3531	1735.8295	1636.9985	1504.9176	1332.9173	1131.2916	1003.8842	956.0048	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
 Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.7018	20.7949	20.8243	20.8243	20.7949	20.9074	20.8528	20.9335	20.9335	20.8805	20.9335	20.8243	
alpha	2.3801	2.3863	2.3883	2.3883	2.3863	2.3938	2.3902	2.3956	2.3956	2.3920	2.3956	2.3883	
util living area													

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	0.9274	0.9047	0.8499	0.7512	0.6119	0.4404	0.3288	0.3444	0.5836	0.7870	0.8956	0.9353 (86)
MIT	18.4683	18.7244	19.3337	20.0045	20.5537	20.8601	20.9507	20.9473	20.7050	20.0919	19.1932	18.4051 (87)
Th 2	19.9866	19.9907	19.9919	19.9919	19.9907	19.9955	19.9932	19.9967	19.9967	19.9944	19.9967	19.9919 (88)
util rest of house												
	0.9179	0.8928	0.8308	0.7198	0.5619	0.3712	0.2433	0.2532	0.5153	0.7506	0.8798	0.9267 (89)
MIT 2	17.0517	17.3733	18.1316	18.9437	19.5764	19.8952	19.9697	19.9722	19.7573	19.0732	17.9735	16.9760 (90)
Living area fraction									FLA = Living area / (4) =			0.3011 (91)
MIT	17.4783	17.7802	18.4936	19.2631	19.8707	20.1858	20.2651	20.2659	20.0427	19.3800	18.3408	17.4064 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4783	17.7802	18.4936	19.2631	19.8707	20.1858	20.2651	20.2659	20.0427	19.3800	18.3408	17.4064 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8859	0.8583	0.7961	0.6940	0.5555	0.3848	0.2671	0.2785	0.5187	0.7245	0.8458	0.8962	(94)
Useful gains	901.7804	993.0841	1064.3625	1082.4246	928.5114	667.9837	437.2387	419.1534	691.4020	819.5970	849.1298	856.7770	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1953.7021	1945.2623	1770.6333	1512.7209	1120.0421	722.5094	452.5924	435.2314	809.2479	1195.7901	1595.7299	1930.8400	(97)
Space heating kWh	782.6298	639.8638	525.4655	309.8133	142.4989	0.0000	0.0000	0.0000	0.0000	279.8876	537.5521	799.1029	(98a)
Space heating requirement - total per year (kWh/year)												4016.8138	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	782.6298	639.8638	525.4655	309.8133	142.4989	0.0000	0.0000	0.0000	0.0000	279.8876	537.5521	799.1029	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4016.8138	
Space heating per m2										(98c) / (4) =		28.2099	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	782.6298	639.8638	525.4655	309.8133	142.4989	0.0000	0.0000	0.0000	0.0000	279.8876	537.5521	799.1029	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	313.1772	256.0479	210.2703	123.9749	57.0224	0.0000	0.0000	0.0000	0.0000	111.9998	215.1069	319.7691	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	184.1822	162.9180	172.8998	151.2899	146.2256	131.2671	129.0611	134.3752	136.0847	152.3632	162.8075	182.0499	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	34.2464	27.4737	24.7370	18.1234	13.9991	11.4373	12.7704	16.5995	21.5611	28.2893	31.9527	35.1982	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1607.3685	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1845.5241	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												276.3880	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3729.2806	(238)

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10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1607.3685	26.0600	418.8802 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1845.5241	26.0600	480.9436 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	276.3880	26.0600	72.0267 (250)
Additional standing charges			0.0000 (251)
Total energy cost			971.8505 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1607.3685	0.1551	249.2777 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1845.5241	0.1410	260.1881 (264)
Space and water heating			509.4659 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	276.3880	0.1443	39.8913 (268)
Total CO2, kg/year			549.3572 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1607.3685	1.5742	2530.2658 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1845.5241	1.5213	2807.6133 (278)
Space and water heating			5337.8791 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	276.3880	1.5338	423.9332 (282)
Total Primary energy kWh/year			5761.8123 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.7	-£ 103	-49 kg (8.9%)
U Solar photovoltaic panels	+ 4.9	-£ 265	-137 kg (27.3%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£103	0.35 kg/m²	B 81 A 96
Solar photovoltaic panels	£265	0.96 kg/m²	B 86 A 97
Total Savings	£368	1.31 kg/m²	

Potential energy efficiency rating: B 86
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £972	Potential £869	Saving £103
Electricity			
Space heating	£419	£440	-£21
Water heating	£481	£357	£124
Lighting	£72	£72	£0
Generated (PV)	-£0	-£265	£265
Total cost of fuels	£972	£604	£368
Total cost of uses	£972	£604	£368
Delivered energy	26 kWh/m²	16 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	3 kg/m²	1 kg/m²
Primary energy	40 kWh/m²	26 kWh/m²	15 kWh/m²

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 344.1250 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
		Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1162 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3662	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3113 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3346	0.2957	0.2957	0.2880	0.3113	0.3346	0.3502	0.3658 (22b)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			29.0200	1.1450	33.2290		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Ground Floor			94.6100	0.1100	10.4071	75.0000	7095.7500 (28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180	9.0000	855.9000 (29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636	9.0000	18.1800 (29a)
Ashlar	17.3000		17.3000	0.1800	3.1140	9.0000	155.7000 (29a)
Joists GF	46.8300		46.8300	0.1100	5.1513	9.0000	421.4700 (30)
Joists FF	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000 (30)
Rafters	29.6100		29.6100	0.1300	3.8493	9.0000	266.4900 (30)
Total net area of external elements Aum(A, m ²)			341.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.0823		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			70.0000			9.0000	630.0000 (32c)
Internal Floor 1			47.7800			18.0000	860.0400 (32d)
Internal Ceiling 1			47.7800			9.0000	430.0200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 11858.5500 (34)
83.2822 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	16.8000	0.0900	1.5120
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652
R6 Flat ceiling	39.5000	0.0600	2.3700
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	47.1000	0.0500	2.3550
E5 Ground floor (normal)	47.0200	0.1600	7.5232
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(36a) = 0.0000
(33) + (36) + (36a) = 97.8807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

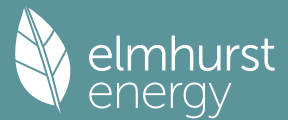
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	65.7257	65.3783	65.0379	63.4387	63.1395	61.7467	61.7467	61.4887	62.2832	63.1395	63.7448	64.3775 (38)
Heat transfer coeff	163.6064	163.2590	162.9186	161.3194	161.0202	159.6274	159.6274	159.3694	160.1639	161.0202	161.6255	162.2583 (39)
Average = Sum(39)m / 12 =												161.3180

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1490	1.1466	1.1442	1.1329	1.1308	1.1211	1.1211	1.1192	1.1248	1.1308	1.1351	1.1395 (40)
HLP (average)												1.1329
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Hot water usage for mixer showers
2.9215 (42)

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Hot water usage for baths	91.5048	90.1296	88.1258	84.2918	81.4624	78.3071	76.5136	78.5023	80.6822	84.0701	87.9864	91.1542 (42a)
Hot water usage for other uses	31.6033	31.1339	30.4730	29.2543	28.3418	27.3299	26.7834	27.4397	28.1543	29.2370	30.4808	31.4964 (42b)
Average daily hot water use (litres/day)	44.5491	42.9291	41.3092	39.6892	38.0692	36.4493	36.4493	38.0692	39.6892	41.3092	42.9291	44.5491 (42c)
												154.1647 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	167.6571	164.1927	159.9079	153.2353	147.8734	142.0863	139.7462	144.0112	148.5257	154.6163	161.3964	167.1997 (44)
Distribution loss (46)m = 0.15 x (45)m	265.5279	233.8082	245.7725	209.7714	199.0660	174.7116	169.0109	178.3159	183.1471	209.8128	229.9387	261.7943 (45)
	39.8292	35.0712	36.8659	31.4657	29.8599	26.2067	25.3516	26.7474	27.4721	31.4719	34.4908	39.2691 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	322.5030	285.2695	301.3518	258.1550	243.2467	217.2421	212.9591	223.1946	232.8814	265.3921	285.0758	318.7694 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												645.3039 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												645.3039
Solar input	-0.0000	-16.1749	-59.5086	-82.8087	-109.5826	-101.2492	-100.6271	-87.2056	-59.3024	-28.8448	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	322.5030	269.0946	241.8432	175.3463	133.6642	115.9929	112.3320	135.9889	173.5790	236.5473	285.0758	318.7694 (64)
												2520.7365 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	133.8681	118.9103	126.1828	108.4558	101.5340	92.1160	91.3546	95.1929	100.6838	114.2262	120.5643	132.6267 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1256	34.7510	28.2614	21.3957	15.9935	13.5024	14.5898	18.9644	25.4540	32.3197	37.7219	40.2130 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	465.8409	470.6749	458.4934	432.5606	399.8250	369.0581	348.5040	343.6700	355.8515	381.7843	414.5199	445.2868 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601 (71)
Water heating gains (Table 5)	179.9302	176.9498	169.6005	150.6331	136.4705	127.9388	122.7885	127.9475	139.8386	153.5299	167.4505	178.2616 (72)
Total internal gains	801.7772	799.2562	773.2359	721.4699	669.1695	624.3799	599.7629	604.4625	635.0247	684.5145	736.5728	780.6419 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					7.0900	10.6334	0.6300	0.7000	0.7700	23.0404 (74)		
East					11.9700	19.6403	0.6300	0.7000	0.7700	71.8478 (76)		
South					2.5800	46.7521	0.6300	0.7000	0.7700	36.8631 (78)		
West					7.3800	19.6403	0.6300	0.7000	0.7700	44.2971 (80)		
Solar gains	176.0484	331.6077	525.8964	752.8066	921.2538	945.0988	898.7622	770.9583	605.4712	387.1276	216.9377	146.5727 (83)
Total gains	977.8257	1130.8640	1299.1323	1474.2765	1590.4233	1569.4787	1498.5251	1375.4208	1240.4959	1071.6420	953.5105	927.2146 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	20.1339	20.1768	20.2189	20.4194	20.4573	20.6358	20.6358	20.6692	20.5667	20.4573	20.3807	20.3012
alpha	2.3423	2.3451	2.3479	2.3613	2.3638	2.3757	2.3757	2.3779	2.3711	2.3638	2.3587	2.3534
util living area	0.9402	0.9162	0.8722	0.7935	0.6813	0.5439	0.4241	0.4697	0.6618	0.8387	0.9192	0.9464 (86)

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MIT	18.1123	18.4611	19.0383	19.7463	20.3360	20.7294	20.8924	20.8597	20.5430	19.7555	18.8058	18.0449 (87)
Th 2	19.9610	19.9630	19.9649	19.9740	19.9757	19.9837	19.9837	19.9851	19.9806	19.9757	19.9723	19.9687 (88)
util rest of house												
	0.9325	0.9056	0.8559	0.7666	0.6385	0.4794	0.3394	0.3837	0.6020	0.8114	0.9072	0.9395 (89)
MIT 2	16.5877	17.0271	17.7496	18.6242	19.3230	19.7626	19.9184	19.8950	19.5780	18.6580	17.4746	16.5069 (90)
Living area fraction									fLA = Living area / (4) =			0.3011 (91)
MIT	17.0468	17.4589	18.1377	18.9621	19.6280	20.0538	20.2117	20.1855	19.8686	18.9885	17.8755	16.9701 (92)
Temperature adjustment												0.0000
adjusted MIT	17.0468	17.4589	18.1377	18.9621	19.6280	20.0538	20.2117	20.1855	19.8686	18.9885	17.8755	16.9701 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9021	0.8713	0.8195	0.7355	0.6224	0.4841	0.3592	0.4016	0.5947	0.7790	0.8741	0.9107	(94)
Useful gains	882.1095	985.3483	1064.6546	1084.3327	989.8890	759.8414	538.3356	552.4320	737.7082	834.7934	833.4366	844.4228	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
Space heating	2085.4649	2050.3595	1896.0012	1623.2109	1276.5736	870.5741	576.5261	603.2958	923.9287	1350.7224	1741.5966	2072.0493	(97)
Space heating kWh	895.2964	715.6875	618.5219	387.9924	213.2933	0.0000	0.0000	0.0000	0.0000	383.8512	653.8752	913.3541	(98a)
Space heating requirement - total per year (kWh/year)												4781.8718	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	895.2964	715.6875	618.5219	387.9924	213.2933	0.0000	0.0000	0.0000	0.0000	383.8512	653.8752	913.3541	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4781.8718	
Space heating per m2										(98c) / (4) =		33.5829	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	895.2964	715.6875	618.5219	387.9924	213.2933	0.0000	0.0000	0.0000	0.0000	383.8512	653.8752	913.3541	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	358.2619	286.3896	247.5077	155.2590	85.3515	0.0000	0.0000	0.0000	0.0000	153.6019	261.6547	365.4878	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	322.5030	269.0946	241.8432	175.3463	133.6642	115.9929	112.3320	135.9889	173.5790	236.5473	285.0758	318.7694	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	184.1822	153.6805	138.1172	100.1407	76.3359	66.2438	64.1530	77.6636	99.1313	135.0927	162.8075	182.0499	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	34.2464	27.4737	24.7370	18.1234	13.9991	11.4373	12.7704	16.5995	21.5611	28.2893	31.9527	35.1982	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.8552	-60.5424	-92.4552	-108.1756	-116.9894	-102.9876	-101.4514	-94.9223	-82.9505	-70.4824	-45.0964	-33.9861	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1913.5141	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1439.5982	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												276.3880	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-949.8946	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2759.6058	(238)

10a. Fuel costs - using Table 12 prices

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	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1913.5141	16.4900	315.5385 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1439.5982	16.4900	237.3897 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	276.3880	16.4900	45.5764 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-949.8946	16.4900	-156.6376
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-156.6376 (252)
Total energy cost			455.0590 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] = 0.8742 (257)$
SAP value	85.8288
SAP rating (Section 12)	86 (258)
SAP band	B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1913.5141	0.1544	295.5304 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1439.5982	0.1449	208.6322 (264)
Space and water heating			504.1626 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	276.3880	0.1443	39.8913 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-949.8946	0.1343	-127.5463
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-127.5463 (269)
Total CO2, kg/year			427.6046 (272)
CO2 emissions per m2			3.0000 (273)
EI value			96.9423
EI rating			97 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	344.1250 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1162 (8)
Pressure Test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3662 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3113 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	3.0000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate												

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Effective ac	0.2802	0.2568	0.2490	0.2490	0.2568	0.2257	0.2413	0.2179	0.2179	0.2335	0.2179	0.2490 (22b)
	0.5392	0.5330	0.5310	0.5310	0.5330	0.5255	0.5291	0.5237	0.5237	0.5273	0.5237	0.5310 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			29.0200	1.1450	33.2290			(27)
Solid Doors			2.1000	1.0000	2.1000			(26)
Ground Floor			94.6100	0.1100	10.4071	75.0000	7095.7500	(28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180	9.0000	855.9000	(29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636	9.0000	18.1800	(29a)
Ashlar	17.3000		17.3000	0.1800	3.1140	9.0000	155.7000	(29a)
Joists GF	46.8300		46.8300	0.1100	5.1513	9.0000	421.4700	(30)
Joists FF	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000	(30)
Rafters	29.6100		29.6100	0.1300	3.8493	9.0000	266.4900	(30)
Total net area of external elements Aum(A, m2)			341.5900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.0823			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			70.0000			9.0000	630.0000	(32c)
Internal Floor 1			47.7800			18.0000	860.0400	(32d)
Internal Ceiling 1			47.7800			9.0000	430.0200	(32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11858.5500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							83.2822	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E16 Corner (normal)	16.8000	0.0900	1.5120	
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820	
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560	
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652	
R6 Flat ceiling	39.5000	0.0600	2.3700	
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168	
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392	
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800	
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800	
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405	
E3 Sill	19.8100	0.0500	0.9905	
E4 Jamb	47.1000	0.0500	2.3550	
E5 Ground floor (normal)	47.0200	0.1600	7.5232	
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				19.7984 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	97.8807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.2377	60.5258	60.3022	60.3022	60.5258	59.6729	60.0856	59.4769	59.4769	59.8758	59.4769	60.3022	(38)
Heat transfer coeff	159.1184	158.4065	158.1829	158.1829	158.4065	157.5536	157.9663	157.3576	157.3576	157.7565	157.3576	158.1829	(39)
Average = Sum(39)m / 12 =												157.9858	
HLP	1.1175	1.1125	1.1109	1.1109	1.1125	1.1065	1.1094	1.1051	1.1051	1.1079	1.1051	1.1109	(40)
HLP (average)												1.1095	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9215 (42)
Hot water usage for mixer showers	91.5048	90.1296	88.1258	84.2918	81.4624	78.3071	76.5136	78.5023	80.6822	84.0701	87.9864	91.1542	(42a)
Hot water usage for baths	31.6033	31.1339	30.4730	29.2543	28.3418	27.3299	26.7834	27.4397	28.1543	29.2370	30.4808	31.4964	(42b)
Hot water usage for other uses	44.5491	42.9291	41.3092	39.6892	38.0692	36.4493	36.4493	38.0692	39.6892	41.3092	42.9291	44.5491	(42c)
Average daily hot water use (litres/day)												154.1647	(43)
Daily hot water use	167.6571	164.1927	159.9079	153.2353	147.8734	142.0863	139.7462	144.0112	148.5257	154.6163	161.3964	167.1997	(44)
Energy conte	265.5279	233.8082	245.7725	209.7714	199.0660	174.7116	169.0109	178.3159	183.1471	209.8128	229.9387	261.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2560.6774	
Distribution loss (46)m = 0.15 x (45)m	39.8292	35.0712	36.8659	31.4657	29.8599	26.2067	25.3516	26.7474	27.4721	31.4719	34.4908	39.2691	(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	322.5030	285.2695	301.3518	258.1550	243.2467	217.2421	212.9591	223.1946	232.8814	265.3921	285.0758	318.7694	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)

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Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												766.4878 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												766.4878
Solar input	-1.7513	-20.9151	-66.5273	-94.5576	-119.4950	-120.3928	-116.9510	-104.4467	-72.9463	-40.9565	-7.5480	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	320.7517	264.3544	234.8245	163.5973	123.7517	96.8492	96.0081	118.7478	159.9350	224.4356	277.5278	318.7694 (64)
								Total per year (kWh/year) =	Sum(64)m =			2399.5525 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) =	Sum(64a)m =			0.0000 (64a)
Heat gains from water heating, kWh/month	133.8681	118.9103	126.1828	108.4558	101.5340	92.1160	91.3546	95.1929	100.6838	114.2262	120.5643	132.6267 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	39.1256	34.7510	28.2614	21.3957	15.9935	13.5024	14.5898	18.9644	25.4540	32.3197	37.7219	40.2130 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	465.8409	470.6749	458.4934	432.5606	399.8250	369.0581	348.5040	343.6700	355.8515	381.7843	414.5199	445.2868 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601 (71)
Water heating gains (Table 5)												
	179.9302	176.9498	169.6005	150.6331	136.4705	127.9388	122.7885	127.9475	139.8386	153.5299	167.4505	178.2616 (72)
Total internal gains	801.7772	799.2562	773.2359	721.4699	669.1695	624.3799	599.7629	604.4625	635.0247	684.5145	736.5728	780.6419 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W	
North					7.0900	13.0723		0.6300	0.7000		0.7700	28.3250 (74)	
East					11.9700	24.4329		0.6300	0.7000		0.7700	89.3800 (76)	
South					2.5800	54.9219		0.6300	0.7000		0.7700	43.3049 (78)	
West					7.3800	24.4329		0.6300	0.7000		0.7700	55.1065 (80)	
Solar gains	216.1164	357.7369	562.3130	830.6472	988.4263	1097.4421	1023.2281	887.4481	691.8894	445.2763	267.3113	175.3629 (83)	
Total gains	1017.8936	1156.9931	1335.5489	1552.1171	1657.5958	1721.8221	1622.9910	1491.9106	1326.9141	1129.7908	1003.8842	956.0048 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.7018	20.7949	20.8243	20.8243	20.7949	20.9074	20.8528	20.9335	20.9335	20.8805	20.9335	20.8243
alpha	2.3801	2.3863	2.3883	2.3883	2.3863	2.3938	2.3902	2.3956	2.3956	2.3920	2.3956	2.3883
util living area	0.9274	0.9047	0.8502	0.7528	0.6150	0.4432	0.3313	0.3470	0.5853	0.7874	0.8956	0.9353 (86)
MIT	18.4683	18.7244	19.3322	19.9993	20.5485	20.8581	20.9498	20.9465	20.7030	20.0908	19.1932	18.4051 (87)
Th 2	19.9866	19.9907	19.9919	19.9919	19.9907	19.9955	19.9932	19.9967	19.9967	19.9944	19.9967	19.9919 (88)
util rest of house	0.9179	0.8928	0.8311	0.7215	0.5651	0.3737	0.2453	0.2553	0.5170	0.7510	0.8798	0.9267 (89)
MIT 2	17.0517	17.3733	18.1298	18.9378	19.5711	19.8937	19.9693	19.9718	19.7556	19.0719	17.9735	16.9760 (90)
Living area fraction									fLA = Living area / (4) =			0.3011 (91)
MIT	17.4783	17.7802	18.4919	19.2575	19.8655	20.1841	20.2646	20.2653	20.0409	19.3787	18.3408	17.4064 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4783	17.7802	18.4919	19.2575	19.8655	20.1841	20.2646	20.2653	20.0409	19.3787	18.3408	17.4064 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8859	0.8583	0.7963	0.6955	0.5584	0.3874	0.2692	0.2807	0.5203	0.7249	0.8458	0.8962 (94)
Useful gains	901.7804	993.0841	1063.5478	1079.5611	925.6119	666.9480	436.8883	418.7858	690.3641	818.9585	849.1298	856.7770 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	1953.7021	1945.2623	1770.3662	1511.8276	1119.2154	722.2441	452.5059	435.1403	808.9613	1195.5883	1595.7299	1930.8400 (97)
Space heating kWh	782.6298	639.8638	525.8729	311.2319	144.0410	0.0000	0.0000	0.0000	0.0000	280.2126	537.5521	799.1029 (98a)
Space heating requirement - total per year (kWh/year)												4020.5070
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	782.6298	639.8638	525.8729	311.2319	144.0410	0.0000	0.0000	0.0000	0.0000	280.2126	537.5521	799.1029 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4020.5070
Space heating per m ²										(98c) / (4) =		28.2359 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	249.9000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	782.6298	639.8638	525.8729	311.2319	144.0410	0.0000	0.0000	0.0000	0.0000	280.2126	537.5521	799.1029	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	313.1772	256.0479	210.4333	124.5426	57.6395	0.0000	0.0000	0.0000	0.0000	112.1299	215.1069	319.7691	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	320.7517	264.3544	234.8245	163.5973	123.7517	96.8492	96.0081	118.7478	159.9350	224.4356	277.5278	318.7694	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	183.1820	150.9734	134.1088	93.4308	70.6749	55.3108	54.8304	67.8172	91.3393	128.1757	158.4968	182.0499	(217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
(221)m	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Pumps and Fa	34.2464	27.4737	24.7370	18.1234	13.9991	11.4373	12.7704	16.5995	21.5611	28.2893	31.9527	35.1982	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-47.1467	-63.6564	-95.6167	-113.1170	-118.7407	-110.2978	-107.6422	-101.8444	-89.5866	-76.7240	-53.0108	-39.4148	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1608.8463	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1370.3898	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												276.3880	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1016.7981	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2318.8261	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1608.8463	26.0600	419.2654	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1370.3898	26.0600	357.1236	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	276.3880	26.0600	72.0267	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1016.7981	26.0600	-264.9776	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-264.9776	(252)
Total energy cost			604.2861	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1608.8463	0.1551	249.4830	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1370.3898	0.1457	199.7242	(264)
Space and water heating			449.2072	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	276.3880	0.1443	39.8913	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1016.7981	0.1345	-136.7327	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-136.7327	(269)
Total CO2, kg/year			363.4628	(272)

13a. Primary energy - Individual heating systems including micro-CHP

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	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1608.8463	1.5741	2532.5032 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1370.3898	1.5391	2109.1955 (278)
Space and water heating			4641.6987 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	276.3880	1.5338	423.9332 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1016.7981	1.4970	-1522.1339
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1522.1339 (283)
Total Primary energy kWh/year			3664.5220 (286)

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Property Reference	FURNERS LANE 24				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 24, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	80 C	DER	4.18	TER	8.46	
Environmental	96 A	% DER < TER				50.59
CO ₂ Emissions (t/year)	0.54	DFEE	40.05	TFEE	40.45	
Compliance Check	See BREL	% DFEE < TFEE				0.99
% DPER < TPER	1.97	DPER	43.79	TPER	44.67	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	344.1250 (5)

2. Ventilation rate

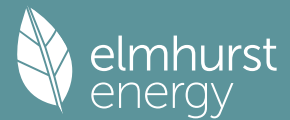
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1162 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3662 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3113 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3346	0.2957	0.2957	0.2880	0.3113	0.3346	0.3502	0.3658 (22b)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			29.0200	1.1450	33.2290		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Ground Floor			94.6100	0.1100	10.4071	75.0000	7095.7500 (28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180	9.0000	855.9000 (29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636	9.0000	18.1800 (29a)
Ashlar	17.3000		17.3000	0.1800	3.1140	9.0000	155.7000 (29a)
Joists GF	46.8300		46.8300	0.1100	5.1513	9.0000	421.4700 (30)
Joists FF	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000 (30)
Rafters	29.6100		29.6100	0.1300	3.8493	9.0000	266.4900 (30)
Total net area of external elements Aum(A, m ²)			341.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.0823		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			70.0000			9.0000	630.0000 (32c)
Internal Floor 1			47.7800			18.0000	860.0400 (32d)
Internal Ceiling 1			47.7800			9.0000	430.0200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11858.5500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.2822 (35)
List of Thermal Bridges							

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K1 Element	Length	Psi-value	Total
E16 Corner (normal)	16.8000	0.0900	1.5120
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652
R6 Flat ceiling	39.5000	0.0600	2.3700
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	47.1000	0.0500	2.3550
E5 Ground floor (normal)	47.0200	0.1600	7.5232
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.7984 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	97.8807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.7257	65.3783	65.0379	63.4387	63.1395	61.7467	61.7467	61.4887	62.2832	63.1395	63.7448	64.3775	(38)
Heat transfer coeff	163.6064	163.2590	162.9186	161.3194	161.0202	159.6274	159.6274	159.3694	160.1639	161.0202	161.6255	162.2583	(39)
Average = Sum(39)m / 12 =												161.3180	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1490	1.1466	1.1442	1.1329	1.1308	1.1211	1.1211	1.1192	1.1248	1.1308	1.1351	1.1395	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9215 (42)
Hot water usage for mixer showers	91.5048	90.1296	88.1258	84.2918	81.4624	78.3071	76.5136	78.5023	80.6822	84.0701	87.9864	91.1542	(42a)
Hot water usage for baths	31.6033	31.1339	30.4730	29.2543	28.3418	27.3299	26.7834	27.4397	28.1543	29.2370	30.4808	31.4964	(42b)
Hot water usage for other uses	44.5491	42.9291	41.3092	39.6892	38.0692	36.4493	36.4493	38.0692	39.6892	41.3092	42.9291	44.5491	(42c)
Average daily hot water use (litres/day)												154.1647	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	167.6571	164.1927	159.9079	153.2353	147.8734	142.0863	139.7462	144.0112	148.5257	154.6163	161.3964	167.1997	(44)
Distribution loss (46)m = 0.15 x (45)m	265.5279	233.8082	245.7725	209.7714	199.0660	174.7116	169.0109	178.3159	183.1471	209.8128	229.9387	261.7943	(45)
	39.8292	35.0712	36.8659	31.4657	29.8599	26.2067	25.3516	26.7474	27.4721	31.4719	34.4908	39.2691	(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694	(64)
12Total per year (kWh/year)												3231.5127	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month	133.8681	118.9103	127.2994	113.8587	111.7695	102.2013	101.7762	104.8701	105.0061	115.3428	120.5643	132.6267	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	158.2412	175.1956	158.2412	163.5159	158.2412	163.5159	158.2412	158.2412	163.5159	158.2412	163.5159	158.2412	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.1134	315.3522	307.1906	289.8156	267.8827	247.2690	233.4977	230.2589	238.4205	255.7955	277.7284	298.3421	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	(71)
Water heating gains (Table 5)	179.9302	176.9498	171.1013	158.1371	150.2278	141.9463	136.7959	140.9544	145.8418	155.0307	167.4505	178.2616	(72)
Total internal gains	720.1074	737.3202	706.3557	681.2911	646.1743	619.5537	595.3574	596.2771	614.6008	638.8899	678.5173	704.6675	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W

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	W/m2				or Table 6b		or Table 6c		Table 6d			
North			2.5800		10.6334		0.6300		0.7700			8.3842 (74)
East			11.9700		19.6403		0.6300		0.7700			71.8478 (76)
South			7.0900		46.7521		0.6300		0.7700			101.3022 (78)
West			7.3800		19.6403		0.6300		0.7700			44.2971 (80)

Solar gains	225.8313	409.1336	612.7351	828.2968	976.6005	987.2233	944.7088	833.8759	688.6787	467.6158	275.2397	190.0358 (83)
Total gains	945.9387	1146.4538	1319.0908	1509.5879	1622.7748	1606.7771	1540.0662	1430.1530	1303.2795	1106.5057	953.7570	894.7034 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.1339	20.1768	20.2189	20.4194	20.4573	20.6358	20.6358	20.6692	20.5667	20.4573	20.3807	20.3012
alpha	2.3423	2.3451	2.3479	2.3613	2.3638	2.3757	2.3757	2.3779	2.3711	2.3638	2.3587	2.3534
util living area	0.9439	0.9141	0.8689	0.7865	0.6740	0.5350	0.4147	0.4556	0.6435	0.8306	0.9192	0.9500 (86)
MIT	18.0701	18.4801	19.0593	19.7743	20.3524	20.7391	20.8975	20.8687	20.5716	19.7880	18.8061	18.0009 (87)
Th 2	19.9610	19.9630	19.9649	19.9740	19.9757	19.9837	19.9837	19.9851	19.9806	19.9757	19.9723	19.9687 (88)
util rest of house	0.9366	0.9033	0.8523	0.7591	0.6309	0.4709	0.3313	0.3712	0.5832	0.8024	0.9072	0.9435 (89)
MIT 2	16.5348	17.0506	17.7751	18.6566	19.3404	19.7712	19.9217	19.9013	19.6057	18.6957	17.4750	16.4516 (90)
Living area fraction												0.3011 (91)
MIT	16.9971	17.4811	18.1618	18.9932	19.6451	20.0627	20.2156	20.1927	19.8965	19.0247	17.8759	16.9181 (92)
Temperature adjustment												0.0000
adjusted MIT	16.9971	17.4811	18.1618	18.9932	19.6451	20.0627	20.2156	20.1927	19.8965	19.0247	17.8759	16.9181 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9070	0.8688	0.8160	0.7286	0.6156	0.4761	0.3511	0.3893	0.5778	0.7704	0.8740	0.9156 (94)
Useful gains	857.9822	996.0161	1076.3168	1099.8605	999.0485	765.0636	540.7738	556.8219	753.0103	852.5070	833.6070	819.2229 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2077.3321	2053.9715	1899.9235	1628.2245	1279.3268	871.9958	577.1470	604.4333	928.3976	1356.5403	1741.6539	2063.6203 (97)
Space heating kWh	907.1963	710.9460	612.7633	380.4221	208.5271	0.0000	0.0000	0.0000	0.0000	375.0008	653.7937	925.8317 (98a)
Space heating requirement - total per year (kWh/year)												4774.4810
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	907.1963	710.9460	612.7633	380.4221	208.5271	0.0000	0.0000	0.0000	0.0000	375.0008	653.7937	925.8317 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4774.4810
Space heating per m2										(98c) / (4) =		33.5310 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	907.1963	710.9460	612.7633	380.4221	208.5271	0.0000	0.0000	0.0000	0.0000	375.0008	653.7937	925.8317 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	363.0237	284.4922	245.2034	152.2297	83.4442	0.0000	0.0000	0.0000	0.0000	150.0603	261.6221	370.4809 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	184.1822	162.9180	172.8998	151.2899	146.2256	131.2671	129.0611	134.3752	136.0847	152.3632	162.8075	182.0499 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.2464	27.4737	24.7370	18.1234	13.9991	11.4373	12.7704	16.5995	21.5611	28.2893	31.9527	35.1982 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1910.5566 (211)
Space heating fuel - main system 2												0.0000 (213)

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	175.1000
Water heating fuel used	1845.5241 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	276.3880 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4032.4688 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1910.5566	0.1546	295.2928	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1845.5241	0.1410	260.1881	(264)
Space and water heating			555.4809	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	276.3880	0.1443	39.8913	(268)
Total CO2, kg/year			595.3722	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.1800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1910.5566	1.5722	3003.7814	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1845.5241	1.5213	2807.6133	(278)
Space and water heating			5811.3948	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	276.3880	1.5338	423.9332	(282)
Total Primary energy kWh/year			6235.3280	(286)
Dwelling Primary energy Rate (DPER)			43.7900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640	(1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 344.1250	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1162 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3662 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3113 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3346	0.2957	0.2957	0.2880	0.3113	0.3346	0.3502	0.3658 (22b)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Opening Type (Uw = 1.20)			29.0200	1.1450	33.2290			(27)
Ground Floor			94.6100	0.1300	12.2993			(28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180			(29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636			(29a)
Ashlar	17.3000		17.3000	0.1800	3.1140			(29a)
Joists GF	46.8300		46.8300	0.1100	5.1513			(30)
Joists FF	25.0000		25.0000	0.1100	2.7500			(30)
Rafters	29.6100		29.6100	0.1100	3.2571			(30)
Total net area of external elements Aum(A, m2)			341.5900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.3823			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

83.2822 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E16 Corner (normal)	16.8000	0.0900	1.5120	
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820	
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560	
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652	
R6 Flat ceiling	39.5000	0.0600	2.3700	
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168	
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392	
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800	
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800	
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405	
E3 Sill	19.8100	0.0500	0.9905	
E4 Jamb	47.1000	0.0500	2.3550	
E5 Ground floor (normal)	47.0200	0.1600	7.5232	
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				19.7984 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	99.1807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.7257	65.3783	65.0379	63.4387	63.1395	61.7467	61.7467	61.4887	62.2832	63.1395	63.7448	64.3775	(38)
Heat transfer coeff	164.9064	164.5590	164.2186	162.6194	162.3202	160.9274	160.9274	160.6694	161.4639	162.3202	162.9255	163.5583	(39)
Average = Sum(39)m / 12 =													162.6180

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1581	1.1557	1.1533	1.1421	1.1400	1.1302	1.1302	1.1284	1.1340	1.1400	1.1442	1.1487	(40)
HLP (average)												1.1421	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9215 (42)
Hot water usage for mixer showers													
73.2038	72.1037	70.5006	67.4334	65.1699	62.6457	61.2109	62.8018	64.5458	67.2561	70.3892	72.9233	72.9233	(42a)
Hot water usage for baths													
31.6033	31.1339	30.4730	29.2543	28.3418	27.3299	26.7834	27.4397	28.1543	29.2370	30.4808	31.4964	31.4964	(42b)
Hot water usage for other uses													
44.5491	42.9291	41.3092	39.6892	38.0692	36.4493	36.4493	38.0692	39.6892	41.3092	42.9291	44.5491	44.5491	(42c)
Average daily hot water use (litres/day)													137.2918 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.3562	146.1667	142.2827	136.3769	131.5809	126.4248	124.4435	128.3107	132.3893	137.8023	143.7991	148.9689	(44)
Energy conte	236.5437	208.1395	218.6833	186.6932	177.1332	155.4541	150.5036	158.8755	163.2492	186.9964	204.8681	233.2492	(45)
Energy content (annual)										Total = Sum(45)m =		2280.3890	
Distribution loss (46)m = 0.15 x (45)m													
35.4815	31.2209	32.8025	28.0040	26.5700	23.3181	22.5755	23.8313	24.4874	28.0495	30.7302	34.9874	34.9874	(46)

Water storage loss:

Store volume 250.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):

Temperature factor from Table 2b 1.8903 (48)

Enter (49) or (54) in (55) 0.5400 (49)

Total storage loss 1.0208 (55)

31.6444 28.5820 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 (56)

If cylinder contains dedicated solar storage

31.6444 28.5820 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month

291.4505 257.7327 273.5901 239.8288 232.0400 208.5897 205.4104 213.7823 216.3848 241.9031 258.0037 288.1560 (62)

WWHRS -33.4657 -29.5974 -30.9927 -25.6631 -23.9171 -20.4661 -19.1837 -20.3999 -21.1750 -24.9630 -28.2800 -32.8460 (63a)

PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h

257.9847 228.1354 242.5974 214.1656 208.1229 188.1236 186.2268 193.3824 195.2099 216.9402 229.7237 255.3100 (64)

12Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 2615.9226 (64)

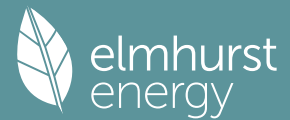
Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Heat gains from water heating, kWh/month 122.5762 108.8810 116.6376 104.5840 102.8222 94.1970 93.9679 96.7515 96.7889 106.1017 110.6271 121.4808 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	158.2412	175.1956	158.2412	163.5159	158.2412	163.5159	158.2412	158.2412	163.5159	158.2412	163.5159	158.2412	(67)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.1134	315.3522	307.1906	289.8156	267.8827	247.2690	233.4977	230.2589	238.4205	255.7955	277.7284	298.3421 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601 (71)
Water heating gains (Table 5)	164.7530	162.0252	156.7710	145.2555	138.2019	130.8291	126.3009	130.0424	134.4290	142.6098	153.6488	163.2806 (72)
Total internal gains	704.9301	722.3956	692.0253	668.4095	634.1484	608.4365	584.8624	585.3651	603.1879	626.4691	664.7156	689.6865 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	

North					2.5800	10.6334	0.6300	0.7000			0.7700	8.3842 (74)	
East					11.9700	19.6403	0.6300	0.7000			0.7700	71.8478 (76)	
South					7.0900	46.7521	0.6300	0.7000			0.7700	101.3022 (78)	
West					7.3800	19.6403	0.6300	0.7000			0.7700	44.2971 (80)	

Solar gains	225.8313	409.1336	612.7351	828.2968	976.6005	987.2233	944.7088	833.8759	688.6787	467.6158	275.2397	190.0358	(83)
Total gains	930.7614	1131.5292	1304.7605	1496.7063	1610.7489	1595.6599	1529.5712	1419.2409	1291.8667	1094.0849	939.9553	879.7224	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.9752	20.0174	20.0589	20.2561	20.2935	20.4691	20.4691	20.5020	20.4011	20.2935	20.2181	20.1399
alpha	2.3317	2.3345	2.3373	2.3504	2.3529	2.3646	2.3646	2.3668	2.3601	2.3529	2.3479	2.3427
util living area	0.9458	0.9165	0.8720	0.7903	0.6787	0.5400	0.4194	0.4608	0.6489	0.8345	0.9217	0.9518 (86)
MIT	18.0260	18.4383	19.0227	19.7466	20.3344	20.7300	20.8933	20.8634	20.5581	19.7610	18.7685	17.9564 (87)
Th 2	19.9536	19.9556	19.9575	19.9666	19.9683	19.9763	19.9763	19.9777	19.9732	19.9683	19.9649	19.9613 (88)
util rest of house	0.9387	0.9059	0.8556	0.7631	0.6355	0.4753	0.3348	0.3752	0.5884	0.8066	0.9099	0.9454 (89)
MIT 2	16.4754	16.9945	17.7259	18.6191	19.3152	19.7564	19.9119	19.8906	19.5864	18.6593	17.4242	16.3917 (90)
Living area fraction	16.9424	17.4293	18.1164	18.9586	19.6221	20.0496	20.2074	20.1836	19.8790	18.9911	17.8291	16.8629 (92)
MIT	16.9424	17.4293	18.1164	18.9586	19.6221	20.0496	20.2074	20.1836	19.8790	18.9911	17.8291	16.8629 (93)
Temperature adjustment												0.0000
adjusted MIT	16.9424	17.4293	18.1164	18.9586	19.6221	20.0496	20.2074	20.1836	19.8790	18.9911	17.8291	16.8629 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	846.4264	986.0482	1068.5664	1095.6120	997.9381	766.2974	542.6302	558.3305	752.2340	846.9969	824.2023	807.5100 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2084.8067	2061.8039	1907.6317	1635.7301	1285.9230	876.9946	580.5313	607.9012	933.0978	1362.0444	1748.0361	2071.1253 (97)
Space heating kWh	921.3549	722.9078	624.2646	388.8850	214.2608	0.0000	0.0000	0.0000	0.0000	383.1954	665.1604	940.1298 (98a)
Space heating requirement - total per year (kWh/year)												4860.1587
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	921.3549	722.9078	624.2646	388.8850	214.2608	0.0000	0.0000	0.0000	0.0000	383.1954	665.1604	940.1298 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4860.1587
Space heating per m2										(98c) / (4) =		34.1327 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	92.3000 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
921.3549	722.9078	624.2646	388.8850	214.2608	0.0000	0.0000	0.0000	0.0000	0.0000	383.1954	665.1604	940.1298 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	998.2176	783.2154	676.3430	421.3272	232.1352	0.0000	0.0000	0.0000	0.0000	415.1629	720.6505	1018.5588 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating	257.9847	228.1354	242.5974	214.1656	208.1229	188.1236	186.2268	193.3824	195.2099	216.9402	229.7237	255.3100 (64)
Water heating requirement	86.6619	86.4609	86.0830	85.3803	84.1250	79.8000	79.8000	79.8000	79.8000	85.3215	86.3014	79.8000 (216)
Efficiency of water heater (217)m	297.6910	263.8596	281.8181	250.8374	247.3970	235.7439	233.3669	242.3338	244.6239	254.2620	266.1877	294.4365 (219)
Fuel for water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Space cooling fuel requirement (221)m	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Pumps and Fa												

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Lighting	32.8794	26.3771	23.7496	17.4000	13.4403	10.9808	12.2607	15.9369	20.7004	27.1601	30.6772	33.7932 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-76.5314	-102.3197	-139.5278	-148.5088	-153.3291	-140.6111	-138.6792	-134.0225	-125.1400	-112.6642	-82.0412	-66.8225 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-61.9962	-127.6814	-248.9778	-367.3077	-479.5498	-479.7781	-474.2884	-404.4769	-300.2819	-180.5015	-82.0462	-49.2526 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												5265.6107 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												3112.5578 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												265.3556 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-4676.3363 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												4053.1879 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5265.6107	0.2100	1105.7782 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3112.5578	0.2100	653.6371 (264)
Space and water heating			1759.4154 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	265.3556	0.1443	38.2990 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1420.1976	0.1358	-192.8167
PV Unit electricity exported	-3256.1387	0.1264	-411.6580
Total			-604.4747 (269)
Total CO2, kg/year			1205.1690 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.4600 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	5265.6107	1.1300	5950.1401 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3112.5578	1.1300	3517.1904 (278)
Space and water heating			9467.3305 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	265.3556	1.5338	407.0113 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1420.1976	1.5018	-2132.9076
PV Unit electricity exported	-3256.1387	0.4641	-1511.1429
Total			-3644.0505 (283)
Total Primary energy kWh/year			6360.3920 (286)
Target Primary Energy Rate (TPER)			44.6700 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

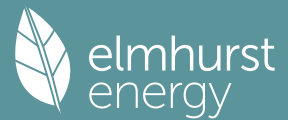
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 344.1250 (5)

2. Ventilation rate

m³ per hour

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Number of open chimneys 0 * 80 = 0.0000 (6a)
Number of open flues 0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire 0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler 0 * 20 = 0.0000 (6d)
Number of flues attached to other heater 0 * 35 = 0.0000 (6e)
Number of blocked chimneys 0 * 20 = 0.0000 (6f)
Number of intermittent extract fans 4 * 10 = 40.0000 (7a)
Number of passive vents 0 * 10 = 0.0000 (7b)
Number of flueless gas fires 0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1162 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3662 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3113 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Adj infilt rate												
	0.3969	0.3891	0.3813	0.3424	0.3346	0.2957	0.2957	0.2880	0.3113	0.3346	0.3502	0.3658
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			29.0200	1.1450	33.2290		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Ground Floor			94.6100	0.1100	10.4071	75.0000	7095.7500 (28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180	9.0000	855.9000 (29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636	9.0000	18.1800 (29a)
Ashlar	17.3000		17.3000	0.1800	3.1140	9.0000	155.7000 (29a)
Joists GF	46.8300		46.8300	0.1100	5.1513	9.0000	421.4700 (30)
Joists FF	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000 (30)
Rafters	29.6100		29.6100	0.1300	3.8493	9.0000	266.4900 (30)
Total net area of external elements Aum(A, m2)			341.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.0823		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			70.0000			9.0000	630.0000 (32c)
Internal Floor 1			47.7800			18.0000	860.0400 (32d)
Internal Ceiling 1			47.7800			9.0000	430.0200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 11858.5500 (34)
List of Thermal Bridges 83.2822 (35)

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	16.8000	0.0900	1.5120
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652
R6 Flat ceiling	39.5000	0.0600	2.3700
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	47.1000	0.0500	2.3550
E5 Ground floor (normal)	47.0200	0.1600	7.5232
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.7984 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 97.8807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Heat transfer coeff 65.7257 65.3783 65.0379 63.4387 63.1395 61.7467 61.7467 61.4887 62.2832 63.1395 63.7448 64.3775 (38)
Average = Sum(39)m / 12 = 163.6064 163.2590 162.9186 161.3194 161.0202 159.6274 159.6274 159.3694 160.1639 161.0202 161.6255 162.2583 (39)
161.3180

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1490	1.1466	1.1442	1.1329	1.1308	1.1211	1.1211	1.1192	1.1248	1.1308	1.1351	1.1395
HLP (average)												1.1329
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9215 (42)
Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)
Hot water usage for baths 31.6033 31.1339 30.4730 29.2543 28.3418 27.3299 26.7834 27.4397 28.1543 29.2370 30.4808 31.4964 (42b)
Hot water usage for other uses 44.5491 42.9291 41.3092 39.6892 38.0692 36.4493 36.4493 38.0692 39.6892 41.3092 42.9291 44.5491 (42c)
Average daily hot water use (litres/day) 69.8004 (43)
Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Energy conte 76.1524 74.0630 71.7821 68.9435 66.4110 63.7792 63.2326 65.5089 67.8435 70.5462 73.4099 76.0455 (44)
Energy content (annual) 120.6067 105.4648 110.3264 94.3802 89.4020 78.4239 76.4744 81.1137 83.6578 95.7305 104.5859 119.0689 (45)
Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 1159.2353
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (46)

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Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
WWHRS	102.5157	89.6451	93.7775	80.2232	75.9917	66.6604	65.0032	68.9467	71.1092	81.3709	88.8980	101.2086 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	102.5157	89.6451	93.7775	80.2232	75.9917	66.6604	65.0032	68.9467	71.1092	81.3709	88.8980	101.2086 (64)
12Total per year (kWh/year)												985.3500 (64)
Electric shower(s)	58.6241	52.2345	57.0381	54.4307	55.4521	52.8959	54.6591	55.4521	54.4307	57.0381	55.9656	58.6241 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												666.8452 (64a)
Heat gains from water heating, kWh/month	40.2849	35.4699	37.7039	33.6635	32.8609	29.8891	29.9156	31.0997	31.3850	34.6023	36.2159	39.9582 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	146.0751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	158.2412	175.1956	158.2412	163.5159	158.2412	163.5159	158.2412	158.2412	163.5159	158.2412	163.5159	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.1134	315.3522	307.1906	289.8156	267.8827	247.2690	233.4977	230.2589	238.4205	255.7955	277.7284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	(71)
Water heating gains (Table 5)	54.1464	52.7826	50.6773	46.7548	44.1679	41.5126	40.2091	41.8007	43.5902	46.5084	50.2998	(72)
Total internal gains	591.3236	610.1529	582.9316	566.9089	537.1144	519.1200	498.7706	497.1233	512.3492	527.3677	558.3667	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				2.5800	10.6334	0.6300	0.7000	0.7700	8.3842 (74)			
East				11.9700	19.6403	0.6300	0.7000	0.7700	71.8478 (76)			
South				7.0900	46.7521	0.6300	0.7000	0.7700	101.3022 (78)			
West				7.3800	19.6403	0.6300	0.7000	0.7700	44.2971 (80)			
Solar gains	225.8313	409.1336	612.7351	828.2968	976.6005	987.2233	944.7088	833.8759	688.6787	467.6158	275.2397	190.0358 (83)
Total gains	817.1549	1019.2865	1195.6668	1395.2056	1513.7149	1506.3434	1443.4794	1330.9992	1201.0279	994.9835	833.6064	767.1489 (84)

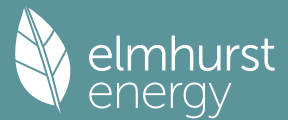
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	20.1339	20.1768	20.2189	20.4194	20.4573	20.6358	20.6358	20.6692	20.5667	20.4573	20.3807	20.3012
alpha	2.3423	2.3451	2.3479	2.3613	2.3638	2.3757	2.3757	2.3779	2.3711	2.3638	2.3587	2.3534
util living area	0.9578	0.9307	0.8888	0.8092	0.6989	0.5594	0.4371	0.4817	0.6736	0.8566	0.9371	0.9631 (86)
MIT	17.8946	18.3217	18.9260	19.6810	20.2950	20.7119	20.8850	20.8517	20.5238	19.6809	18.6531	17.8232 (87)
Th 2	19.9610	19.9630	19.9649	19.9740	19.9757	19.9837	19.9837	19.9851	19.9806	19.9757	19.9723	19.9687 (88)
util rest of house	0.9521	0.9217	0.8741	0.7835	0.6568	0.4945	0.3507	0.3945	0.6142	0.8312	0.9273	0.9581 (89)
MIT 2	17.1190	17.5400	18.1319	18.8628	19.4329	19.7993	19.9290	19.9105	19.6523	18.8807	17.8784	17.0533 (90)
Living area fraction	17.3525	17.7754	18.3711	19.1092	19.6925	20.0741	20.2169	20.1940	19.9148	19.1217	18.1117	17.2852 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3525	17.7754	18.3711	19.1092	19.6925	20.0741	20.2169	20.1940	19.9148	19.1217	18.1117	17.2852 (93)

8. Space heating requirement

Utilisation	0.9322	0.8965	0.8457	0.7583	0.6439	0.5007	0.3715	0.4135	0.6099	0.8054	0.9036	0.9398 (94)
Useful gains	761.7511	913.7488	1011.2096	1057.9458	974.6903	754.1550	536.2137	550.3272	732.5593	801.3787	753.2551	720.9919 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2135.4776	2102.0235	1934.0168	1646.9430	1286.9595	873.8173	577.3585	604.6414	931.3143	1372.1652	1779.7761	2123.1794 (97)
Space heating kWh	1022.0525	798.5206	686.5686	424.0779	232.3282	0.0000	0.0000	0.0000	0.0000	424.6652	739.0951	1043.2275 (98a)
Space heating requirement - total per year (kWh/year)												5370.5357
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1022.0525	798.5206	686.5686	424.0779	232.3282	0.0000	0.0000	0.0000	0.0000	424.6652	739.0951	1043.2275 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5370.5357
Space heating per m ²												37.7171 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1500.4972	1181.2425	1211.2077	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7448	0.8053	0.7736	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1117.5585	951.2241	936.9426	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1692.1942	1621.7593	1493.4576	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	413.7377	498.8782	414.0472	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	103.4344	124.7195	103.5118	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling requirement												331.6658 (107)
Energy for space heating												37.7171 (99)
Energy for space cooling												2.3293 (108)
Total												40.0464 (109)
Fabric Energy Efficiency (DFEE)												40.0 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	344.1250 (5)

2. Ventilation rate

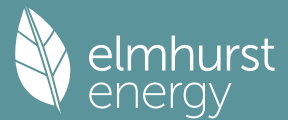
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1162 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3662 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3113 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3346	0.2957	0.2957	0.2880	0.3113	0.3346	0.3502	0.3658 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.20)			29.0200	1.1450	33.2290		(27)
Ground Floor			94.6100	0.1300	12.2993		(28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180		(29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636		(29a)
Ashlar	17.3000		17.3000	0.1800	3.1140		(29a)
Joists GF	46.8300		46.8300	0.1100	5.1513		(30)
Joists FF	25.0000		25.0000	0.1100	2.7500		(30)
Rafters	29.6100		29.6100	0.1100	3.2571		(30)
Total net area of external elements Aum(A, m ²)			341.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.3823		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.2822 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				16.8000	0.0900	1.5120	
E10 Eaves (insulation at ceiling level)				24.7000	0.0600	1.4820	

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E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560										
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652										
R6 Flat ceiling	39.5000	0.0600	2.3700										
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168										
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392										
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800										
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800										
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405										
E3 Sill	19.8100	0.0500	0.9905										
E4 Jamb	47.1000	0.0500	2.3550										
E5 Ground floor (normal)	47.0200	0.1600	7.5232										
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.7984	(36)									
Point Thermal bridges			(36a) =	0.0000									
Total fabric heat loss		(33) + (36) + (36a) =		99.1807 (37)									
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 65.7257	Feb 65.3783	Mar 65.0379	Apr 63.4387	May 63.1395	Jun 61.7467	Jul 61.7467	Aug 61.4887	Sep 62.2832	Oct 63.1395	Nov 63.7448	Dec 64.3775	(38)
Heat transfer coeff	164.9064	164.5590	164.2186	162.6194	162.3202	160.9274	160.9274	160.6694	161.4639	162.3202	162.9255	163.5583	(39)
Average = Sum(39)m / 12 =												162.6180	
HLP	Jan 1.1581	Feb 1.1557	Mar 1.1533	Apr 1.1421	May 1.1400	Jun 1.1302	Jul 1.1302	Aug 1.1284	Sep 1.1340	Oct 1.1400	Nov 1.1442	Dec 1.1487	(40)
HLP (average)												1.1421	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.9215 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.6033	31.1339	30.4730	29.2543	28.3418	27.3299	26.7834	27.4397	28.1543	29.2370	30.4808	31.4964	(42b)
Hot water usage for other uses	44.5491	42.9291	41.3092	39.6892	38.0692	36.4493	36.4493	38.0692	39.6892	41.3092	42.9291	44.5491	(42c)
Average daily hot water use (litres/day)												69.8004	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	76.1524	74.0630	71.7821	68.9435	66.4110	63.7792	63.2326	65.5089	67.8435	70.5462	73.4099	76.0455	(44)
Energy conte	120.6067	105.4648	110.3264	94.3802	89.4020	78.4239	76.4744	81.1137	83.6578	95.7305	104.5859	119.0689	(45)
Energy content (annual)										Total = Sum(45)m =		1159.2353	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	102.5157	89.6451	93.7775	80.2232	75.9917	66.6604	65.0032	68.9467	71.1092	81.3709	88.8980	101.2086	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	102.5157	89.6451	93.7775	80.2232	75.9917	66.6604	65.0032	68.9467	71.1092	81.3709	88.8980	101.2086	(64)
									Total per year (kWh/year) = Sum(64)m =			985.3500	(64)
12Total per year (kWh/year)												985	(64)
Electric shower(s)	58.6241	52.2345	57.0381	54.4307	55.4521	52.8959	54.6591	55.4521	54.4307	57.0381	55.9656	58.6241	(64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	666.8452 (64a)
Heat gains from water heating, kWh/month	40.2849	35.4699	37.7039	33.6635	32.8609	29.8891	29.9156	31.0997	31.3850	34.6023	36.2159	39.9582	(65)

5. Internal gains (see Table 5 and 5a)													

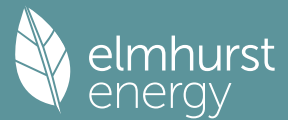
Metabolic gains (Table 5), Watts													
(66)m	Jan 146.0751	Feb 146.0751	Mar 146.0751	Apr 146.0751	May 146.0751	Jun 146.0751	Jul 146.0751	Aug 146.0751	Sep 146.0751	Oct 146.0751	Nov 146.0751	Dec 146.0751	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	158.2412	175.1956	158.2412	163.5159	158.2412	163.5159	158.2412	158.2412	163.5159	158.2412	163.5159	158.2412	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.1134	315.3522	307.1906	289.8156	267.8827	247.2690	233.4977	230.2589	238.4205	255.7955	277.7284	298.3421	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	37.6075	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	(71)
Water heating gains (Table 5)	54.1464	52.7826	50.6773	46.7548	44.1679	41.5126	40.2091	41.8007	43.5902	46.5084	50.2998	53.7072	(72)
Total internal gains	591.3236	610.1529	582.9316	566.9089	537.1144	519.1200	498.7706	497.1233	512.3492	527.3677	558.3667	577.1131	(73)

6. Solar gains													

[Jan]													
			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			2.5800		10.6334		0.6300		0.7000		0.7700		8.3842 (74)
East			11.9700		19.6403		0.6300		0.7000		0.7700		71.8478 (76)
South			7.0900		46.7521		0.6300		0.7000		0.7700		101.3022 (78)
West			7.3800		19.6403		0.6300		0.7000		0.7700		44.2971 (80)

Solar gains	225.8313	409.1336	612.7351	828.2968	976.6005	987.2233	944.7088	833.8759	688.6787	467.6158	275.2397	190.0358	(83)

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Total gains 817.1549 1019.2865 1195.6668 1395.2056 1513.7149 1506.3434 1443.4794 1330.9992 1201.0279 994.9835 833.6064 767.1489 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.9752	20.0174	20.0589	20.2561	20.2935	20.4691	20.4691	20.5020	20.4011	20.2935	20.2181	20.1399
alpha	2.3317	2.3345	2.3373	2.3504	2.3529	2.3646	2.3646	2.3668	2.3601	2.3529	2.3479	2.3427
util living area	0.9579	0.9310	0.8894	0.8104	0.7008	0.5618	0.4395	0.4841	0.6756	0.8574	0.9373	0.9632 (86)
MIT	17.8711	18.2983	18.9045	19.6632	20.2826	20.7053	20.8818	20.8479	20.5150	19.6653	18.6329	17.7997 (87)
Th 2	19.9536	19.9556	19.9575	19.9666	19.9683	19.9763	19.9763	19.9777	19.9732	19.9683	19.9649	19.9613 (88)
util rest of house	0.9522	0.9219	0.8747	0.7847	0.6585	0.4964	0.3522	0.3961	0.6159	0.8321	0.9276	0.9582 (89)
MIT 2	17.0913	17.5124	18.1062	18.8409	19.4164	19.7878	19.9202	19.9013	19.6391	18.8610	17.8540	17.0256 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.3261	17.7491	18.3466	19.0885	19.6772	20.0641	20.2098	20.1864	19.9029	19.1032	18.0885	17.2587 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.3261	17.7491	18.3466	19.0885	19.6772	20.0641	20.2098	20.1864	19.9029	19.1032	18.0885	17.2587 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9322	0.8966	0.8462	0.7592	0.6453	0.5024	0.3731	0.4152	0.6114	0.8060	0.9037	0.9398 (94)
Useful gains	761.7695	913.9273	1011.7176	1059.1838	976.8055	756.7978	538.5934	552.5803	734.3196	801.9925	753.3705	720.9894 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2148.0938	2114.4287	1945.4318	1656.8500	1294.8668	879.3281	580.9162	608.3540	936.9529	1380.2398	1790.3118	2135.8567 (97)
Space heating kWh	1031.4253	806.7370	694.6834	430.3196	236.6375	0.0000	0.0000	0.0000	0.0000	430.2160	746.5978	1052.6613 (98a)
Space heating requirement - total per year (kWh/year)	5429.2778											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	1031.4253	806.7370	694.6834	430.3196	236.6375	0.0000	0.0000	0.0000	0.0000	430.2160	746.5978	1052.6613 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5429.2778											
Space heating per m2	(98c) / (4) = 38.1296 (99)											

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1512.7172	1190.8625	1221.0877	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7411	0.8019	0.7700	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1121.0571	954.9724	940.2244	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1692.1942	1621.7593	1493.4576	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	411.2187	496.0895	411.6055	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	fc = cooled area / (4) = 1.0000 (105)											
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	102.8047	124.0224	102.9014	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	329.7284 (107)											
Energy for space heating	38.1296 (99)											
Energy for space cooling	2.3157 (108)											
Total	40.4453 (109)											
Fabric Energy Efficiency (TFEE)	40.4 (109)											

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		344.1250 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)

$$\begin{array}{ll} 4 * 10 = & 40.0000 \quad (7a) \\ 0 * 10 = & 0.0000 \quad (7b) \\ 0 * 40 = & 0.0000 \quad (7c) \end{array}$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22a)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.3969	0.3891	0.3813	0.3424	0.3346	0.2957	0.2957	0.2880	0.3113	0.3346	0.3502	0.3658 (22b)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669 (25)

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			29.0200	1.1450	33.2290			(27)
Solid Doors			2.1000	1.0000	2.1000			(26)
Ground Floor			94.6100	0.1100	10.4071	75.0000	7095.7500	(28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180	9.0000	855.9000	(29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636	9.0000	18.1800	(29a)
Ashlar	17.3000		17.3000	0.1800	3.1140	9.0000	155.7000	(29a)
Joists GF	46.8300		46.8300	0.1100	5.1513	9.0000	421.4700	(30)
Joists FF	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000	(30)
Rafters	29.6100		29.6100	0.1300	3.8493	9.0000	266.4900	(30)
Total net area of external elements Aum(A, m2)			341.5900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.0823			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			70.0000			9.0000	630.0000	(32c)
Internal Floor 1			47.7800			18.0000	860.0400	(32d)
Internal Ceiling 1			47.7800			9.0000	430.0200	(32e)

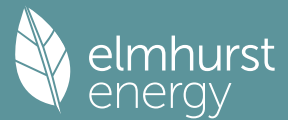
K1 Element	Length	Psi-value	Total
E16 Corner (normal)	16.8000	0.0900	1.5120
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652
R6 Flat ceiling	39.5000	0.0600	2.3700
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	47.1000	0.0500	2.3550
E5 Ground floor (normal)	47.0200	0.1600	7.5232
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000

[illegible]

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	167.6571	164.1927	159.9079	153.2353	147.8734	142.0863	139.7462	144.0112	148.5257	154.6163	161.3964	167.1997 (44)
Energy content (annual)	265.5279	233.8082	245.7725	209.7714	199.0660	174.7116	169.0109	178.3159	183.1471	209.8128	229.9387	261.7943 (45)
Distribution loss (46)m = 0.15 x (45)m	39.8292	35.0712	36.8659	31.4657	29.8599	26.2067	25.3516	26.7474	27.4721	31.4719	34.4908	39.2691 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)

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If cylinder contains dedicated solar storage											
Primary loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252 (57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
WWHRS	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Total per year (kWh/year) = Sum(64)m =											
Electric shower(s)	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758 (64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	133.8681	118.9103	127.2994	113.8587	111.7695	102.2013	101.7762	104.8701	105.0061	115.3428	120.5643 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1256	34.7510	28.2614	21.3957	15.9935	13.5024	14.5898	18.9644	25.4540	32.3197	37.7219	40.2130	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	465.8409	470.6749	458.4934	432.5606	399.8250	369.0581	348.5040	343.6700	355.8515	381.7843	414.5199	445.2868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	(71)
Water heating gains (Table 5)	179.9302	176.9498	171.1013	158.1371	150.2278	141.9463	136.7959	140.9544	145.8418	155.0307	167.4505	178.2616	(72)
Total internal gains	801.7772	799.2562	774.7367	728.9739	682.9269	638.3874	613.7703	617.4694	641.0279	686.0153	736.5728	780.6419	(73)

6. Solar gains

[Jan]					Area	Solar flux	g	FF		Access		Gains	
					m2	Table 6a	Specific data	Specific data		factor		W	
						W/m2	or Table 6b	or Table 6c		Table 6d			

North					2.5800	10.6334	0.6300		0.7000		0.7700		8.3842 (74)
East					11.9700	19.6403	0.6300		0.7000		0.7700		71.8478 (76)
South					7.0900	46.7521	0.6300		0.7000		0.7700		101.3022 (78)
West					7.3800	19.6403	0.6300		0.7000		0.7700		44.2971 (80)

Solar gains	225.8313	409.1336	612.7351	828.2968	976.6005	987.2233	944.7088	833.8759	688.6787	467.6158	275.2397	190.0358	(83)
Total gains	1027.6086	1208.3899	1387.4718	1557.2707	1659.5274	1625.6107	1558.4791	1451.3453	1329.7066	1153.6311	1011.8125	970.6778	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.1339	20.1768	20.2189	20.4194	20.4573	20.6358	20.6358	20.6692	20.5667	20.4573	20.3807	20.3012
alpha	2.3423	2.3451	2.3479	2.3613	2.3638	2.3757	2.3757	2.3779	2.3711	2.3638	2.3587	2.3534
util living area	0.9344	0.9057	0.8578	0.7771	0.6659	0.5306	0.4107	0.4504	0.6360	0.8196	0.9101	0.9415 (86)
MIT	18.1773	18.5541	19.1293	19.8109	20.3704	20.7439	20.8997	20.8720	20.5829	19.8304	18.8769	18.1030 (87)
Th 2	19.9610	19.9630	19.9649	19.9740	19.9757	19.9837	19.9837	19.9851	19.9806	19.9757	19.9723	19.9687 (88)
util rest of house	0.9260	0.8941	0.8402	0.7490	0.6226	0.4666	0.3278	0.3665	0.5756	0.7903	0.8970	0.9340 (89)
MIT 2	16.6690	17.1421	17.8598	18.6989	19.3594	19.7754	19.9232	19.9036	19.6166	18.7448	17.5621	16.5798 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.1232	17.5674	18.2421	19.0338	19.6639	20.0670	20.2172	20.1952	19.9076	19.0717	17.9580	17.0385 (91)
Temperature adjustment	0.0000											
adjusted MIT	17.1232	17.5674	18.2421	19.0338	19.6639	20.0670	20.2172	20.1952	19.9076	19.0717	17.9580	17.0385 (92)
	0.0000											
	17.0385 (93)											

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8944	0.8587	0.8038	0.7194	0.6081	0.4722	0.3476	0.3848	0.5709	0.7591	0.8629	0.9041	(94)
Ext temp.	919.0999	1037.6163	1115.3112	1120.2384	1009.1351	767.6091	541.8036	558.4185	759.1030	875.6718	873.1008	877.5551	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Space heating kWh	2097.9548	2068.0596	1913.0129	1634.7764	1282.3446	872.6864	577.4086	604.8453	930.1633	1364.1170	1754.9359	2083.1529	(97)
Space heating requirement - total per year (kWh/year)	877.0680	692.4579	593.4901	370.4673	203.2678	0.0000	0.0000	0.0000	0.0000	363.4033	634.9213	896.9648	(98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating contribution - total per year (kWh/year)	877.0680	692.4579	593.4901	370.4673	203.2678	0.0000	0.0000	0.0000	0.0000	363.4033	634.9213	896.9648	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	877.0680	692.4579	593.4901	370.4673	203.2678	0.0000	0.0000	0.0000	0.0000	363.4033	634.9213	896.9648	(98c)
Space heating per m ²	(98c) / (4) =												32.5307 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)

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Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	877.0680	692.4579	593.4901	370.4673	203.2678	0.0000	0.0000	0.0000	0.0000	363.4033	634.9213	896.9648 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	350.9676	277.0940	237.4910	148.2462	81.3397	0.0000	0.0000	0.0000	0.0000	145.4195	254.0701	358.9295 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	184.1822	162.9180	172.8998	151.2899	146.2256	131.2671	129.0611	134.3752	136.0847	152.3632	162.8075	182.0499 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.2464	27.4737	24.7370	18.1234	13.9991	11.4373	12.7704	16.5995	21.5611	28.2893	31.9527	35.1982 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1853.5576 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1845.5241 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												276.3880 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3975.4698 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1853.5576	16.4900	305.6517 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1845.5241	16.4900	304.3269 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	276.3880	16.4900	45.5764 (250)
Additional standing charges			0.0000 (251)
Total energy cost			655.5550 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		1.2594 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	79.5851
SAP rating (Section 12)		80 (258)
SAP band		C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1853.5576	0.1545	286.4621 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1845.5241	0.1410	260.1881 (264)
Space and water heating			546.6502 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	276.3880	0.1443	39.8913 (268)
Total CO2, kg/year			586.5415 (272)
CO2 emissions per m2			4.1200 (273)
EI value			95.8057

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EI rating
EI band

96 (274)
A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 344.1250 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1162 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3662 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3113 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.2802	0.2568	0.2490	0.2490	0.2568	0.2257	0.2413	0.2179	0.2179	0.2335	0.2179	0.2490 (22b)
Effective ac	0.5392	0.5330	0.5310	0.5310	0.5330	0.5255	0.5291	0.5237	0.5237	0.5273	0.5237	0.5310 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			29.0200	1.1450	33.2290		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Ground Floor			94.6100	0.1100	10.4071	75.0000	7095.7500 (28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180	9.0000	855.9000 (29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636	9.0000	18.1800 (29a)
Ashlar	17.3000		17.3000	0.1800	3.1140	9.0000	155.7000 (29a)
Joists GF	46.8300		46.8300	0.1100	5.1513	9.0000	421.4700 (30)
Joists FF	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000 (30)
Rafters	29.6100		29.6100	0.1300	3.8493	9.0000	266.4900 (30)
Total net area of external elements Aum(A, m2)			341.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.0823		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			70.0000			9.0000	630.0000 (32c)
Internal Floor 1			47.7800			18.0000	860.0400 (32d)
Internal Ceiling 1			47.7800			9.0000	430.0200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11858.5500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 83.2822 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	16.8000	0.0900	1.5120
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652
R6 Flat ceiling	39.5000	0.0600	2.3700
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	47.1000	0.0500	2.3550
E5 Ground floor (normal)	47.0200	0.1600	7.5232
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.7984 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 97.8807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

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(38)m 61.2377 60.5258 60.3022 60.3022 60.5258 59.6729 60.0856 59.4769 59.4769 59.8758 59.4769 60.3022 (38)
 Heat transfer coeff 159.1184 158.4065 158.1829 158.1829 158.4065 157.5536 157.9663 157.3576 157.3576 157.7565 157.3576 158.1829 (39)
 Average = Sum(39)m / 12 = 157.9858

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1175	1.1125	1.1109	1.1109	1.1125	1.1065	1.1094	1.1051	1.1051	1.1079	1.1051	1.1109	(40)
HLP (average)												1.1095	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9215 (42)
 Hot water usage for mixer showers 91.5048 90.1296 88.1258 84.2918 81.4624 78.3071 76.5136 78.5023 80.6822 84.0701 87.9864 91.1542 (42a)
 Hot water usage for baths 31.6033 31.1339 30.4730 29.2543 28.3418 27.3299 26.7834 27.4397 28.1543 29.2370 30.4808 31.4964 (42b)
 Hot water usage for other uses 44.5491 42.9291 41.3092 39.6892 38.0692 36.4493 36.4493 38.0692 39.6892 41.3092 42.9291 44.5491 (42c)
 Average daily hot water use (litres/day) 154.1647 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	167.6571	164.1927	159.9079	153.2353	147.8734	142.0863	139.7462	144.0112	148.5257	154.6163	161.3964	167.1997	(44)
Energy conte	265.5279	233.8082	245.7725	209.7714	199.0660	174.7116	169.0109	178.3159	183.1471	209.8128	229.9387	261.7943	(45)
Energy content (annual)										Total = Sum(45)m =		2560.6774	
Distribution loss (46)m = 0.15 x (45)m	39.8292	35.0712	36.8659	31.4657	29.8599	26.2067	25.3516	26.7474	27.4721	31.4719	34.4908	39.2691	(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694	(64)
										Total per year (kWh/year) = Sum(64)m =		3231.5127	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month	133.8681	118.9103	127.2994	113.8587	111.7695	102.2013	101.7762	104.8701	105.0061	115.3428	120.5643	132.6267	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1256	34.7510	28.2614	21.3957	15.9935	13.5024	14.5898	18.9644	25.4540	32.3197	37.7219	40.2130	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	465.8409	470.6749	458.4934	432.5606	399.8250	369.0581	348.5040	343.6700	355.8515	381.7843	414.5199	445.2868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	(71)
Water heating gains (Table 5)	179.9302	176.9498	171.1013	158.1371	150.2278	141.9463	136.7959	140.9544	145.8418	155.0307	167.4505	178.2616	(72)
Total internal gains	801.7772	799.2562	774.7367	728.9739	682.9269	638.3874	613.7703	617.4694	641.0279	686.0153	736.5728	780.6419	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	2.5800	13.0723	0.6300	0.7000	0.7700	10.3073	(74)						
East	11.9700	24.4329	0.6300	0.7000	0.7700	89.3800	(76)						
South	7.0900	54.9219	0.6300	0.7000	0.7700	119.0046	(78)						
West	7.3800	24.4329	0.6300	0.7000	0.7700	55.1065	(80)						
Solar gains	273.7983	435.4996	646.4380	903.4350	1038.2529	1137.3618	1066.4882	949.7577	776.9017	530.5901	334.8411	224.6336	(83)
Total gains	1075.5756	1234.7558	1421.1747	1632.4089	1721.1798	1775.7492	1680.2586	1567.2271	1417.9296	1216.6054	1071.4139	1005.2755	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
 Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.7018	20.7949	20.8243	20.8243	20.7949	20.9074	20.8528	20.9335	20.9335	20.8805	20.9335	20.8243	
alpha	2.3801	2.3863	2.3883	2.3883	2.3863	2.3938	2.3902	2.3956	2.3956	2.3920	2.3956	2.3883	
util living area													

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	0.9196	0.8932	0.8348	0.7361	0.6008	0.4324	0.3212	0.3323	0.5600	0.7645	0.8831	0.9288 (86)
MIT	18.5410	18.8150	19.4145	20.0530	20.5720	20.8656	20.9531	20.9513	20.7312	20.1563	19.2696	18.4691 (87)
Th 2	19.9866	19.9907	19.9919	19.9919	19.9907	19.9955	19.9932	19.9967	19.9967	19.9944	19.9967	19.9919 (88)
util rest of house	0.9093	0.8801	0.8144	0.7039	0.5508	0.3640	0.2374	0.2438	0.4923	0.7263	0.8659	0.9196 (89)
MIT 2	17.1420	17.4848	18.2283	18.9984	19.5946	19.8995	19.9710	19.9742	19.7805	19.1447	18.0661	17.0558 (90)
Living area fraction	17.1420	17.4848	18.2283	18.9984	19.5946	19.8995	19.9710	19.9742	19.7805	19.1447	18.0661	17.0558 (90)
MIT	17.5633	17.8854	18.5855	19.3160	19.8889	20.1904	20.2667	20.2685	20.0668	19.4493	18.4285	17.4814 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5633	17.8854	18.5855	19.3160	19.8889	20.1904	20.2667	20.2685	20.0668	19.4493	18.4285	17.4814 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8762	0.8449	0.7802	0.6796	0.5454	0.3778	0.2608	0.2685	0.4973	0.7023	0.8316	0.8879	(94)
Useful gains	942.4319	1043.2580	1108.8559	1109.3704	938.6774	670.8291	438.2702	420.8000	705.2043	854.4379	890.9810	892.6175	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1967.2358	1961.9253	1785.1778	1521.0872	1122.9285	723.2367	452.8470	435.6386	813.0333	1206.7314	1609.5377	1942.7100	(97)
Space heating kWh	762.4541	617.3444	503.1835	296.4361	137.0828	0.0000	0.0000	0.0000	0.0000	262.1064	517.3608	781.2688	(98a)
Space heating requirement - total per year (kWh/year)												3877.2369	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	762.4541	617.3444	503.1835	296.4361	137.0828	0.0000	0.0000	0.0000	0.0000	262.1064	517.3608	781.2688	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3877.2369	
Space heating per m2										(98c) / (4) =		27.2297	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	762.4541	617.3444	503.1835	296.4361	137.0828	0.0000	0.0000	0.0000	0.0000	262.1064	517.3608	781.2688	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	305.1037	247.0366	201.3539	118.6219	54.8551	0.0000	0.0000	0.0000	0.0000	104.8845	207.0271	312.6326	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	322.5030	285.2695	302.7475	264.9086	256.0411	229.8488	225.9860	235.2910	238.2842	266.7879	285.0758	318.7694	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	184.1822	162.9180	172.8998	151.2899	146.2256	131.2671	129.0611	134.3752	136.0847	152.3632	162.8075	182.0499	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	34.2464	27.4737	24.7370	18.1234	13.9991	11.4373	12.7704	16.5995	21.5611	28.2893	31.9527	35.1982	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1551.5154	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1845.5241	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												276.3880	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3673.4275	(238)

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10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1551.5154	26.0600	404.3249 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1845.5241	26.0600	480.9436 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	276.3880	26.0600	72.0267 (250)
Additional standing charges			0.0000 (251)
Total energy cost			957.2952 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1551.5154	0.1552	240.7532 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1845.5241	0.1410	260.1881 (264)
Space and water heating			500.9413 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	276.3880	0.1443	39.8913 (268)
Total CO2, kg/year			540.8327 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1551.5154	1.5745	2442.8466 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1845.5241	1.5213	2807.6133 (278)
Space and water heating			5250.4599 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	276.3880	1.5338	423.9332 (282)
Total Primary energy kWh/year			5674.3931 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating: C 80
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.7	-£ 103	-49 kg (9.1%)
U Solar photovoltaic panels	+ 4.9	-£ 265	-137 kg (27.8%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£103	0.35 kg/m²	B 81 A 96
Solar photovoltaic panels	£265	0.96 kg/m²	B 86 A 97
Total Savings	£367	1.30 kg/m²	

Potential energy efficiency rating: B 86
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £957	Potential £855	Saving £103
Electricity			
Space heating	£404	£426	-£21
Water heating	£481	£357	£124
Lighting	£72	£72	£0
Generated (PV)	-£0	-£265	£265
Total cost of fuels	£957	£590	£368
Total cost of uses	£957	£590	£368
Delivered energy	26 kWh/m²	16 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	2 kg/m²	1 kg/m²
Primary energy	40 kWh/m²	25 kWh/m²	15 kWh/m²

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 344.1250 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1162 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3662 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3113 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3346	0.2957	0.2957	0.2880	0.3113	0.3346	0.3502	0.3658 (22b)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			29.0200	1.1450	33.2290		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Ground Floor			94.6100	0.1100	10.4071	75.0000	7095.7500 (28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180	9.0000	855.9000 (29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636	9.0000	18.1800 (29a)
Ashlar	17.3000		17.3000	0.1800	3.1140	9.0000	155.7000 (29a)
Joists GF	46.8300		46.8300	0.1100	5.1513	9.0000	421.4700 (30)
Joists FF	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000 (30)
Rafts	29.6100		29.6100	0.1300	3.8493	9.0000	266.4900 (30)
Total net area of external elements Aum(A, m ²)			341.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.0823		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			70.0000			9.0000	630.0000 (32c)
Internal Floor 1			47.7800			18.0000	860.0400 (32d)
Internal Ceiling 1			47.7800			9.0000	430.0200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 11858.5500 (34)
83.2822 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	16.8000	0.0900	1.5120
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652
R6 Flat ceiling	39.5000	0.0600	2.3700
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405
E3 Sill	19.8100	0.0500	0.9905
E4 Jamb	47.1000	0.0500	2.3550
E5 Ground floor (normal)	47.0200	0.1600	7.5232
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(36a) = 0.0000
(33) + (36) + (36a) = 97.8807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

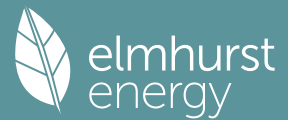
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	65.7257	65.3783	65.0379	63.4387	63.1395	61.7467	61.7467	61.4887	62.2832	63.1395	63.7448	64.3775 (38)
Heat transfer coeff	163.6064	163.2590	162.9186	161.3194	161.0202	159.6274	159.6274	159.3694	160.1639	161.0202	161.6255	162.2583 (39)
Average = Sum(39)m / 12 =												161.3180

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1490	1.1466	1.1442	1.1329	1.1308	1.1211	1.1211	1.1192	1.1248	1.1308	1.1351	1.1395 (40)
HLP (average)												1.1329
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Hot water usage for mixer showers
2.9215 (42)

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Hot water usage for baths	91.5048	90.1296	88.1258	84.2918	81.4624	78.3071	76.5136	78.5023	80.6822	84.0701	87.9864	91.1542 (42a)
Hot water usage for other uses	31.6033	31.1339	30.4730	29.2543	28.3418	27.3299	26.7834	27.4397	28.1543	29.2370	30.4808	31.4964 (42b)
Average daily hot water use (litres/day)	44.5491	42.9291	41.3092	39.6892	38.0692	36.4493	36.4493	38.0692	39.6892	41.3092	42.9291	44.5491 (42c)
												154.1647 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	167.6571	164.1927	159.9079	153.2353	147.8734	142.0863	139.7462	144.0112	148.5257	154.6163	161.3964	167.1997 (44)
Distribution loss (46)m = 0.15 x (45)m	265.5279	233.8082	245.7725	209.7714	199.0660	174.7116	169.0109	178.3159	183.1471	209.8128	229.9387	261.7943 (45)
	39.8292	35.0712	36.8659	31.4657	29.8599	26.2067	25.3516	26.7474	27.4721	31.4719	34.4908	39.2691 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	322.5030	285.2695	301.3518	258.1550	243.2467	217.2421	212.9591	223.1946	232.8814	265.3921	285.0758	318.7694 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												645.3039 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												645.3039
Solar input	-0.0000	-16.1749	-59.5086	-82.8087	-109.5826	-101.2492	-100.6271	-87.2056	-59.3024	-28.8448	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	322.5030	269.0946	241.8432	175.3463	133.6642	115.9929	112.3320	135.9889	173.5790	236.5473	285.0758	318.7694 (64)
												2520.7365 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	133.8681	118.9103	126.1828	108.4558	101.5340	92.1160	91.3546	95.1929	100.6838	114.2262	120.5643	132.6267 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1256	34.7510	28.2614	21.3957	15.9935	13.5024	14.5898	18.9644	25.4540	32.3197	37.7219	40.2130 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	465.8409	470.6749	458.4934	432.5606	399.8250	369.0581	348.5040	343.6700	355.8515	381.7843	414.5199	445.2868 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601 (71)
Water heating gains (Table 5)	179.9302	176.9498	169.6005	150.6331	136.4705	127.9388	122.7885	127.9475	139.8386	153.5299	167.4505	178.2616 (72)
Total internal gains	801.7772	799.2562	773.2359	721.4699	669.1695	624.3799	599.7629	604.4625	635.0247	684.5145	736.5728	780.6419 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				2.5800	10.6334	0.6300	0.7000	0.7700	8.3842 (74)			
East				11.9700	19.6403	0.6300	0.7000	0.7700	71.8478 (76)			
South				7.0900	46.7521	0.6300	0.7000	0.7700	101.3022 (78)			
West				7.3800	19.6403	0.6300	0.7000	0.7700	44.2971 (80)			
Solar gains	225.8313	409.1336	612.7351	828.2968	976.6005	987.2233	944.7088	833.8759	688.6787	467.6158	275.2397	190.0358 (83)
Total gains	1027.6086	1208.3899	1385.9710	1549.7667	1645.7700	1611.6033	1544.4717	1438.3384	1323.7034	1152.1303	1011.8125	970.6778 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	20.1339	20.1768	20.2189	20.4194	20.4573	20.6358	20.6358	20.6692	20.5667	20.4573	20.3807	20.3012
alpha	2.3423	2.3451	2.3479	2.3613	2.3638	2.3757	2.3757	2.3779	2.3711	2.3638	2.3587	2.3534
util living area	0.9344	0.9057	0.8580	0.7785	0.6689	0.5339	0.4138	0.4536	0.6377	0.8199	0.9101	0.9415 (86)

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MIT	18.1773	18.5541	19.1278	19.8052	20.3637	20.7404	20.8980	20.8700	20.5804	19.8291	18.8769	18.1030 (87)
Th 2	19.9610	19.9630	19.9649	19.9740	19.9757	19.9837	19.9837	19.9851	19.9806	19.9757	19.9723	19.9687 (88)
util rest of house												
	0.9260	0.8941	0.8404	0.7506	0.6257	0.4698	0.3304	0.3694	0.5773	0.7906	0.8970	0.9340 (89)
MIT 2	16.6690	17.1421	17.8580	18.6924	19.3524	19.7723	19.9221	19.9022	19.6141	18.7433	17.5621	16.5798 (90)
Living area fraction									fLA = Living area / (4) =			0.3011 (91)
MIT	17.1232	17.5674	18.2404	19.0275	19.6569	20.0638	20.2160	20.1937	19.9051	19.0702	17.9580	17.0385 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1232	17.5674	18.2404	19.0275	19.6569	20.0638	20.2160	20.1937	19.9051	19.0702	17.9580	17.0385 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8944	0.8587	0.8041	0.7208	0.6109	0.4751	0.3503	0.3876	0.5724	0.7594	0.8629	0.9041	(94)
Useful gains	919.0999	1037.6163	1114.4711	1117.0757	1005.3985	765.7216	541.0230	557.4451	757.7364	874.9475	873.1008	877.5551	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
Space heating kWh	2097.9548	2068.0596	1912.7314	1633.7616	1281.2284	872.1745	577.2104	604.5942	929.7679	1363.8807	1754.9359	2083.1529	(97)
Space heating requirement - total per year (kWh/year)													
Solar heating kWh	877.0680	692.4579	593.9056	372.0139	205.2174	0.0000	0.0000	0.0000	0.0000	363.7663	634.9213	896.9648	(98a)
Solar heating contribution - total per year (kWh/year)													
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Space heating kWh	877.0680	692.4579	593.9056	372.0139	205.2174	0.0000	0.0000	0.0000	0.0000	363.7663	634.9213	896.9648	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													
Space heating per m2													(98c) / (4) = 32.5607 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	877.0680	692.4579	593.9056	372.0139	205.2174	0.0000	0.0000	0.0000	0.0000	363.7663	634.9213	896.9648	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	350.9676	277.0940	237.6573	148.8651	82.1198	0.0000	0.0000	0.0000	0.0000	145.5647	254.0701	358.9295	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	322.5030	269.0946	241.8432	175.3463	133.6642	115.9929	112.3320	135.9889	173.5790	236.5473	285.0758	318.7694	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	184.1822	153.6805	138.1172	100.1407	76.3359	66.2438	64.1530	77.6636	99.1313	135.0927	162.8075	182.0499	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	34.2464	27.4737	24.7370	18.1234	13.9991	11.4373	12.7704	16.5995	21.5611	28.2893	31.9527	35.1982	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.8192	-60.4266	-92.1946	-107.8446	-116.7170	-102.9876	-101.4514	-94.9223	-82.9505	-70.2885	-45.0342	-33.9606	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													1855.2682 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													175.1000
Water heating fuel used													1439.5982 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
pump for solar water heating													80.0000 (230g)
Total electricity for the above, kWh/year													80.0000 (231)
Electricity for lighting (calculated in Appendix L)													276.3880 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-948.5971 (233)
Wind generation													0.0000 (234)
Hydro-electric generation (Appendix N)													0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (235)
Appendix Q - special features													
Energy saved or generated													-0.0000 (236)
Energy used													0.0000 (237)
Total delivered energy for all uses													2702.6573 (238)

10a. Fuel costs - using Table 12 prices

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	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1855.2682	16.4900	305.9337 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1439.5982	16.4900	237.3897 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	276.3880	16.4900	45.5764 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-948.5971	16.4900	-156.4237
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-156.4237 (252)
Total energy cost			445.6682 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8562 (257)
SAP value		86.1212
SAP rating (Section 12)		86 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1855.2682	0.1545	286.6988 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1439.5982	0.1449	208.6322 (264)
Space and water heating			495.3310 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	276.3880	0.1443	39.8913 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-948.5971	0.1343	-127.3588
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-127.3588 (269)
Total CO2, kg/year			418.9605 (272)
CO2 emissions per m2			2.9400 (273)
EI value			97.0041
EI rating			97 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	94.6100 (1b)	x 2.4000 (2b)	= 227.0640 (1b) - (3b)
First floor	47.7800 (1c)	x 2.4500 (2c)	= 117.0610 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	344.1250 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1162 (8)
Pressure Test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3662 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3113 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate												

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Effective ac	0.2802	0.2568	0.2490	0.2490	0.2568	0.2257	0.2413	0.2179	0.2179	0.2335	0.2179	0.2490 (22b)
	0.5392	0.5330	0.5310	0.5310	0.5330	0.5255	0.5291	0.5237	0.5237	0.5273	0.5237	0.5310 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			29.0200	1.1450	33.2290			(27)
Solid Doors			2.1000	1.0000	2.1000			(26)
Ground Floor			94.6100	0.1100	10.4071	75.0000	7095.7500	(28a)
Brick	120.7400	25.6400	95.1000	0.1800	17.1180	9.0000	855.9000	(29a)
Dormer	7.5000	5.4800	2.0200	0.1800	0.3636	9.0000	18.1800	(29a)
Ashlar	17.3000		17.3000	0.1800	3.1140	9.0000	155.7000	(29a)
Joists GF	46.8300		46.8300	0.1100	5.1513	9.0000	421.4700	(30)
Joists FF	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000	(30)
Rafters	29.6100		29.6100	0.1300	3.8493	9.0000	266.4900	(30)
Total net area of external elements Aum(A, m2)			341.5900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.0823			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			70.0000			9.0000	630.0000	(32c)
Internal Floor 1			47.7800			18.0000	860.0400	(32d)
Internal Ceiling 1			47.7800			9.0000	430.0200	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11858.5500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 83.2822 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E16 Corner (normal)	16.8000	0.0900	1.5120	
E10 Eaves (insulation at ceiling level)	24.7000	0.0600	1.4820	
E17 Corner (inverted - internal area greater than external area)	8.4000	-0.0900	-0.7560	
R8 Roof to wall (rafter)	14.4200	0.0600	0.8652	
R6 Flat ceiling	39.5000	0.0600	2.3700	
E13 Gable (insulation at rafter level)	8.9600	0.0800	0.7168	
E12 Gable (insulation at ceiling level)	22.3200	0.0600	1.3392	
R7 Flat ceiling (inverted)	4.5000	0.0400	0.1800	
R9 Roof to wall (flat ceiling)	4.5000	0.0400	0.1800	
E2 Other lintels (including other steel lintels)	20.8100	0.0500	1.0405	
E3 Sill	19.8100	0.0500	0.9905	
E4 Jamb	47.1000	0.0500	2.3550	
E5 Ground floor (normal)	47.0200	0.1600	7.5232	
E6 Intermediate floor within a dwelling	34.4700	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				19.7984 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	97.8807 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	61.2377	60.5258	60.3022	60.3022	60.5258	59.6729	60.0856	59.4769	59.4769	59.8758	59.4769	60.3022 (38)
Average = Sum(39)m / 12 =	159.1184	158.4065	158.1829	158.1829	158.4065	157.5536	157.9663	157.3576	157.3576	157.7565	157.3576	158.1829 (39)
												157.9858
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1175	1.1125	1.1109	1.1109	1.1125	1.1065	1.1094	1.1051	1.1051	1.1079	1.1051	1.1109 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9215 (42)
Hot water usage for mixer showers	91.5048	90.1296	88.1258	84.2918	81.4624	78.3071	76.5136	78.5023	80.6822	84.0701	87.9864	91.1542 (42a)
Hot water usage for baths	31.6033	31.1339	30.4730	29.2543	28.3418	27.3299	26.7834	27.4397	28.1543	29.2370	30.4808	31.4964 (42b)
Hot water usage for other uses	44.5491	42.9291	41.3092	39.6892	38.0692	36.4493	36.4493	38.0692	39.6892	41.3092	42.9291	44.5491 (42c)
Average daily hot water use (litres/day)												154.1647 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	167.6571	164.1927	159.9079	153.2353	147.8734	142.0863	139.7462	144.0112	148.5257	154.6163	161.3964	167.1997 (44)
Energy content (annual)	265.5279	233.8082	245.7725	209.7714	199.0660	174.7116	169.0109	178.3159	183.1471	209.8128	229.9387	261.7943 (45)
Distribution loss (46)m = 0.15 x (45)m	39.8292	35.0712	36.8659	31.4657	29.8599	26.2067	25.3516	26.7474	27.4721	31.4719	34.4908	39.2691 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	322.5030	285.2695	301.3518	258.1550	243.2467	217.2421	212.9591	223.1946	232.8814	265.3921	285.0758	318.7694 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)

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Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												766.4878 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												766.4878
Solar input	-1.7513	-20.9151	-66.5273	-94.5576	-119.4950	-120.3928	-116.9510	-104.4467	-72.9463	-40.9565	-7.5480	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	320.7517	264.3544	234.8245	163.5973	123.7517	96.8492	96.0081	118.7478	159.9350	224.4356	277.5278	318.7694 (64)
								Total per year (kWh/year) =	Sum(64)m =			2399.5525 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) =	Sum(64a)m =			0.0000 (64a)
Heat gains from water heating, kWh/month	133.8681	118.9103	126.1828	108.4558	101.5340	92.1160	91.3546	95.1929	100.6838	114.2262	120.5643	132.6267 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901	175.2901 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	39.1256	34.7510	28.2614	21.3957	15.9935	13.5024	14.5898	18.9644	25.4540	32.3197	37.7219	40.2130 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	465.8409	470.6749	458.4934	432.5606	399.8250	369.0581	348.5040	343.6700	355.8515	381.7843	414.5199	445.2868 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505	55.4505 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601	-116.8601 (71)
Water heating gains (Table 5)												
	179.9302	176.9498	169.6005	150.6331	136.4705	127.9388	122.7885	127.9475	139.8386	153.5299	167.4505	178.2616 (72)
Total internal gains	801.7772	799.2562	773.2359	721.4699	669.1695	624.3799	599.7629	604.4625	635.0247	684.5145	736.5728	780.6419 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					2.5800	13.0723		0.6300	0.7000	0.7700		10.3073 (74)
East					11.9700	24.4329		0.6300	0.7000	0.7700		89.3800 (76)
South					7.0900	54.9219		0.6300	0.7000	0.7700		119.0046 (78)
West					7.3800	24.4329		0.6300	0.7000	0.7700		55.1065 (80)
Solar gains	273.7983	435.4996	646.4380	903.4350	1038.2529	1137.3618	1066.4882	949.7577	776.9017	530.5901	334.8411	224.6336 (83)
Total gains	1075.5756	1234.7558	1419.6739	1624.9049	1707.4225	1761.7418	1666.2511	1554.2202	1411.9264	1215.1046	1071.4139	1005.2755 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.7018	20.7949	20.8243	20.8243	20.7949	20.9074	20.8528	20.9335	20.9335	20.8805	20.9335	20.8243
alpha	2.3801	2.3863	2.3883	2.3883	2.3863	2.3938	2.3902	2.3956	2.3956	2.3920	2.3956	2.3883
util living area	0.9196	0.8932	0.8351	0.7377	0.6038	0.4352	0.3236	0.3347	0.5616	0.7649	0.8831	0.9288 (86)
MIT	18.5410	18.8150	19.4131	20.0481	20.5670	20.8637	20.9524	20.9505	20.7295	20.1552	19.2696	18.4691 (87)
Th 2	19.9866	19.9907	19.9919	19.9919	19.9907	19.9955	19.9932	19.9967	19.9967	19.9944	19.9967	19.9919 (88)
util rest of house	0.9093	0.8801	0.8147	0.7055	0.5538	0.3665	0.2393	0.2457	0.4939	0.7267	0.8659	0.9196 (89)
MIT 2	17.1420	17.4848	18.2266	18.9929	19.5896	19.8980	19.9706	19.9738	19.7789	19.1435	18.0661	17.0558 (90)
Living area fraction									fLA = Living area / (4) =			0.3011 (91)
MIT	17.5633	17.8854	18.5839	19.3107	19.8840	20.1888	20.2662	20.2679	20.0652	19.4482	18.4285	17.4814 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5633	17.8854	18.5839	19.3107	19.8840	20.1888	20.2662	20.2679	20.0652	19.4482	18.4285	17.4814 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8762	0.8449	0.7805	0.6811	0.5481	0.3802	0.2628	0.2705	0.4988	0.7027	0.8316	0.8879 (94)
Useful gains	942.4319	1043.2580	1108.0820	1106.6607	935.9221	669.8482	437.9443	420.4712	704.2820	853.8491	890.9810	892.6175 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	1967.2358	1961.9253	1784.9255	1520.2492	1122.1481	722.9863	452.7666	435.5574	812.7820	1206.5477	1609.5377	1942.7100 (97)
Space heating kWh	762.4541	617.3444	503.5716	297.7837	138.5521	0.0000	0.0000	0.0000	0.0000	262.4078	517.3608	781.2688 (98a)
Space heating requirement - total per year (kWh/year)												3880.7433
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	762.4541	617.3444	503.5716	297.7837	138.5521	0.0000	0.0000	0.0000	0.0000	262.4078	517.3608	781.2688 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3880.7433
Space heating per m ²										(98c) / (4) =		27.2543 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	249.9000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	762.4541	617.3444	503.5716	297.7837	138.5521	0.0000	0.0000	0.0000	0.0000	262.4078	517.3608	781.2688	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	305.1037	247.0366	201.5092	119.1611	55.4430	0.0000	0.0000	0.0000	0.0000	105.0051	207.0271	312.6326	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	320.7517	264.3544	234.8245	163.5973	123.7517	96.8492	96.0081	118.7478	159.9350	224.4356	277.5278	318.7694	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	183.1820	150.9734	134.1088	93.4308	70.6749	55.3108	54.8304	67.8172	91.3393	128.1757	158.4968	182.0499	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
(221)m	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Pumps and Fa	34.2464	27.4737	24.7370	18.1234	13.9991	11.4373	12.7704	16.5995	21.5611	28.2893	31.9527	35.1982	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-47.0905	-63.5261	-95.3435	-112.7813	-118.5253	-110.2978	-107.6422	-101.8444	-89.5866	-76.4981	-52.9151	-39.3768	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1552.9185	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1370.3898	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												276.3880	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1015.4277	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2264.2686	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1552.9185	26.0600	404.6906	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1370.3898	26.0600	357.1236	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	276.3880	26.0600	72.0267	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1015.4277	26.0600	-264.6205	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-264.6205	(252)
Total energy cost			590.0684	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1552.9185	0.1552	240.9481	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1370.3898	0.1457	199.7242	(264)
Space and water heating			440.6722	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	276.3880	0.1443	39.8913	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1015.4277	0.1345	-136.5330	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-136.5330	(269)
Total CO2, kg/year			355.1275	(272)

13a. Primary energy - Individual heating systems including micro-CHP

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	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1552.9185	1.5744	2444.9708 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1370.3898	1.5391	2109.1955 (278)
Space and water heating			4554.1663 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	276.3880	1.5338	423.9332 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1015.4277	1.4969	-1520.0241
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1520.0241 (283)
Total Primary energy kWh/year			3579.0994 (286)

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Property Reference	FURNERS LANE 25				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 25, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	78 C	DER	4.72	TER	9.49	
Environmental	96 A	% DER < TER				50.26
CO ₂ Emissions (t/year)	0.48	DFEE	40.59	TFEE	42.15	
Compliance Check	See BREL	% DFEE < TFEE				3.70
% DPER < TPER	0.80	DPER	49.59	TPER	49.99	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

2. Ventilation rate

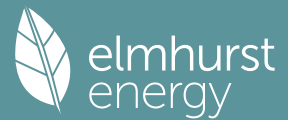
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.2298 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4798 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4078 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5200	0.5098	0.4996	0.4486	0.4384	0.3875	0.3875	0.3773	0.4078	0.4384	0.4588	0.4792 (22b)
Effective ac	0.6352	0.6300	0.6248	0.6006	0.5961	0.5751	0.5751	0.5712	0.5832	0.5961	0.6053	0.6148 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000 (28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800 (29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200 (29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300 (29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700 (30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700 (30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500 (30)
Total net area of external elements Aum(A, m ²)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3071		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			45.0000			9.0000	405.0000 (32c)
Internal Floor 1			31.0300			18.0000	558.5400 (32d)
Internal Ceiling 1			30.1300			9.0000	271.1700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9935.1300 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.2724 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.0000	0.0900	2.1600
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1000	4.1430
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			14.1428 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	81.4499 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	54.7248	54.2725	53.8292	51.7467	51.3571	49.5433	49.5433	49.2075	50.2420	51.3571	52.1453	52.9693 (38)
Heat transfer coeff	136.1747	135.7224	135.2790	133.1966	132.8070	130.9932	130.9932	130.6573	131.6918	132.8070	133.5952	134.4192 (39)
Average = Sum(39)m / 12 =												133.1947
HLP	1.2236	1.2195	1.2156	1.1968	1.1933	1.1770	1.1770	1.1740	1.1833	1.1933	1.2004	1.2078 (40)
HLP (average)												1.1968
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8224 (42)
Hot water usage for mixer showers	89.4267	88.0828	86.1245	82.3775	79.6124	76.5287	74.7760	76.7195	78.8500	82.1609	85.9883	89.0841 (42a)
Hot water usage for baths	30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839 (42b)
Hot water usage for other uses	43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337 (42c)
Average daily hot water use (litres/day)												150.6629 (43)
Daily hot water use	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017 (44)
Energy conte	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476 (45)
Energy content (annual)										Total = Sum(45)m =		2502.5121
Distribution loss (46)m = 0.15 x (45)m	38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3173.3474 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	131.8626	117.1444	125.4432	112.2744	110.2660	100.8818	100.4997	103.5233	103.6229	113.7581	118.8277	130.6494 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	137.9683	152.7507	137.9683	142.5673	137.9683	142.5673	137.9683	137.9683	142.5673	137.9683	142.5673	137.9683 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.3965	276.2335	269.0844	253.8647	234.6525	216.5958	204.5329	201.6959	208.8450	224.0647	243.2768	261.3335 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941 (71)
Water heating gains (Table 5)	177.2347	174.3220	168.6064	155.9367	148.2071	140.1137	135.0803	139.1443	143.9206	152.9007	165.0384	175.6040 (72)
Total internal gains	656.9348	671.6415	643.9944	620.7039	589.1632	564.6121	542.9167	544.1437	560.6682	583.2690	619.2178	643.2411 (73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b		Specific data or Table 6c		FF	Access factor Table 6d	Gains W
North	2.8300				10.6334	0.6300		0.7000			0.7700	9.1967 (74)
East	7.4600				19.6403	0.6300		0.7000			0.7700	44.7773 (76)
South	3.7400				46.7521	0.6300		0.7000			0.7700	53.4373 (78)
West	9.6800				19.6403	0.6300		0.7000			0.7700	58.1025 (80)
West	0.5400				25.9287	0.6300		0.7000			1.0000	5.5572 (82)
Solar gains	171.0709	317.4648	491.7254	685.9946	824.3481	839.2568	800.7245	696.7982	560.1973	367.4790	209.9388	142.9869 (83)
Total gains	828.0057	989.1063	1135.7198	1306.6985	1413.5113	1403.8689	1343.6413	1240.9419	1120.8654	950.7480	829.1566	786.2280 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.2663	20.3338	20.4005	20.7194	20.7802	21.0679	21.0679	21.1221	20.9562	20.7802	20.6576	20.5310
alpha	2.3511	2.3556	2.3600	2.3813	2.3853	2.4045	2.4045	2.4081	2.3971	2.3853	2.3772	2.3687
util living area	0.9388	0.9090	0.8621	0.7740	0.6558	0.5130	0.3951	0.4367	0.6287	0.8218	0.9129	0.9449 (86)
MIT	18.1460	18.5443	19.1212	19.8441	20.4059	20.7708	20.9117	20.8853	20.6052	19.8436	18.8848	18.0940 (87)
Th 2	19.9012	19.9044	19.9076	19.9225	19.9253	19.9384	19.9384	19.9408	19.9334	19.9253	19.9197	19.9137 (88)
util rest of house	0.9305	0.8970	0.8437	0.7441	0.6097	0.4465	0.3104	0.3503	0.5648	0.7909	0.8993	0.9373 (89)
MIT 2	16.5881	17.0885	17.8083	18.6974	19.3550	19.7581	19.8879	19.8713	19.5978	18.7218	17.5339	16.5296 (90)
Living area fraction	fLA = Living area / (4) = 0.2649 (91)											
MIT	17.0008	17.4742	18.1561	19.0012	19.6334	20.0264	20.1591	20.1399	19.8646	19.0190	17.8917	16.9440 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.0008	17.4742	18.1561	19.0012	19.6334	20.0264	20.1591	20.1399	19.8646	19.0190	17.8917	16.9440 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8992	0.8615	0.8070	0.7145	0.5960	0.4523	0.3287	0.3674	0.5603	0.7593	0.8651	0.9078 (94)
Useful gains	744.5547	852.0730	916.4756	933.6012	842.4211	635.0373	441.6626	455.8761	627.9670	721.9157	717.3054	713.7290 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1729.5272	1706.5942	1576.8239	1345.4423	1053.6063	710.8186	466.2184	488.6423	759.1545	1118.0994	1441.7184	1713.0377 (97)
Space heating kWh	732.8195	574.2383	491.2991	296.5256	157.1218	0.0000	0.0000	0.0000	0.0000	294.7607	521.5774	743.4857 (98a)
Space heating requirement - total per year (kWh/year)												3811.8280
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	732.8195	574.2383	491.2991	296.5256	157.1218	0.0000	0.0000	0.0000	0.0000	294.7607	521.5774	743.4857 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3811.8280
Space heating per m2	(98c) / (4) =											34.2513 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	732.8195	574.2383	491.2991	296.5256	157.1218	0.0000	0.0000	0.0000	0.0000	294.7607	521.5774	743.4857 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	293.2451	229.7872	196.5983	118.6577	62.8739	0.0000	0.0000	0.0000	0.0000	117.9515	208.7144	297.5133 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	180.7375	159.8850	169.7116	148.5687	143.6433	129.0008	126.8686	132.0620	133.7087	149.6413	159.8245	178.6537 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

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Annual totals kWh/year		
Space heating fuel - main system 1	1525.3413	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	175.1000	
Water heating fuel used	1812.3058	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	236.7193	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3574.3664	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1525.3413	0.1547	235.9638 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1812.3058	0.1410	255.4851 (264)
Space and water heating			491.4489 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Total CO2, kg/year			525.6148 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.7200 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1525.3413	1.5727	2398.9229 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1812.3058	1.5213	2757.0039 (278)
Space and water heating			5155.9268 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	236.7193	1.5338	363.0879 (282)
Total Primary energy kWh/year			5519.0147 (286)
Dwelling Primary energy Rate (DPER)			49.5900 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1532 (8)
Pressure Test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4032 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3427 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												

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Effective ac	0.4370	0.4284	0.4198	0.3770	0.3684	0.3256	0.3256	0.3170	0.3427	0.3684	0.3856	0.4027 (22b)
	0.5955	0.5918	0.5881	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.0200	1.0000	2.0200		(26)
TER Opening Type (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Rooflight W			0.5400	1.4151	0.7642		(27a)
Ground Floor			81.1600	0.1300	10.5508		(28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476		(29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284		(29a)
Ashlar	27.0700		27.0700	0.1800	4.8726		(29a)
Joists GF	51.0300		51.0300	0.1100	5.6133		(30)
Joists FF	20.0000		20.0000	0.1100	2.2000		(30)
Rafters	13.1700	0.5400	12.6300	0.1100	1.3893		(30)
D Flat	1.4500		1.4500	0.1100	0.1595		(30)
Total net area of external elements Aum(A, m2)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.7945		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.2724 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.0000	0.0900	2.1600
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1600	6.6288
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0800	0.0440
R2 Sill of roof window	0.5500	0.0600	0.0330
R3 Jamb of roof window	1.9600	0.0800	0.1568

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.6678 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 85.4623 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	51.3023	50.9829	50.6698	49.1992	48.9241	47.6432	47.6432	47.4060	48.1366	48.9241	49.4807	50.0626 (38)
Heat transfer coeff	136.7646	136.4452	136.1321	134.6615	134.3864	133.1055	133.1055	132.8683	133.5989	134.3864	134.9430	135.5249 (39)
Average = Sum(39)m / 12 =												134.6602

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2289	1.2260	1.2232	1.2100	1.2075	1.1960	1.1960	1.1939	1.2005	1.2075	1.2125	1.2178 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8224 (42)
Hot water usage for mixer showers												
71.5414	70.4662	68.8996	65.9020	63.6899	61.2230	59.8208	61.3756	63.0800	65.7287	68.7906	71.2673 (42a)	
Hot water usage for baths												
30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839 (42b)	
Hot water usage for other uses												
43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337 (42c)	
Average daily hot water use (litres/day)												134.1732 (43)

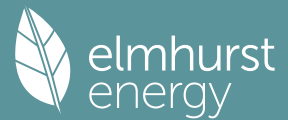
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	145.9634	142.8465	139.0508	133.2791	128.5921	123.5531	121.6168	125.3961	129.3820	134.6719	140.5325	145.5849 (44)
Energy conte	231.1704	203.4115	213.7159	182.4524	173.1096	151.9230	147.0849	155.2666	159.5409	182.7486	200.2144	227.9507 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
34.6756	30.5117	32.0574	27.3679	25.9664	22.7885	22.0627	23.2900	23.9311	27.4123	30.0322	34.1926 (46)	
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)	

If cylinder contains dedicated solar storage												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
286.0772	253.0048	268.6227	235.5880	228.0164	205.0586	201.9917	210.1734	212.6765	237.6554	253.3500	282.8575 (62)	
WWHRS	-32.7057	-28.9252	-30.2888	-25.0803	-23.3740	-20.0013	-18.7480	-19.9366	-20.6941	-24.3960	-27.6378	-32.1001 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	253.3714	224.0795	238.3339	210.5077	204.6425	185.0573	183.2437	190.2367	191.9824	213.2593	225.7122	250.7575 (64)
12Total per year (kWh/year)												2571.1842 (64)
Electric shower(s)												2571 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)

Heat gains from water heating, kWh/month												
120.7896	107.3089	114.9860	103.1739	101.4844	93.0229	92.8312	95.5516	95.5558	104.6893	109.0798	119.7191 (65)	

5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	137.9683	152.7507	137.9683	142.5673	137.9683	142.5673	137.9683	137.9683	142.5673	137.9683	142.5673	137.9683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.3965	276.2335	269.0844	253.8647	234.6525	216.5958	204.5329	201.6959	208.8450	224.0647	243.2768	261.3335	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	(71)
Water heating gains (Table 5)	162.3516	159.6859	154.5510	143.2971	136.4037	129.1984	124.7731	128.4295	132.7164	140.7115	151.4997	160.9127	(72)
Total internal gains	642.0517	657.0053	629.9390	608.0643	577.3599	553.6968	532.6096	533.4290	549.4640	571.0798	605.6791	628.5498	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					2.8300	10.6334		0.6300	0.7000	0.7700		9.1967 (74)	
East					7.4600	19.6403		0.6300	0.7000	0.7700		44.7773 (76)	
South					3.7400	46.7521		0.6300	0.7000	0.7700		53.4373 (78)	
West					9.6800	19.6403		0.6300	0.7000	0.7700		58.1025 (80)	
West					0.5400	25.9287		0.6300	0.7000	1.0000		5.5572 (82)	
Solar gains	171.0709	317.4648	491.7254	685.9946	824.3481	839.2568	800.7245	696.7982	560.1973	367.4790	209.9388	142.9869	(83)
Total gains	813.1226	974.4702	1121.6644	1294.0589	1401.7080	1392.9536	1333.3341	1230.2272	1109.6612	938.5588	815.6178	771.5367	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.1789	20.2261	20.2727	20.4940	20.5360	20.7336	20.7336	20.7706	20.6570	20.5360	20.4513	20.3635	
alpha	2.3453	2.3484	2.3515	2.3663	2.3691	2.3822	2.3822	2.3847	2.3771	2.3691	2.3634	2.3576	
util living area	0.9410	0.9117	0.8655	0.7789	0.6619	0.5207	0.4023	0.4448	0.6363	0.8268	0.9159	0.9470	(86)
MIT	18.1095	18.5075	19.0870	19.8092	20.3824	20.7563	20.9050	20.8767	20.5852	19.8079	18.8393	18.0457	(87)
Th 2	19.8969	19.8992	19.9015	19.9120	19.9140	19.9232	19.9232	19.9249	19.9196	19.9140	19.9100	19.9058	(88)
util rest of house	0.9329	0.9000	0.8474	0.7492	0.6156	0.4531	0.3154	0.3562	0.5719	0.7963	0.9027	0.9397	(89)
MIT 2	16.5402	17.0400	17.7630	18.6496	19.3211	19.7318	19.8692	19.8503	19.5671	18.6729	17.4723	16.4646	(90)
Living area fraction													(91)
MIT	16.9559	17.4288	18.1137	18.9567	19.6022	20.0032	20.1435	20.1222	19.8368	18.9736	17.8344	16.8834	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9559	17.4288	18.1137	18.9567	19.6022	20.0032	20.1435	20.1222	19.8368	18.9736	17.8344	16.8834	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9020	0.8645	0.8104	0.7187	0.6010	0.4584	0.3339	0.3733	0.5664	0.7640	0.8685	0.9105	(94)
Useful gains	733.4582	842.4287	908.9509	930.0974	842.4295	638.5461	445.2395	459.2880	628.5573	717.0146	708.3808	702.5170	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1730.8755	1709.4888	1580.9997	1354.2565	1061.9506	719.1950	471.6660	494.5640	766.4254	1125.2914	1448.5307	1718.9173	(97)
Space heating kWh	742.0785	582.6644	500.0043	305.3946	163.3237	0.0000	0.0000	0.0000	0.0000	303.7580	532.9079	756.2018	(98a)
Space heating requirement - total per year (kWh/year)												3886.3331	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	742.0785	582.6644	500.0043	305.3946	163.3237	0.0000	0.0000	0.0000	0.0000	303.7580	532.9079	756.2018	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3886.3331	
Space heating per m2										(98c) / (4) =		34.9208	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	742.0785	582.6644	500.0043	305.3946	163.3237	0.0000	0.0000	0.0000	0.0000	303.7580	532.9079	756.2018	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	803.9854	631.2723	541.7165	330.8717	176.9487	0.0000	0.0000	0.0000	0.0000	329.0986	577.3650	819.2869	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.3714	224.0795	238.3339	210.5077	204.6425	185.0573	183.2437	190.2367	191.9824	213.2593	225.7122	250.7575	(64)
Efficiency of water heater												79.8000	(216)

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(217)m	86.3220	86.1027	85.6807	84.8933	83.5589	79.8000	79.8000	79.8000	79.8000	84.8526	85.9170	86.3741	(217)
Fuel for water heating, kWh/month	293.5189	260.2467	278.1651	247.9675	244.9080	231.9014	229.6287	238.3919	240.5795	251.3290	262.7097	290.3154	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	28.6671	22.9978	20.7070	15.1708	11.7184	9.5740	10.6899	13.8951	18.0484	23.6805	26.7470	29.4638	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-66.2250	-88.8236	-121.5277	-129.8283	-134.4741	-123.5238	-121.8757	-117.5957	-109.4642	-98.0916	-71.1184	-57.7932	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-52.6092	-108.4800	-211.7469	-312.6585	-408.4331	-408.6693	-403.9509	-344.3492	-255.4786	-153.3969	-69.6420	-41.7803	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4210.5451	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3069.6619	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												231.3599	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4011.5363	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3586.0305	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4210.5451	0.2100	884.2145 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3069.6619	0.2100	644.6290 (264)
Space and water heating			1528.8435 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	231.3599	0.1443	33.3924 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1240.3412	0.1357	-168.2922
PV Unit electricity exported	-2771.1952	0.1264	-350.2815
Total			-518.5738 (269)
Total CO2, kg/year			1055.5913 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.4900 (273)

13a. Primary energy - Individual heating systems including micro-CHP

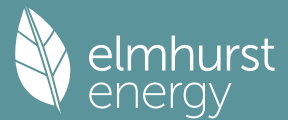
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4210.5451	1.1300	4757.9159 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3069.6619	1.1300	3468.7179 (278)
Space and water heating			8226.6338 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	231.3599	1.5338	354.8675 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1240.3412	1.5015	-1862.3954
PV Unit electricity exported	-2771.1952	0.4640	-1285.8356
Total			-3148.2310 (283)
Total Primary energy kWh/year			5563.3711 (286)
Target Primary Energy Rate (TPER)			49.9900 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

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2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											4 * 10 =	40.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1532 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											5.0000 (17)	
Infiltration rate											0.4032 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3427 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4370	0.4284	0.4198	0.3770	0.3684	0.3256	0.3256	0.3170	0.3427	0.3684	0.3856	0.4027 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.0000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =											0.0000 (23c)	
Effective ac	0.5955	0.5918	0.5881	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			23.7100	1.1450	27.1489			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight W			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000	(28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800	(29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200	(29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300	(29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700	(30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000	(30)
Rafts	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700	(30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500	(30)
Total net area of external elements Aum(A, m2)			297.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3071			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			45.0000			9.0000	405.0000	(32c)
Internal Floor 1			31.0300			18.0000	558.5400	(32d)
Internal Ceiling 1			30.1300			9.0000	271.1700	(32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =				9935.1300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								89.2724 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E16 Corner (normal)				24.0000	0.0900		2.1600	
E10 Eaves (insulation at ceiling level)				41.4300	0.0600		2.4858	
E17 Corner (inverted - internal area greater than external area)				14.4000	-0.0900		-1.2960	
R8 Roof to wall (rafter)				22.5600	0.0600		1.3536	
R6 Flat ceiling				22.5300	0.0600		1.3518	
E13 Gable (insulation at rafter level)				2.6000	0.0800		0.2080	
E2 Other lintels (including other steel lintels)				16.7200	0.0500		0.8360	
E3 Sill				15.7600	0.0500		0.7880	
E4 Jamb				38.3600	0.0500		1.9180	
E5 Ground floor (normal)				41.4300	0.1000		4.1430	
E6 Intermediate floor within a dwelling				26.9200	0.0000		0.0000	
R1 Head of roof window				0.5500	0.0600		0.0330	
R2 Sill of roof window				0.5500	0.0800		0.0440	
R3 Jamb of roof window				1.9600	0.0600		0.1176	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								14.1428 (36)
Point Thermal bridges				(36a) =				0.0000
Total fabric heat loss				(33) + (36) + (36a) =				81.4499 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8224 (42)											
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839 (42b)
Hot water usage for other uses	43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337 (42c)
Average daily hot water use (litres/day)	68.2145 (43)											

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.4220	72.3803	70.1512	67.3771	64.9022	62.3302	61.7960	64.0205	66.3020	68.9433	71.7419	74.3176	(44)
Energy content (annual)	117.8663	103.0685	107.8198	92.2359	87.3708	76.6422	74.7369	79.2708	81.7570	93.5553	102.2095	116.3634	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	100.1864	87.6083	91.6469	78.4005	74.2652	65.1459	63.5264	67.3801	69.4934	79.5220	86.8781	98.9089	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	100.1864	87.6083	91.6469	78.4005	74.2652	65.1459	63.5264	67.3801	69.4934	79.5220	86.8781	98.9089	(64)
12Total per year (kWh/year)													
Electric shower(s)	57.2927	51.0483	55.7428	53.1946	54.1928	51.6947	53.4178	54.1928	53.1946	55.7428	54.6946	57.2927	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												963	(64)
Heat gains from water heating, kWh/month	39.3698	34.6641	36.8474	32.8988	32.1145	29.2101	29.2360	30.3932	30.6720	33.8162	35.3932	39.0504	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	137.9683	152.7507	137.9683	142.5673	137.9683	142.5673	137.9683	137.9683	142.5673	137.9683	142.5673	137.9683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.3965	276.2335	269.0844	253.8647	234.6525	216.5958	204.5329	201.6959	208.8450	224.0647	243.2768	261.3335	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	(71)
Water heating gains (Table 5)	52.9164	51.5835	49.5261	45.6927	43.1646	40.5696	39.2958	40.8511	42.6000	45.4519	49.1572	52.4871	(72)
Total internal gains	529.6165	545.9030	521.9140	507.4600	481.1208	465.0680	447.1322	445.8506	459.3476	472.8202	500.3366	517.1242	(73)

6. Solar gains

[Jan]												
				Area	Solar flux		g		FF		Access	Gains
				m2	Table 6a						factor	W
					W/m2		Specific data		Specific data		Table 6d	
							or Table 6b		or Table 6c			
North				2.8300	10.6334		0.6300		0.7000		0.7700	9.1967 (74)
East				7.4600	19.6403		0.6300		0.7000		0.7700	44.7773 (76)
South				3.7400	46.7521		0.6300		0.7000		0.7700	53.4373 (78)
West				9.6800	19.6403		0.6300		0.7000		0.7700	58.1025 (80)
West				0.5400	25.9287		0.6300		0.7000		1.0000	5.5572 (82)
Solar gains	171.0709	317.4648	491.7254	685.9946	824.3481	839.2568	800.7245	696.7982	560.1973	367.4790	209.9388	142.9869 (83)
Total gains	700.6874	863.3678	1013.6394	1193.4546	1305.4689	1304.3248	1247.8568	1142.6488	1019.5448	840.2992	710.2753	660.1111 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
tau	20.7888	20.8389	20.8883	21.1234	21.1680	21.3780	21.3780	21.4174	21.2967	21.1680	21.0780	20.9848		
alpha	2.3859	2.3893	2.3926	2.4082	2.4112	2.4252	2.4252	2.4278	2.4198	2.4112	2.4052	2.3990		
util living area	0.9553	0.9280	0.8839	0.7980	0.6803	0.5364	0.4158	0.4620	0.6599	0.8509	0.9339	0.9607	(86)	
MIT	18.0160	18.4310	19.0297	19.7797	20.3697	20.7530	20.9040	20.8734	20.5687	19.7546	18.7565	17.9503	(87)	
Th 2	19.9257	19.9280	19.9303	19.9409	19.9429	19.9522	19.9522	19.9539	19.9486	19.9429	19.9389	19.9347	(88)	
util rest of house	0.9490	0.9182	0.8679	0.7701	0.6355	0.4695	0.3289	0.3735	0.5973	0.8236	0.9232	0.9551	(89)	
MIT 2	17.2082	17.6167	18.2017	18.9248	19.4667	19.7990	19.9087	19.8930	19.6585	18.9207	17.9501	17.1491	(90)	
Living area fraction														
MIT	17.4222	17.8324	18.4210	19.1512	19.7059	20.0517	20.1724	20.1527	19.8996	19.1416	18.1637	17.3614	(92)	
Temperature adjustment														
adjusted MIT	17.4222	17.8324	18.4210	19.1512	19.7059	20.0517	20.1724	20.1527	19.8996	19.1416	18.1637	17.3614	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	650.7154	770.9659	851.3923	890.4643	815.2180	621.2302	434.2717	447.0698	605.7047	670.8842	638.7552	618.0941	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1741.9987	1712.6774	1575.0034	1339.3138	1043.7599	703.7755	461.1662	483.5607	751.5460	1113.5982	1448.5778	1730.8825	(97)
Space heating kWh	811.9147	632.8301	538.3666	323.1717	170.0352	0.0000	0.0000	0.0000	0.0000	329.3792	583.0723	827.9146	(98a)
Space heating requirement - total per year (kWh/year)												4216.6844	
Solar heating kWh													

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Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	811.9147	632.8301	538.3666	323.1717	170.0352	0.0000	0.0000	0.0000	0.0000	329.3792	583.0723	827.9146 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4216.6844
Space heating per m2										(98c) / (4) =		37.8892 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1213.4752	955.2890	979.3050	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7706	0.8275	0.7957	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	935.1194	790.5428	779.2500	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1461.7754	1398.7622	1279.4679	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	379.1923	452.5152	372.1622	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	fc = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	94.7981	113.1288	93.0405	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												300.9674 (107)
Energy for space heating												37.8892 (99)
Energy for space cooling												2.7044 (108)
Total												40.5935 (109)
Fabric Energy Efficiency (DFEE)												40.6 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.0700 (5)

2. Ventilation rate

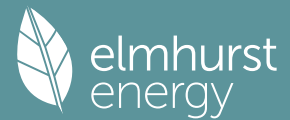
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1532 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4032 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3427 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4370	0.4284	0.4198	0.3770	0.3684	0.3256	0.3256	0.3170	0.3427	0.3684	0.3856	0.4027 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5955	0.5918	0.5881	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.0200	1.0000	2.0200		(26)
TER Opening Type (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Rooflight W			0.5400	1.4151	0.7642		(27a)
Ground Floor			81.1600	0.1300	10.5508		(28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476		(29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284		(29a)
Ashlar	27.0700		27.0700	0.1800	4.8726		(29a)
Joists GF	51.0300		51.0300	0.1100	5.6133		(30)

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Joists FF	20.0000		20.0000	0.1100	2.2000	(30)
Rafters	13.1700	0.5400	12.6300	0.1100	1.3893	(30)
D Flat	1.4500		1.4500	0.1100	0.1595	(30)
Total net area of external elements Aum(A, m2)			297.8100			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	68.7945		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 89.2724 (35)

List of Thermal Bridges						
K1 Element	Length	Psi-value	Total			
E16 Corner (normal)	24.0000	0.0900	2.1600			
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858			
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960			
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536			
R6 Flat ceiling	22.5300	0.0600	1.3518			
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080			
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360			
E3 Sill	15.7600	0.0500	0.7880			
E4 Jamb	38.3600	0.0500	1.9180			
E5 Ground floor (normal)	41.4300	0.1600	6.6288			
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000			
R1 Head of roof window	0.5500	0.0800	0.0440			
R2 Sill of roof window	0.5500	0.0600	0.0330			
R3 Jamb of roof window	1.9600	0.0800	0.1568			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.6678 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 85.4623 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	51.3023	50.9829	50.6698	49.1992	48.9241	47.6432	47.6432	47.4060	48.1366	48.9241	49.4807	50.0626	(38)
Heat transfer coeff	136.7646	136.4452	136.1321	134.6615	134.3864	133.1055	133.1055	132.8683	133.5989	134.3864	134.9430	135.5249	(39)
Average = Sum(39)m / 12 =												134.6602	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.2289	1.2260	1.2232	1.2100	1.2075	1.1960	1.1960	1.1939	1.2005	1.2075	1.2125	1.2178	(40)
HLP (average)												1.2100	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8224 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths 30.8883 30.4296 29.7836 28.5925 27.7006 26.7117 26.1775 26.8190 27.5174 28.5756 29.7913 30.7839 (42b)

Hot water usage for other uses 43.5337 41.9507 40.3676 38.7846 37.2015 35.6185 35.6185 37.2015 38.7846 40.3676 41.9507 43.5337 (42c)

Average daily hot water use (litres/day) 68.2145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.4220	72.3803	70.1512	67.3771	64.9022	62.3302	61.7960	64.0205	66.3020	68.9433	71.7419	74.3176	(44)
Energy conte	117.8663	103.0685	107.8198	92.2359	87.3708	76.6422	74.7369	79.2708	81.7570	93.5553	102.2095	116.3634	(45)
Energy content (annual)										Total = Sum(45)m =		1132.8965	

Distribution loss (46)m = 0.15 x (45)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (46)

Water storage loss: 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (46)

Total storage loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)

If cylinder contains dedicated solar storage 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)

Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 100.1864 87.6083 91.6469 78.4005 74.2652 65.1459 63.5264 67.3801 69.4934 79.5220 86.8781 98.9089 (62)

WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)

PV diverter 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h 100.1864 87.6083 91.6469 78.4005 74.2652 65.1459 63.5264 67.3801 69.4934 79.5220 86.8781 98.9089 (64)

Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 962.9620 (64)

Electric shower(s) 57.2927 51.0483 55.7428 53.1946 54.1928 51.6947 53.4178 54.1928 53.1946 55.7428 54.6946 57.2927 (64a)

Heat gains from water heating, kWh/month 39.3698 34.6641 36.8474 32.8988 32.1145 29.2101 29.2360 30.3932 30.6720 33.8162 35.3932 39.0504 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts (66)m 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 137.9683 152.7507 137.9683 142.5673 137.9683 142.5673 137.9683 137.9683 137.9683 142.5673 137.9683 142.5673 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 273.3965 276.2335 269.0844 253.8647 234.6525 216.5958 204.5329 201.6959 208.8450 224.0647 243.2768 261.3335 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 (69)

Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5) -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 (71)

Water heating gains (Table 5) 52.9164 51.5835 49.5261 45.6927 43.1646 40.5696 39.2958 40.8511 42.6000 45.4519 49.1572 52.4871 (72)

Total internal gains 529.6165 545.9030 521.9140 507.4600 481.1208 465.0680 447.1322 445.8506 459.3476 472.8202 500.3366 517.1242 (73)

6. Solar gains

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[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.8300	10.6334	0.6300	0.7000	0.7700	9.1967 (74)
East	7.4600	19.6403	0.6300	0.7000	0.7700	44.7773 (76)
South	3.7400	46.7521	0.6300	0.7000	0.7700	53.4373 (78)
West	9.6800	19.6403	0.6300	0.7000	0.7700	58.1025 (80)
West	0.5400	25.9287	0.6300	0.7000	1.0000	5.5572 (82)

Solar gains	171.0709	317.4648	491.7254	685.9946	824.3481	839.2568	800.7245	696.7982	560.1973	367.4790	209.9388	142.9869 (83)
Total gains	700.6874	863.3678	1013.6394	1193.4546	1305.4689	1304.3248	1247.8568	1142.6488	1019.5448	840.2992	710.2753	660.1111 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	20.1789	20.2261	20.2727	20.4940	20.5360	20.7336	20.7336	20.7706	20.6570	20.5360	20.4513	Dec
alpha	2.3453	2.3484	2.3515	2.3663	2.3691	2.3822	2.3822	2.3847	2.3771	2.3691	2.3634	20.3635
util living area	0.9558	0.9292	0.8863	0.8028	0.6877	0.5455	0.4248	0.4713	0.6677	0.8543	0.9349	0.9611 (86)
MIT	17.9278	18.3433	18.9490	19.7137	20.3249	20.7297	20.8930	20.8599	20.5364	19.6963	18.6804	17.8617 (87)
Th 2	19.8969	19.8992	19.9015	19.9120	19.9140	19.9232	19.9232	19.9249	19.9196	19.9140	19.9100	19.9058 (88)
util rest of house	0.9494	0.9193	0.8703	0.7748	0.6423	0.4768	0.3345	0.3796	0.6041	0.8269	0.9242	0.9555 (89)
MIT 2	17.1034	17.5125	18.1047	18.8425	19.4050	19.7563	19.8753	19.8581	19.6089	18.8461	17.8574	17.0438 (90)
Living area fraction	17.3218	17.7325	18.3284	19.0732	19.6487	20.0142	20.1448	20.1235	fLA = Living area / (4) =			0.2649 (91)
MIT	17.3218	17.7325	18.3284	19.0732	19.6487	20.0142	20.1448	20.1235	19.8546	19.0713	18.0754	17.2605 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3218	17.7325	18.3284	19.0732	19.6487	20.0142	20.1448	20.1235	19.8546	19.0713	18.0754	17.2605 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9288	0.8937	0.8417	0.7497	0.6300	0.4830	0.3540	0.3975	0.5998	0.8009	0.8999	0.9364 (94)
Ext temp.	650.8120	771.5929	853.1358	894.7504	822.4744	629.9980	441.7911	454.2430	611.5214	672.9552	639.1817	618.1192 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1780.9236	1750.9367	1610.2200	1369.9447	1068.1977	720.6574	471.8387	494.7347	768.8027	1138.4277	1481.0539	1770.0176 (97)
Space heating requirement - total per year (kWh/year)	840.8031	658.1190	563.2706	342.1399	182.8181	0.0000	0.0000	0.0000	0.0000	346.3115	606.1480	857.0124 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	840.8031	658.1190	563.2706	342.1399	182.8181	0.0000	0.0000	0.0000	0.0000	346.3115	606.1480	857.0124 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4396.6227
Space heating per m2										(98c) / (4) =		39.5060 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1251.1920	984.9810	1009.7994	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7569	0.8153	0.7825	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	947.0394	803.0739	790.2120	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1461.7754	1398.7622	1279.4679	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	370.6099	443.1921	364.0064	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	fc = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	92.6525	110.7980	91.0016	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling requirement												0.0000 (107)
Energy for space heating												294.4521 (107)
Energy for space cooling												39.5060 (99)
Total												2.6458 (108)
Fabric Energy Efficiency (TFEE)												42.1518 (109)
												42.2 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x	2.4000 (2b) =
First floor	30.1300 (1c)	x	2.2000 (2c) =
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.0700 (5)

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2. Ventilation rate

			m3 per hour
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		6 * 10 =	60.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
			Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.2298 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.4798 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.4078 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Effective ac	0.5200	0.5098	0.4996	0.4486	0.4384	0.3875	0.3875	0.3773	0.4078	0.4384	0.4588	0.4792	(22b)
	0.6352	0.6300	0.6248	0.6006	0.5961	0.5751	0.5751	0.5712	0.5832	0.5961	0.6053	0.6148	(25)

3. Heat losses and heat loss parameter

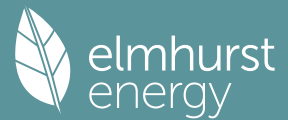
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			23.7100	1.1450	27.1489			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight W			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000	(28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800	(29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200	(29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300	(29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700	(30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000	(30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700	(30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500	(30)
Total net area of external elements Aum(A, m2)			297.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3071			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			45.0000			9.0000	405.0000	(32c)
Internal Floor 1			31.0300			18.0000	558.5400	(32d)
Internal Ceiling 1			30.1300			9.0000	271.1700	(32e)
Heat capacity Cm = Sum(A x k)								(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E16 Corner (normal)				24.0000	0.0900	2.1600		
E10 Eaves (insulation at ceiling level)				41.4300	0.0600	2.4858		
E17 Corner (inverted - internal area greater than external area)				14.4000	-0.0900	-1.2960		
R8 Roof to wall (rafter)				22.5600	0.0600	1.3536		
R6 Flat ceiling				22.5300	0.0600	1.3518		
E13 Gable (insulation at rafter level)				2.6000	0.0800	0.2080		
E2 Other lintels (including other steel lintels)				16.7200	0.0500	0.8360		
E3 Sill				15.7600	0.0500	0.7880		
E4 Jamb				38.3600	0.0500	1.9180		
E5 Ground floor (normal)				41.4300	0.1000	4.1430		
E6 Intermediate floor within a dwelling				26.9200	0.0000	0.0000		
R1 Head of roof window				0.5500	0.0600	0.0330		
R2 Sill of roof window				0.5500	0.0800	0.0440		
R3 Jamb of roof window				1.9600	0.0600	0.1176		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1428	(36)
Point Thermal bridges							(36a) =	0.0000
Total fabric heat loss							(33) + (36) + (36a) =	81.4499 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	54.7248	54.2725	53.8292	51.7467	51.3571	49.5433	49.5433	49.2075	50.2420	51.3571	52.1453	52.9693 (38)
Average = Sum(39)m / 12 =	136.1747	135.7224	135.2790	133.1966	132.8070	130.9932	130.9932	130.6573	131.6918	132.8070	133.5952	134.4192 (39)
												133.1947
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2236	1.2195	1.2156	1.1968	1.1933	1.1770	1.1770	1.1740	1.1833	1.1933	1.2004	1.2078 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8224 (42)
Hot water usage for mixer showers													89.0841 (42a)
Hot water usage for baths													30.7839 (42b)
Hot water usage for other uses													43.5337 (42c)
Average daily hot water use (litres/day)													150.6629 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													

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Energy conte	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017 (44)
Energy content (annual)	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2502.5121
Water storage loss:	38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
WWHRS	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	131.8626	117.1444	125.4432	112.2744	110.2660	100.8818	100.4997	103.5233	103.6229	113.7581	118.8277	130.6494 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.5101	29.7633	24.2052	18.3249	13.6981	11.5645	12.4958	16.2425	21.8007	27.6810	32.3078	34.4414 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.0545	412.2888	401.6184	378.9025	350.2277	323.2774	305.2729	301.0386	311.7090	334.4249	363.0998	390.0500 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941 (71)
Water heating gains (Table 5)	177.2347	174.3220	168.6064	155.9367	148.2071	140.1137	135.0803	139.1443	143.9206	152.9007	165.0384	175.6040 (72)
Total internal gains	733.0027	730.5777	708.6335	667.3675	626.3363	586.1590	564.0525	567.6289	588.6338	629.2101	674.6495	714.2989 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
North						2.8300	10.6334	0.6300	0.7000			0.7700	9.1967 (74)	
East						7.4600	19.6403	0.6300	0.7000			0.7700	44.7773 (76)	
South						3.7400	46.7521	0.6300	0.7000			0.7700	53.4373 (78)	
West						9.6800	19.6403	0.6300	0.7000			0.7700	58.1025 (80)	
West						0.5400	25.9287	0.6300	0.7000			1.0000	5.5572 (82)	
Solar gains	171.0709	317.4648	491.7254	685.9946	824.3481	839.2568	800.7245	696.7982	560.1973	367.4790	209.9388	142.9869	(83)	
Total gains	904.0736	1048.0425	1200.3589	1353.3622	1450.6843	1425.4158	1364.7770	1264.4271	1148.8311	996.6891	884.5883	857.2858	(84)	

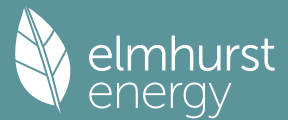
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.2663	20.3338	20.4005	20.7194	20.7802	21.0679	21.0679	21.1221	20.9562	20.7802	20.6576	20.5310
alpha	2.3511	2.3556	2.3600	2.3813	2.3853	2.4045	2.4045	2.4081	2.3971	2.3853	2.3772	2.3687
util living area	0.9278	0.8993	0.8493	0.7629	0.6461	0.5073	0.3899	0.4302	0.6193	0.8088	0.9022	0.9350 (86)
MIT	18.2633	18.6270	19.1984	19.8850	20.4260	20.7764	20.9142	20.8891	20.6185	19.8914	18.9639	18.2065 (87)
Th 2	19.9012	19.9044	19.9076	19.9225	19.9253	19.9384	19.9384	19.9408	19.9334	19.9253	19.9197	19.9137 (88)
util rest of house	0.9183	0.8863	0.8298	0.7324	0.5998	0.4411	0.3060	0.3446	0.5554	0.7766	0.8874	0.9263 (89)
MIT 2	16.7343	17.1904	17.9011	18.7440	19.3757	19.7629	19.8895	19.8737	19.6102	18.7765	17.6307	16.6701 (90)
Living area fraction									fLA = Living area / (4) =			0.2649 (91)
MIT	17.1393	17.5710	18.2447	19.0462	19.6539	20.0314	20.1609	20.1427	19.8773	19.0718	17.9839	17.0771 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1393	17.5710	18.2447	19.0462	19.6539	20.0314	20.1609	20.1427	19.8773	19.0718	17.9839	17.0771 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	800.0597	890.7008	952.1799	952.4364	851.6762	637.5063	442.6081	457.3299	633.8119	743.5272	753.8858	766.8982 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1748.3938	1719.7335	1588.8174	1351.4437	1056.3331	711.4758	466.4557	489.0121	760.8216	1125.1202	1454.0316	1730.9314 (97)
Space heating kWh	705.5605	557.1100	473.6583	287.2853	152.2647	0.0000	0.0000	0.0000	0.0000	283.9052	504.1050	717.2407 (98a)

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Space heating requirement - total per year (kWh/year)	3681.1297										
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000										
Space heating kWh	705.5605	557.1100	473.6583	287.2853	152.2647	0.0000	0.0000	0.0000	283.9052	504.1050	717.2407 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3681.1297										
Space heating per m2	(98c) / (4) = 33.0769 (99)										

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	705.5605	557.1100	473.6583	287.2853	152.2647	0.0000	0.0000	0.0000	0.0000	283.9052	504.1050	717.2407 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	282.3372	222.9332	189.5391	114.9601	60.9303	0.0000	0.0000	0.0000	0.0000	113.6075	201.7227	287.0111 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	180.7375	159.8850	169.7116	148.5687	143.6433	129.0008	126.8686	132.0620	133.7087	149.6413	159.8245	178.6537 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1473.0411 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1812.3058 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												236.7193 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3522.0661 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1473.0411	16.4900	242.9045 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1812.3058	16.4900	298.8492 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	236.7193	16.4900	39.0350 (250)
Additional standing charges			0.0000 (251)
Total energy cost			580.7887 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)	
Energy cost factor (ECF)	1.3378 (257)	
SAP value	78.3143	
SAP rating (Section 12)	78 (258)	
SAP band	C	

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12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1473.0411	0.1547	227.8654 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1812.3058	0.1410	255.4851 (264)
Space and water heating			483.3505 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Total CO2, kg/year			517.5164 (272)
CO2 emissions per m2			4.6500 (273)
EI value			95.5629
EI rating			96 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 60.0000 / (5) = 0.2298 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4798 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4078 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3671	0.3365	0.3263	0.3263	0.3365	0.2957	0.3161	0.2855	0.2855	0.3059	0.2855	0.3263 (22b)
Effective ac	0.5674	0.5566	0.5532	0.5532	0.5566	0.5437	0.5500	0.5408	0.5408	0.5468	0.5408	0.5532 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000 (28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800 (29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200 (29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300 (29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700 (30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700 (30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500 (30)
Total net area of external elements Aum(A, m2)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3071		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			45.0000			9.0000	405.0000 (32c)
Internal Floor 1			31.0300			18.0000	558.5400 (32d)
Internal Ceiling 1			30.1300			9.0000	271.1700 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9935.1300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.2724 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E16 Corner (normal)				24.0000	0.0900		2.1600
E10 Eaves (insulation at ceiling level)				41.4300	0.0600		2.4858
E17 Corner (inverted - internal area greater than external area)				14.4000	-0.0900		-1.2960

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R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1000	4.1430
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			14.1428 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	81.4499 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.8805	47.9535	47.6624	47.6624	47.9535	46.8429	47.3803	46.5876	46.5876	47.1071	46.5876	47.6624 (38)
Average = Sum(39)m / 12 =	130.3304	129.4034	129.1123	129.1123	129.4034	128.2927	128.8302	128.0375	128.0375	128.5570	128.0375	129.1123 (39)
												128.8555
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1711	1.1628	1.1601	1.1601	1.1628	1.1528	1.1576	1.1505	1.1505	1.1552	1.1505	1.1601 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.1578
												31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8224 (42)
Hot water usage for mixer showers	89.4267	88.0828	86.1245	82.3775	79.6124	76.5287	74.7760	76.7195	78.8500	82.1609	85.9883	89.0841	(42a)
Hot water usage for baths	30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839	(42b)
Hot water usage for other uses	43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337	(42c)
Average daily hot water use (litres/day)													150.6629 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017	(44)
Energy content (annual)	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476	(45)
Distribution loss (46)m = 0.15 x (45)m	38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771	(46)
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226	(64)
	Total per year (kWh/year) = Sum(64)m =												3173.3474 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	131.8626	117.1444	125.4432	112.2744	110.2660	100.8818	100.4997	103.5233	103.6229	113.7581	118.8277	130.6494	(65)

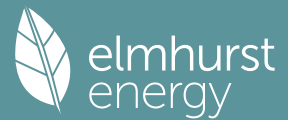
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.5101	29.7633	24.2052	18.3249	13.6981	11.5645	12.4958	16.2425	21.8007	27.6810	32.3078	34.4414	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.0545	412.2888	401.6184	378.9025	350.2277	323.2774	305.2729	301.0386	311.7090	334.4249	363.0998	390.0500	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	(71)
Water heating gains (Table 5)	177.2347	174.3220	168.6064	155.9367	148.2071	140.1137	135.0803	139.1443	143.9206	152.9007	165.0384	175.6040	(72)
Total internal gains	733.0027	730.5777	708.6335	667.3675	626.3363	586.1590	564.0525	567.6289	588.6338	629.2101	674.6495	714.2989	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.8300	13.0723	0.6300	0.7000	0.7700	11.3060 (74)
East	7.4600	24.4329	0.6300	0.7000	0.7700	55.7038 (76)
South	3.7400	54.9219	0.6300	0.7000	0.7700	62.7753 (78)

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West	9.6800	24.4329	0.6300	0.7000	0.7700	72.2806 (80)
West	0.5400	32.4879	0.6300	0.7000	1.0000	6.9630 (82)

Solar gains	209.0288	340.6553	522.7230	752.7663	880.2980	970.4539	907.5803	797.9094	636.4487	420.3171	257.4280	170.3152 (83)
Total gains	942.0315	1071.2330	1231.3565	1420.1338	1506.6343	1556.6130	1471.6328	1365.5383	1225.0825	1049.5272	932.0774	884.6141 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.1751	21.3268	21.3749	21.3749	21.3268	21.5114	21.4217	21.5543	21.5543	21.4672	21.5543	21.3749
alpha	2.4117	2.4218	2.4250	2.4250	2.4218	2.4341	2.4281	2.4370	2.4370	2.4311	2.4370	2.4250
util living area	0.9116	0.8845	0.8224	0.7175	0.5768	0.4084	0.3018	0.3133	0.5395	0.7496	0.8727	0.9208 (86)
MIT	18.6668	18.9369	19.5244	20.1414	20.6254	20.8882	20.9617	20.9601	20.7648	20.2257	19.3834	18.6087 (87)
Th 2	19.9432	19.9499	19.9520	19.9520	19.9499	19.9580	19.9541	19.9598	19.9598	19.9560	19.9598	19.9520 (88)
util rest of house	0.8998	0.8698	0.8000	0.6827	0.5244	0.3396	0.2190	0.2256	0.4694	0.7082	0.8534	0.9101 (89)
MIT 2	17.2652	17.6032	18.3281	19.0654	19.6120	19.8813	19.9371	19.9426	19.7770	19.1903	18.1750	17.1987 (90)
Living area fraction									fLA = Living area / (4) =			0.2649 (91)
MIT	17.6364	17.9565	18.6450	19.3504	19.8804	20.1480	20.2085	20.2122	20.0386	19.4646	18.4951	17.5722 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6364	17.9565	18.6450	19.3504	19.8804	20.1480	20.2085	20.2122	20.0386	19.4646	18.4951	17.5722 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8658	0.8344	0.7666	0.6604	0.5207	0.3526	0.2397	0.2475	0.4751	0.6859	0.8192	0.8773 (94)
Useful gains	815.5921	893.8339	943.9589	937.9171	784.5687	548.8098	352.7000	337.9683	582.0206	719.8451	763.5491	776.1120 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	1620.8462	1611.9094	1464.7807	1245.9849	916.2308	583.4764	361.8208	347.2585	657.9384	985.3380	1318.1560	1597.3988 (97)
Space heating kWh	599.1090	482.5467	387.4914	221.8088	97.9566	0.0000	0.0000	0.0000	0.0000	197.5267	399.3170	611.0374 (98a)
Space heating requirement - total per year (kWh/year)												2996.7935
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	599.1090	482.5467	387.4914	221.8088	97.9566	0.0000	0.0000	0.0000	0.0000	197.5267	399.3170	611.0374 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2996.7935
Space heating per m2										(98c) / (4) =		26.9278 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	599.1090	482.5467	387.4914	221.8088	97.9566	0.0000	0.0000	0.0000	0.0000	197.5267	399.3170	611.0374 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	239.7395	193.0959	155.0586	88.7590	39.1983	0.0000	0.0000	0.0000	0.0000	79.0423	159.7907	244.5128 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	180.7375	159.8850	169.7116	148.5687	143.6433	129.0008	126.8686	132.0620	133.7087	149.6413	159.8245	178.6537 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1199.1971 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1812.3058 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	236.7193 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3248.2221 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1199.1971	26.0600	312.5108 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1812.3058	26.0600	472.2869 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	236.7193	26.0600	61.6890 (250)
Additional standing charges			0.0000 (251)
Total energy cost			846.4867 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1199.1971	0.1554	186.2973 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1812.3058	0.1410	255.4851 (264)
Space and water heating			441.7824 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Total CO2, kg/year			475.9483 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1199.1971	1.5752	1888.9175 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1812.3058	1.5213	2757.0039 (278)
Space and water heating			4645.9214 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	236.7193	1.5338	363.0879 (282)
Total Primary energy kWh/year			5009.0093 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:	C 78
Current environmental impact rating:	A 96

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.0	-£ 102	-49 kg (10.3%)
U Solar photovoltaic panels	+ 5.6	-£ 254	-131 kg (30.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£102	0.44 kg/m²	C 80 A 96
Solar photovoltaic panels	£254	1.18 kg/m²	B 86 A 97
Total Savings	£357	1.62 kg/m²	

Potential energy efficiency rating:	B 86
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£846	£744	£102
Space heating	£313	£334	-£21
Water heating	£472	£349	£123
Lighting	£62	£62	£0
Generated (PV)	-£10	-£254	£254
Total cost of fuels	£846	£490	£356
Total cost of uses	£847	£491	£356
Delivered energy	29 kWh/m²	17 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	3 kg/m²	2 kg/m²

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Primary energy 45 kWh/m² 27 kWh/m² 18 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.2298 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4798 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4078 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5200	0.5098	0.4996	0.4486	0.4384	0.3875	0.3875	0.3773	0.4078	0.4384	0.4588	0.4792 (22b)
Effective ac	0.6352	0.6300	0.6248	0.6006	0.5961	0.5751	0.5751	0.5712	0.5832	0.5961	0.6053	0.6148 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000 (28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800 (29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200 (29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300 (29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700 (30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700 (30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500 (30)
Total net area of external elements Aum(A, m ²)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3071		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			45.0000			9.0000	405.0000 (32c)
Internal Floor 1			31.0300			18.0000	558.5400 (32d)
Internal Ceiling 1			30.1300			9.0000	271.1700 (32e)

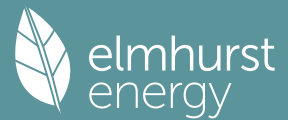
Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9935.1300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 89.2724 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.0000	0.0900	2.1600
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1000	4.1430
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.1428 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 81.4499 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.7248	54.2725	53.8292	51.7467	51.3571	49.5433	49.5433	49.2075	50.2420	51.3571	52.1453	52.9693	(38)
Heat transfer coeff	136.1747	135.7224	135.2790	133.1966	132.8070	130.9932	130.9932	130.6573	131.6918	132.8070	133.5952	134.4192	(39)
Average = Sum(39)m / 12 =												133.1947	
HLP	1.2236	1.2195	1.2156	1.1968	1.1933	1.1770	1.1770	1.1740	1.1833	1.1933	1.2004	1.2078	(40)
HLP (average)												1.1968	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8224	(42)
Hot water usage for mixer showers														
89.4267	88.0828	86.1245	82.3775	79.6124	76.5287	74.7760	76.7195	78.8500	82.1609	85.9883	89.0841		(42a)	
Hot water usage for baths														
30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839		(42b)	
Hot water usage for other uses														
43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337		(42c)	
Average daily hot water use (litres/day)													150.6629	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017		(44)
Energy content (annual)	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476		(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2502.5121		
38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771		(46)	
Water storage loss:														
Store volume													250.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103	(51)
Volume factor from Table 2a													0.7830	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													1.0875	(55)
Total storage loss														
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127		(56)	
If cylinder contains dedicated solar storage														
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127		(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624		(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(61)
Total heat required for water heating calculated for each month														
316.4714	279.9586	295.7692	253.3901	238.7251	213.2736	209.1201	219.1441	228.7211	260.6262	279.8527	312.8226		(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000		(63b)	
Aperture area of solar collector														
Zero-loss collector efficiency													3.0000	(H1)
Collector linear heat loss coefficient													0.8000	(H2)
Collector 2nd order heat loss coefficient													1.8000	(H3)
Collector loop efficiency													0.0000	(H4)
Incidence angle modifier													0.9000	(H5)
Overshading factor													1.0000	(H6)
Overall heat loss coefficient of system													0.8000	(H8)
Heat loss coefficient of collector loop													6.5000	(H10)
Dedicated solar storage volume													3.9667	(H11)
Effective solar volume													75.0000	(H12)
Reference volume													75.0000	(H14)
Storage tank correction coefficient													225.0000	(H15)
Heat delivered to hot water													1.3161	(H16)
Heat delivered to space heating													643.0091	(H24)
Solar input													0.0000	(H29)
Solar input	-0.0000	-16.1781	-59.3926	-82.5498	-109.1021	-100.7843	-100.1538	-86.8676	-59.1534	-28.8275	-0.0000		643.0091	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		-0.0000	(63c)
Output from w/h													0.0000	(63d)
316.4714	263.7805	236.3766	170.8403	129.6230	112.4893	108.9663	132.2765	169.5678	231.7987	279.8527	312.8226		(64)	
Electric shower(s)														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000	(64a)
Heat gains from water heating, kWh/month														
131.8626	117.1444	124.3266	106.8715	100.0306	90.7965	90.0782	93.8462	99.3006	112.6415	118.8277	130.6494		(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts														
(66)m	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411		(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5														
33.5101	29.7633	24.2052	18.3249	13.6981	11.5645	12.4958	16.2425	21.8007	27.6810	32.3078	34.4414		(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5														
408.0545	412.2888	401.6184	378.9025	350.2277	323.2774	305.2729	301.0386	311.7090	334.4249	363.0998	390.0500		(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5														
54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565		(69)	
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000		3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)														
-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941		-112.8941	(71)
Water heating gains (Table 5)														
177.2347	174.3220	167.1056	148.4327	134.4497	126.1062	121.0728	126.1373	137.9174	151.3999	165.0384	175.6040		(72)	
Total internal gains														
733.0027	730.5777	707.1327	659.8635	612.5789	572.1515	550.0450	554.6220	582.6306	627.7093	674.6495	714.2989		(73)	

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.8300	10.6334	0.6300	0.7000	0.7700	9.1967	(74)
East	7.4600	19.6403	0.6300	0.7000	0.7700	44.7773	(76)

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South	3.7400	46.7521	0.6300	0.7000	0.7700	53.4373 (78)
West	9.6800	19.6403	0.6300	0.7000	0.7700	58.1025 (80)
West	0.5400	25.9287	0.6300	0.7000	1.0000	5.5572 (82)

Solar gains	171.0709	317.4648	491.7254	685.9946	824.3481	839.2568	800.7245	696.7982	560.1973	367.4790	209.9388	142.9869 (83)
Total gains	904.0736	1048.0425	1198.8581	1345.8582	1436.9270	1411.4083	1350.7696	1251.4201	1142.8279	995.1883	884.5883	857.2858 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.2663	20.3338	20.4005	20.7194	20.7802	21.0679	21.0679	21.1221	20.9562	20.7802	20.6576	20.5310
alpha	2.3511	2.3556	2.3600	2.3813	2.3853	2.4045	2.4045	2.4081	2.3971	2.3853	2.3772	2.3687
util living area	0.9278	0.8993	0.8496	0.7647	0.6497	0.5110	0.3933	0.4338	0.6213	0.8092	0.9022	0.9350 (86)
MIT	18.2633	18.6270	19.1967	19.8785	20.4186	20.7728	20.9125	20.8870	20.6157	19.8899	18.9639	18.2065 (87)
Th 2	19.9012	19.9044	19.9076	19.9225	19.9253	19.9384	19.9384	19.9408	19.9334	19.9253	19.9197	19.9137 (88)
util rest of house	0.9183	0.8863	0.8301	0.7342	0.6035	0.4446	0.3089	0.3477	0.5574	0.7771	0.8874	0.9263 (89)
MIT 2	16.7343	17.1904	17.8990	18.7367	19.3681	19.7598	19.8885	19.8724	19.6076	18.7748	17.6307	16.6701 (90)
Living area fraction	17.1393	17.5710	18.2427	19.0391	19.6464	20.0282	20.1597	20.1412	19.8746	19.0702	17.9839	0.2649 (91)
MIT	17.1393	17.5710	18.2427	19.0391	19.6464	20.0282	20.1597	20.1412	19.8746	19.0702	17.9839	17.0771 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1393	17.5710	18.2427	19.0391	19.6464	20.0282	20.1597	20.1412	19.8746	19.0702	17.9839	17.0771 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8849	0.8499	0.7936	0.7055	0.5904	0.4506	0.3272	0.3648	0.5535	0.7464	0.8522	0.8946 (94)
Useful gains	800.0597	890.7008	951.3684	949.4572	848.2949	635.9104	441.9857	456.5330	632.5780	742.8367	753.8858	766.8982 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1748.3938	1719.7335	1588.5454	1350.4969	1055.3387	711.0512	466.2995	488.8095	760.4704	1124.8965	1454.0316	1730.9314 (97)
Space heating kWh	705.5605	557.1100	474.0596	288.7486	154.0406	0.0000	0.0000	0.0000	0.0000	284.2525	504.1050	717.2407 (98a)
Space heating requirement - total per year (kWh/year)												3685.1176
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	705.5605	557.1100	474.0596	288.7486	154.0406	0.0000	0.0000	0.0000	0.0000	284.2525	504.1050	717.2407 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3685.1176
Space heating per m2										(98c) / (4) =		33.1127 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	705.5605	557.1100	474.0596	288.7486	154.0406	0.0000	0.0000	0.0000	0.0000	284.2525	504.1050	717.2407 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	282.3372	222.9332	189.6997	115.5457	61.6409	0.0000	0.0000	0.0000	0.0000	113.7465	201.7227	287.0111 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	316.4714	263.7805	236.3766	170.8403	129.6230	112.4893	108.9663	132.2765	169.5678	231.7987	279.8527	312.8226 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	180.7375	150.6457	134.9952	97.5673	74.0280	64.2429	62.2309	75.5434	96.8405	132.3807	159.8245	178.6537 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.1642	-59.0447	-89.3686	-103.4671	-111.0655	-98.4666	-96.9938	-91.2117	-80.2976	-68.3338	-44.1550	-33.4356 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1474.6369 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1407.6904 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	80.0000 (231)
Electricity for lighting (calculated in Appendix L)	236.7193 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-915.0041 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2284.0424 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1474.6369	16.4900	243.1676 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1407.6904	16.4900	232.1282 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	236.7193	16.4900	39.0350 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-915.0041	16.4900	-150.8842
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-150.8842 (252)
Total energy cost			376.6386 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8676 (257)
SAP value		85.9370
SAP rating (Section 12)		86 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1474.6369	0.1547	228.0864 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1407.6904	0.1450	204.0916 (264)
Space and water heating			432.1780 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-915.0041	0.1344	-122.9659
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-122.9659 (269)
Total CO2, kg/year			354.4751 (272)
CO2 emissions per m2			3.1900 (273)
EI value			96.9608
EI rating			97 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.0700 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)

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Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6f)
6 * 10 = 60.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
60.0000 / (5) = 0.2298 (8)
Yes
Blower Door
5.0000 (17)
0.4798 (18)
2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.4078 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate													
Effective ac	0.3671	0.3365	0.3263	0.3263	0.3365	0.2957	0.3161	0.2855	0.2855	0.3059	0.2855	0.3263	(22b)
	0.5674	0.5566	0.5532	0.5532	0.5566	0.5437	0.5500	0.5408	0.5408	0.5468	0.5408	0.5532	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000 (28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800 (29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200 (29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300 (29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700 (30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700 (30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500 (30)
Total net area of external elements Aum(A, m2)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3071		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			45.0000			9.0000	405.0000 (32c)
Internal Floor 1			31.0300			18.0000	558.5400 (32d)
Internal Ceiling 1			30.1300			9.0000	271.1700 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 9935.1300 (34)
89.2724 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.0000	0.0900	2.1600
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1000	4.1430
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 81.4499 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

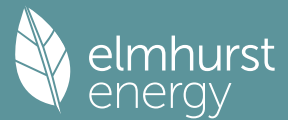
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	48.8805	47.9535	47.6624	47.6624	47.9535	46.8429	47.3803	46.5876	46.5876	47.1071	46.5876	47.6624	(38)
Heat transfer coeff													
	130.3304	129.4034	129.1123	129.1123	129.4034	128.2927	128.8302	128.0375	128.0375	128.5570	128.0375	129.1123	(39)
Average = Sum(39)m / 12 =												128.8555	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.1711	1.1628	1.1601	1.1601	1.1628	1.1528	1.1576	1.1505	1.1505	1.1552	1.1505	1.1601	(40)
HLP (average)												1.1578	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8224 (42)
Hot water usage for mixer showers													
	89.4267	88.0828	86.1245	82.3775	79.6124	76.5287	74.7760	76.7195	78.8500	82.1609	85.9883	89.0841	(42a)
Hot water usage for baths													
	30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839	(42b)
Hot water usage for other uses													
	43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337	(42c)
Average daily hot water use (litres/day)													150.6629 (43)
Daily hot water use													
	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017	(44)
Energy conte	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476	(45)
Energy content (annual)										Total = Sum(45)m =		2502.5121	
Distribution loss (46)m = 0.15 x (45)m													
	38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771	(46)
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)

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Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	316.4714	279.9586	295.7692	253.3901	238.7251	213.2736	209.1201	219.1441	228.7211	260.6262	279.8527	312.8226 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												763.4754 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												763.4754
Solar input	-1.7811	-20.9077	-66.3852	-94.2285	-118.9341	-119.7484	-116.3206	-103.9739	-72.7236	-40.8984	-7.5739	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	314.6904	259.0509	229.3840	159.1616	119.7910	93.5253	92.7994	115.1702	155.9976	219.7278	272.2788	312.8226 (64)
												Total per year (kWh/year) = Sum(64)m = 2344.3996 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	131.8626	117.1444	124.3266	106.8715	100.0306	90.7965	90.0782	93.8462	99.3006	112.6415	118.8277	130.6494 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.5101	29.7633	24.2052	18.3249	13.6981	11.5645	12.4958	16.2425	21.8007	27.6810	32.3078	34.4414	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.0545	412.2888	401.6184	378.9025	350.2277	323.2774	305.2729	301.0386	311.7090	334.4249	363.0998	390.0500	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	(71)
Water heating gains (Table 5)	177.2347	174.3220	167.1056	148.4327	134.4497	126.1062	121.0728	126.1373	137.9174	151.3999	165.0384	175.6040	(72)
Total internal gains	733.0027	730.5777	707.1327	659.8635	612.5789	572.1515	550.0450	554.6220	582.6306	627.7093	674.6495	714.2989	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
North					2.8300	13.0723		0.6300		0.7000	0.7700	11.3060 (74)	
East					7.4600	24.4329		0.6300		0.7000	0.7700	55.7038 (76)	
South					3.7400	54.9219		0.6300		0.7000	0.7700	62.7753 (78)	
West					9.6800	24.4329		0.6300		0.7000	0.7700	72.2806 (80)	
West					0.5400	32.4879		0.6300		0.7000	1.0000	6.9630 (82)	
Solar gains	209.0288	340.6553	522.7230	752.7663	880.2980	970.4539	907.5803	797.9094	636.4487	420.3171	257.4280	170.3152	(83)
Total gains	942.0315	1071.2330	1229.8557	1412.6298	1492.8769	1542.6055	1457.6253	1352.5313	1219.0793	1048.0264	932.0774	884.6141	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.1751	21.3268	21.3749	21.3749	21.3268	21.5114	21.4217	21.5543	21.5543	21.4672	21.5543	21.3749	
alpha	2.4117	2.4218	2.4250	2.4250	2.4218	2.4341	2.4281	2.4370	2.4370	2.4311	2.4370	2.4250	
util living area	0.9116	0.8845	0.8227	0.7194	0.5803	0.4114	0.3045	0.3160	0.5414	0.7500	0.8727	0.9208	(86)
MIT	18.6668	18.9369	19.5227	20.1360	20.6202	20.8863	20.9609	20.9593	20.7630	20.2245	19.3834	18.6087	(87)
Th 2	19.9432	19.9499	19.9520	19.9520	19.9499	19.9580	19.9541	19.9598	19.9598	19.9560	19.9598	19.9520	(88)
util rest of house	0.8998	0.8698	0.8003	0.6847	0.5279	0.3423	0.2210	0.2277	0.4712	0.7087	0.8534	0.9101	(89)
MIT 2	17.2652	17.6032	18.3262	19.0594	19.6069	19.8799	19.9368	19.9423	19.7754	19.1890	18.1750	17.1987	(90)
Living area fraction									fLA = Living area / (4) =			0.2649	(91)
MIT	17.6364	17.9565	18.6432	19.3446	19.8753	20.1465	20.2081	20.2117	20.0370	19.4633	18.4951	17.5722	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6364	17.9565	18.6432	19.3446	19.8753	20.1465	20.2081	20.2117	20.0370	19.4633	18.4951	17.5722	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	815.5921	893.8339	943.2233	935.4261	782.1779	548.0319	352.4580	337.7223	581.2265	719.2966	763.5491	776.1120	(95)

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Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	1620.8462	1611.9094	1464.5442	1245.2303	915.5696	583.2817	361.7617	347.1983	657.7270	985.1701	1318.1560	1597.3988 (97)
Space heating kWh	599.1090	482.5467	387.8628	223.0590	99.2435	0.0000	0.0000	0.0000	0.0000	197.8099	399.3170	611.0374 (98a)
Space heating requirement - total per year (kWh/year)												2999.9852
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	599.1090	482.5467	387.8628	223.0590	99.2435	0.0000	0.0000	0.0000	0.0000	197.8099	399.3170	611.0374 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2999.9852
Space heating per m2										(98c) / (4) =		26.9565 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	599.1090	482.5467	387.8628	223.0590	99.2435	0.0000	0.0000	0.0000	0.0000	197.8099	399.3170	611.0374 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	239.7395	193.0959	155.2072	89.2593	39.7133	0.0000	0.0000	0.0000	0.0000	79.1556	159.7907	244.5128 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	314.6904	259.0509	229.3840	159.1616	119.7910	93.5253	92.7994	115.1702	155.9976	219.7278	272.2788	312.8226 (64)
Efficiency of water heater												175.1000 (216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (217)
Fuel for water heating, kWh/month	179.7204	147.9445	131.0017	90.8975	68.4129	53.4125	52.9980	65.7740	89.0906	125.4870	155.4990	178.6537 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-46.1881	-61.9214	-92.1243	-107.7484	-112.4825	-104.8607	-102.4154	-97.4168	-86.4432	-74.1418	-51.7106	-38.6802 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1200.4743 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1338.8918 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												236.7193 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-976.1332 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												1879.9521 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1200.4743	26.0600	312.8436 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1338.8918	26.0600	348.9152 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	236.7193	26.0600	61.6890 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-976.1332	26.0600	-254.3803
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-254.3803 (252)
Total energy cost			489.9155 (255)

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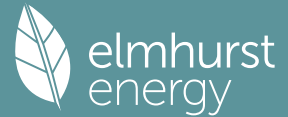
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1200.4743	0.1553	186.4750 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1338.8918	0.1458	195.2328 (264)
Space and water heating			381.7078 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-976.1332	0.1346	-131.3914
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-131.3914 (269)
Total CO2, kg/year			295.5793 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1200.4743	1.5751	1890.8521 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1338.8918	1.5394	2061.0875 (278)
Space and water heating			3951.9397 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	236.7193	1.5338	363.0879 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-976.1332	1.4975	-1461.7348
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1461.7348 (283)
Total Primary energy kWh/year			2974.3167 (286)

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Property Reference	FURNERS LANE 26				Issued on Date	12/09/2024
Assessment Reference	PLANNING	Prop Type Ref				
Property	Plot 26, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	78 C	DER	4.78	TER	9.54	
Environmental	96 A	% DER < TER				49.90
CO ₂ Emissions (t/year)	0.48	DFEE	41.67	TFEE	42.42	
Compliance Check	See BREL	% DFEE < TFEE				1.78
% DPER < TPER	0.17	DPER	50.22	TPER	50.31	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

2. Ventilation rate

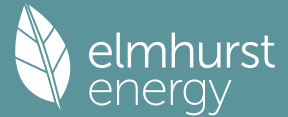
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.2298 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4798 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4078 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5200	0.5098	0.4996	0.4486	0.4384	0.3875	0.3875	0.3773	0.4078	0.4384	0.4588	0.4792 (22b)
Effective ac	0.6352	0.6300	0.6248	0.6006	0.5961	0.5751	0.5751	0.5712	0.5832	0.5961	0.6053	0.6148 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000 (28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800 (29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200 (29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300 (29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700 (30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700 (30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500 (30)
Total net area of external elements Aum(A, m ²)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3071		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			45.0000			9.0000	405.0000 (32c)
Internal Floor 1			31.0300			18.0000	558.5400 (32d)
Internal Ceiling 1			30.1300			9.0000	271.1700 (32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			9935.1300 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.2724 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.0000	0.0900	2.1600
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1500	6.2145
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.2143 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	83.5214 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	54.7248	54.2725	53.8292	51.7467	51.3571	49.5433	49.5433	49.2075	50.2420	51.3571	52.1453	52.9693 (38)
Heat transfer coeff	138.2462	137.7939	137.3505	135.2681	134.8785	133.0647	133.0647	132.7288	133.7633	134.8785	135.6667	136.4907 (39)
Average = Sum(39)m / 12 =												135.2662
HLP	1.2422	1.2382	1.2342	1.2155	1.2120	1.1957	1.1957	1.1926	1.2019	1.2120	1.2190	1.2264 (40)
HLP (average)												1.2154
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

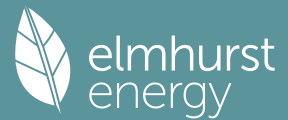
Assumed occupancy												2.8224 (42)
Hot water usage for mixer showers	89.4267	88.0828	86.1245	82.3775	79.6124	76.5287	74.7760	76.7195	78.8500	82.1609	85.9883	89.0841 (42a)
Hot water usage for baths	30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839 (42b)
Hot water usage for other uses	43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337 (42c)
Average daily hot water use (litres/day)												150.6629 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017 (44)
Energy conte	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476 (45)
Energy content (annual)										Total = Sum(45)m =		2502.5121
Distribution loss (46)m = 0.15 x (45)m	38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3173.3474 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	131.8626	117.1444	125.4432	112.2744	110.2660	100.8818	100.4997	103.5233	103.6229	113.7581	118.8277	130.6494 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	137.9683	152.7507	137.9683	142.5673	137.9683	142.5673	137.9683	137.9683	142.5673	137.9683	142.5673	137.9683 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.3965	276.2335	269.0844	253.8647	234.6525	216.5958	204.5329	201.6959	208.8450	224.0647	243.2768	261.3335 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941 (71)
Water heating gains (Table 5)	177.2347	174.3220	168.6064	155.9367	148.2071	140.1137	135.0803	139.1443	143.9206	152.9007	165.0384	175.6040 (72)
Total internal gains	656.9348	671.6415	643.9944	620.7039	589.1632	564.6121	542.9167	544.1437	560.6682	583.2690	619.2178	643.2411 (73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
North	3.7400				10.6334	0.6300		0.7000		0.7700	12.1539	(74)
East	7.4600				19.6403	0.6300		0.7000		0.7700	44.7773	(76)
South	2.8300				46.7521	0.6300		0.7000		0.7700	40.4351	(78)
West	9.6800				19.6403	0.6300		0.7000		0.7700	58.1025	(80)
West	0.5400				25.9287	0.6300		0.7000		1.0000	5.5572	(82)
Solar gains	161.0260	301.8221	474.2036	670.7627	813.1806	830.7572	791.4537	684.1030	543.4081	351.2386	198.1750	134.2172 (83)
Total gains	817.9608	973.4636	1118.1980	1291.4666	1402.3438	1395.3692	1334.3704	1228.2468	1104.0763	934.5076	817.3928	777.4583 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	19.9626	20.0282	20.0928	20.4021	20.4611	20.7400	20.7400	20.7925	20.6316	20.4611	20.3422	20.2194
alpha	2.3308	2.3352	2.3395	2.3601	2.3641	2.3827	2.3827	2.3862	2.3754	2.3641	2.3561	2.3480
util living area	0.9406	0.9124	0.8670	0.7803	0.6627	0.5200	0.4019	0.4451	0.6385	0.8285	0.9159	0.9464 (86)
MIT	18.0845	18.4767	19.0585	19.7971	20.3775	20.7572	20.9053	20.8767	20.5811	19.7965	18.8282	18.0337 (87)
Th 2	19.8864	19.8896	19.8928	19.9077	19.9104	19.9235	19.9235	19.9259	19.9185	19.9104	19.9048	19.8989 (88)
util rest of house	0.9324	0.9007	0.8490	0.7506	0.6163	0.4524	0.3151	0.3565	0.5741	0.7980	0.9026	0.9390 (89)
MIT 2	16.5031	16.9963	17.7230	18.6325	19.3130	19.7328	19.8696	19.8514	19.5622	18.6573	17.4555	16.4459 (90)
Living area fraction	16.9220	17.3884	18.0768	18.9410	19.5950	20.0042	20.1439	20.1230	fLA = Living area / (4) =	18.9591	17.8191	0.2649 (91)
MIT	16.9220	17.3884	18.0768	18.9410	19.5950	20.0042	20.1439	20.1230	19.8321	18.9591	17.8191	16.8665 (92)
Temperature adjustment												0.0000
adjusted MIT	16.9220	17.3884	18.0768	18.9410	19.5950	20.0042	20.1439	20.1230	19.8321	18.9591	17.8191	16.8665 (93)
8. Space heating requirement												
Utilisation	0.9012	0.8650	0.8116	0.7199	0.6015	0.4578	0.3336	0.3736	0.5684	0.7655	0.8683	0.9095 (94)
Useful gains	737.1714	842.0331	907.5841	929.7046	843.5220	638.7503	445.2126	458.8991	627.5652	715.3249	709.7058	707.0974 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1744.9388	1720.8305	1590.0779	1358.2241	1064.8639	719.1072	471.5718	494.1470	766.7463	1127.4596	1454.2299	1728.8600 (97)
Space heating kWh	749.7789	590.5519	507.7754	308.5340	164.6784	0.0000	0.0000	0.0000	0.0000	306.6282	536.0574	760.1914 (98a)
Space heating requirement - total per year (kWh/year)												3924.1956
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	749.7789	590.5519	507.7754	308.5340	164.6784	0.0000	0.0000	0.0000	0.0000	306.6282	536.0574	760.1914 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3924.1956
Space heating per m2										(98c) / (4) =		35.2610 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	749.7789	590.5519	507.7754	308.5340	164.6784	0.0000	0.0000	0.0000	0.0000	306.6282	536.0574	760.1914 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	300.0316	236.3153	203.1914	123.4630	65.8977	0.0000	0.0000	0.0000	0.0000	122.7004	214.5088	304.1982 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	180.7375	159.8850	169.7116	148.5687	143.6433	129.0008	126.8686	132.0620	133.7087	149.6413	159.8245	178.6537 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

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Annual totals kWh/year		
Space heating fuel - main system 1	1570.3064	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	175.1000	
Water heating fuel used	1812.3058	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	236.7193	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3619.3314	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1570.3064	0.1546	242.8200 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1812.3058	0.1410	255.4851 (264)
Space and water heating			498.3051 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Total CO2, kg/year			532.4710 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.7800 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1570.3064	1.5725	2469.2733 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1812.3058	1.5213	2757.0039 (278)
Space and water heating			5226.2771 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	236.7193	1.5338	363.0879 (282)
Total Primary energy kWh/year			5589.3651 (286)
Dwelling Primary energy Rate (DPER)			50.2200 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

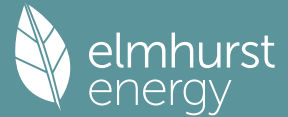
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.0700 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1532 (8)
Pressure Test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4032 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3427 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												

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Effective ac	0.4370	0.4284	0.4198	0.3770	0.3684	0.3256	0.3256	0.3170	0.3427	0.3684	0.3856	0.4027 (22b)
	0.5955	0.5918	0.5881	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.0200	1.0000	2.0200		(26)
TER Opening Type (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Rooflight W			0.5400	1.4151	0.7642		(27a)
Ground Floor			81.1600	0.1300	10.5508		(28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476		(29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284		(29a)
Ashlar	27.0700		27.0700	0.1800	4.8726		(29a)
Joists GF	51.0300		51.0300	0.1100	5.6133		(30)
Joists FF	20.0000		20.0000	0.1100	2.2000		(30)
Rafters	13.1700	0.5400	12.6300	0.1100	1.3893		(30)
D Flat	1.4500		1.4500	0.1100	0.1595		(30)
Total net area of external elements Aum(A, m2)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.7945		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.2724 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.0000	0.0900	2.1600
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1600	6.6288
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0800	0.0440
R2 Sill of roof window	0.5500	0.0600	0.0330
R3 Jamb of roof window	1.9600	0.0800	0.1568

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.6678 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 85.4623 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	51.3023	50.9829	50.6698	49.1992	48.9241	47.6432	47.6432	47.4060	48.1366	48.9241	49.4807	50.0626 (38)
Heat transfer coeff	136.7646	136.4452	136.1321	134.6615	134.3864	133.1055	133.1055	132.8683	133.5989	134.3864	134.9430	135.5249 (39)
Average = Sum(39)m / 12 =												134.6602

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2289	1.2260	1.2232	1.2100	1.2075	1.1960	1.1960	1.1939	1.2005	1.2075	1.2125	1.2178 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8224 (42)
Hot water usage for mixer showers												
71.5414	70.4662	68.8996	65.9020	63.6899	61.2230	59.8208	61.3756	63.0800	65.7287	68.7906	71.2673 (42a)	
Hot water usage for baths												
30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839 (42b)	
Hot water usage for other uses												
43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337 (42c)	
Average daily hot water use (litres/day)												134.1732 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	145.9634	142.8465	139.0508	133.2791	128.5921	123.5531	121.6168	125.3961	129.3820	134.6719	140.5325	145.5849 (44)
Energy conte	231.1704	203.4115	213.7159	182.4524	173.1096	151.9230	147.0849	155.2666	159.5409	182.7486	200.2144	227.9507 (45)
Energy content (annual)										Total = Sum(45)m =		2228.5890
Distribution loss (46)m = 0.15 x (45)m	34.6756	30.5117	32.0574	27.3679	25.9664	22.7885	22.0627	23.2900	23.9311	27.4123	30.0322	34.1926 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)

If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	286.0772	253.0048	268.6227	235.5880	228.0164	205.0586	201.9917	210.1734	212.6765	237.6554	253.3500	282.8575 (62)
WWHRS	-32.7057	-28.9252	-30.2888	-25.0803	-23.3740	-20.0013	-18.7480	-19.9366	-20.6941	-24.3960	-27.6378	-32.1001 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	253.3714	224.0795	238.3339	210.5077	204.6425	185.0573	183.2437	190.2367	191.9824	213.2593	225.7122	250.7575 (64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				2571.1842 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =												0.0000 (64a)

Heat gains from water heating, kWh/month	120.7896	107.3089	114.9860	103.1739	101.4844	93.0229	92.8312	95.5516	95.5558	104.6893	109.0798	119.7191 (65)

5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	137.9683	152.7507	137.9683	142.5673	137.9683	142.5673	137.9683	137.9683	142.5673	137.9683	142.5673	137.9683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.3965	276.2335	269.0844	253.8647	234.6525	216.5958	204.5329	201.6959	208.8450	224.0647	243.2768	261.3335	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	(71)
Water heating gains (Table 5)	162.3516	159.6859	154.5510	143.2971	136.4037	129.1984	124.7731	128.4295	132.7164	140.7115	151.4997	160.9127	(72)
Total internal gains	642.0517	657.0053	629.9390	608.0643	577.3599	553.6968	532.6096	533.4290	549.4640	571.0798	605.6791	628.5498	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North					3.7400	10.6334	0.6300	0.7000	0.7700		12.1539 (74)		
East					7.4600	19.6403	0.6300	0.7000	0.7700		44.7773 (76)		
South					2.8300	46.7521	0.6300	0.7000	0.7700		40.4351 (78)		
West					9.6800	19.6403	0.6300	0.7000	0.7700		58.1025 (80)		
West					0.5400	25.9287	0.6300	0.7000	1.0000		5.5572 (82)		
Solar gains	161.0260	301.8221	474.2036	670.7627	813.1806	830.7572	791.4537	684.1030	543.4081	351.2386	198.1750	134.2172	(83)
Total gains	803.0777	958.8275	1104.1426	1278.8270	1390.5405	1384.4540	1324.0633	1217.5320	1092.8721	922.3183	803.8540	762.7670	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	20.1789	20.2261	20.2727	20.4940	20.5360	20.7336	20.7336	20.7706	20.6570	20.5360	20.4513	20.3635		
alpha	2.3453	2.3484	2.3515	2.3663	2.3691	2.3822	2.3822	2.3847	2.3771	2.3691	2.3634	2.3576		
util living area	0.9424	0.9142	0.8689	0.7825	0.6648	0.5230	0.4046	0.4485	0.6420	0.8314	0.9181	0.9482	(86)	
MIT	18.0936	18.4849	19.0652	19.7953	20.3761	20.7539	20.9038	20.8744	20.5766	19.7902	18.8220	18.0315	(87)	
Th 2	19.8969	19.8992	19.9015	19.9120	19.9140	19.9232	19.9232	19.9249	19.9196	19.9140	19.9100	19.9058	(88)	
util rest of house	0.9344	0.9027	0.8511	0.7530	0.6186	0.4553	0.3173	0.3594	0.5777	0.8013	0.9052	0.9410	(89)	
MIT 2	16.5203	17.0122	17.7368	18.6336	19.3145	19.7298	19.8684	19.8489	19.5590	18.6525	17.4511	16.4468	(90)	
Living area fraction									fLA = Living area / (4) =			0.2649	(91)	
MIT	16.9371	17.4023	18.0887	18.9413	19.5957	20.0011	20.1427	20.1205	19.8286	18.9539	17.8142	16.8666	(92)	
Temperature adjustment												0.0000		
adjusted MIT	16.9371	17.4023	18.0887	18.9413	19.5957	20.0011	20.1427	20.1205	19.8286	18.9539	17.8142	16.8666	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9039	0.8676	0.8141	0.7223	0.6037	0.4605	0.3359	0.3765	0.5717	0.7687	0.8712	0.9121	(94)	
Useful gains	725.8924	831.8494	898.8844	923.6679	839.4918	637.4976	444.7834	458.4189	624.7857	708.9898	700.3452	695.7554	(95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Heat loss rate W	1728.3037	1705.8780	1577.5927	1352.1795	1061.0719	718.9116	471.5501	494.3397	765.3302	1122.6474	1445.8088	1716.6373	(97)	
Space heating kWh	745.7940	587.3472	504.9590	308.5284	164.8556	0.0000	0.0000	0.0000	0.0000	307.7612	536.7338	759.5362	(98a)	
Space heating requirement - total per year (kWh/year)												3915.5153		
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)	
Solar heating contribution - total per year (kWh/year)												0.0000		
Space heating kWh	745.7940	587.3472	504.9590	308.5284	164.8556	0.0000	0.0000	0.0000	0.0000	307.7612	536.7338	759.5362	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												3915.5153		
Space heating per m2										(98c) / (4) =		35.1830	(99)	

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													92.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	745.7940	587.3472	504.9590	308.5284	164.8556	0.0000	0.0000	0.0000	0.0000	307.7612	536.7338	759.5362	(98)	
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)	
Space heating fuel (main heating system)	808.0108	636.3458	547.0845	334.2669	178.6084	0.0000	0.0000	0.0000	0.0000	333.4358	581.5101	822.8994	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	253.3714	224.0795	238.3339	210.5077	204.6425	185.0573	183.2437	190.2367	191.9824	213.2593	225.7122	250.7575	(64)	
Efficiency of water heater												79.8000	(216)	

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(217)m	86.3310	86.1178	85.7008	84.9158	83.5794	79.8000	79.8000	79.8000	79.8000	84.8816	85.9310	86.3819	(217)
Fuel for water heating, kWh/month	293.4885	260.2011	278.1000	247.9016	244.8480	231.9014	229.6287	238.3919	240.5795	251.2432	262.6669	290.2893	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	28.6671	22.9978	20.7070	15.1708	11.7184	9.5740	10.6899	13.8951	18.0484	23.6805	26.7470	29.4638	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-66.2250	-88.8236	-121.5277	-129.8283	-134.4741	-123.5238	-121.8757	-117.5957	-109.4642	-98.0916	-71.1184	-57.7932	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-52.6092	-108.4800	-211.7469	-312.6585	-408.4331	-408.6693	-403.9509	-344.3492	-255.4786	-153.3969	-69.6420	-41.7803	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4242.1618	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3069.2400	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												231.3599	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4011.5363	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3617.2254	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4242.1618	0.2100	890.8540 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)			644.5404 (264)
Space and water heating			1535.3944 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	231.3599	0.1443	33.3924 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1240.3412	0.1357	-168.2922
PV Unit electricity exported	-2771.1952	0.1264	-350.2815
Total			-518.5738 (269)
Total CO2, kg/year			1062.1423 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5400 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4242.1618	1.1300	4793.6428 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)			3468.2413 (278)
Space and water heating			8261.8841 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	231.3599	1.5338	354.8675 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1240.3412	1.5015	-1862.3954
PV Unit electricity exported	-2771.1952	0.4640	-1285.8356
Total			-3148.2310 (283)
Total Primary energy kWh/year			5598.6214 (286)
Target Primary Energy Rate (TPER)			50.3100 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

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2. Ventilation rate

											m3 per hour			
Number of open chimneys												0 * 80 =	0.0000 (6a)	
Number of open flues												0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)	
Number of blocked chimneys												0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)	
Number of passive vents												0 * 10 =	0.0000 (7b)	
Number of flueless gas fires												0 * 40 =	0.0000 (7c)	
													Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1532 (8)	
Pressure test												Yes		
Pressure Test Method												Blower Door		
Measured/design AP50												5.0000 (17)		
Infiltration rate												0.4032 (18)		
Number of sides sheltered												2 (19)		
													(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Shelter factor												(21) = (18) x (20) =	0.3427 (21)	
Infiltration rate adjusted to include shelter factor														
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)		
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)		
	0.4370	0.4284	0.4198	0.3770	0.3684	0.3256	0.3256	0.3170	0.3427	0.3684	0.3856	0.4027 (22b)		
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)		
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)		
Effective ac	0.5955	0.5918	0.5881	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811 (25)		

3. Heat losses and heat loss parameter

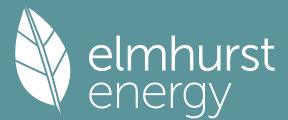
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			23.7100	1.1450	27.1489			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight W			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000	(28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800	(29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200	(29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300	(29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700	(30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000	(30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700	(30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500	(30)
Total net area of external elements Aum(A, m2)			297.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3071			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			45.0000			9.0000	405.0000	(32c)
Internal Floor 1			31.0300			18.0000	558.5400	(32d)
Internal Ceiling 1			30.1300			9.0000	271.1700	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9935.1300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.2724	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E16 Corner (normal)				24.0000	0.0900		2.1600	
E10 Eaves (insulation at ceiling level)				41.4300	0.0600		2.4858	
E17 Corner (inverted - internal area greater than external area)				14.4000	-0.0900		-1.2960	
R8 Roof to wall (rafter)				22.5600	0.0600		1.3536	
R6 Flat ceiling				22.5300	0.0600		1.3518	
E13 Gable (insulation at rafter level)				2.6000	0.0800		0.2080	
E2 Other lintels (including other steel lintels)				16.7200	0.0500		0.8360	
E3 Sill				15.7600	0.0500		0.7880	
E4 Jamb				38.3600	0.0500		1.9180	
E5 Ground floor (normal)				41.4300	0.1500		6.2145	
E6 Intermediate floor within a dwelling				26.9200	0.0000		0.0000	
R1 Head of roof window				0.5500	0.0600		0.0330	
R2 Sill of roof window				0.5500	0.0800		0.0440	
R3 Jamb of roof window				1.9600	0.0600		0.1176	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.2143	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss						(33) + (36) + (36a) =	83.5214	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.3023	50.9829	50.6698	49.1992	48.9241	47.6432	47.6432	47.4060	48.1366	48.9241	49.4807	50.0626 (38)
Average = Sum(39)m / 12 =	134.8236	134.5042	134.1911	132.7206	132.4454	131.1646	131.1646	130.9274	131.6580	132.4454	133.0020	133.5839 (39)
												132.7192
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2115	1.2086	1.2058	1.1926	1.1901	1.1786	1.1786	1.1765	1.1830	1.1901	1.1951	1.2003 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8224 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	30.8883
Hot water usage for other uses	30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839 (42b)
Average daily hot water use (litres/day)	43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337 (42c)
												68.2145 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.4220	72.3803	70.1512	67.3771	64.9022	62.3302	61.7960	64.0205	66.3020	68.9433	71.7419	74.3176	(44)
Energy content (annual)	117.8663	103.0685	107.8198	92.2359	87.3708	76.6422	74.7369	79.2708	81.7570	93.5553	102.2095	116.3634	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	100.1864	87.6083	91.6469	78.4005	74.2652	65.1459	63.5264	67.3801	69.4934	79.5220	86.8781	98.9089	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	100.1864	87.6083	91.6469	78.4005	74.2652	65.1459	63.5264	67.3801	69.4934	79.5220	86.8781	98.9089	(64)
12Total per year (kWh/year)													
Electric shower(s)	57.2927	51.0483	55.7428	53.1946	54.1928	51.6947	53.4178	54.1928	53.1946	55.7428	54.6946	57.2927	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												963	(64)
Heat gains from water heating, kWh/month	39.3698	34.6641	36.8474	32.8988	32.1145	29.2101	29.2360	30.3932	30.6720	33.8162	35.3932	39.0504	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	141.1176	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	137.9683	152.7507	137.9683	142.5673	137.9683	142.5673	137.9683	137.9683	142.5673	137.9683	142.5673	137.9683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.3965	276.2335	269.0844	253.8647	234.6525	216.5958	204.5329	201.6959	208.8450	224.0647	243.2768	261.3335	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	37.1118	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	(71)
Water heating gains (Table 5)	52.9164	51.5835	49.5261	45.6927	43.1646	40.5696	39.2958	40.8511	42.6000	45.4519	49.1572	52.4871	(72)
Total internal gains	529.6165	545.9030	521.9140	507.4600	481.1208	465.0680	447.1322	445.8506	459.3476	472.8202	500.3366	517.1242	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				3.7400	10.6334		0.6300		0.7000		0.7700		12.1539 (74)
East				7.4600	19.6403		0.6300		0.7000		0.7700		44.7773 (76)
South				2.8300	46.7521		0.6300		0.7000		0.7700		40.4351 (78)
West				9.6800	19.6403		0.6300		0.7000		0.7700		58.1025 (80)
West				0.5400	25.9287		0.6300		0.7000		1.0000		5.5572 (82)
Solar gains	161.0260	301.8221	474.2036	670.7627	813.1806	830.7572	791.4537	684.1030	543.4081	351.2386	198.1750	134.2172	(83)
Total gains	690.6425	847.7251	996.1176	1178.2226	1294.3013	1295.8252	1238.5859	1129.9536	1002.7557	824.0588	698.5115	651.3414	(84)

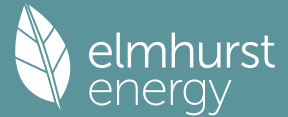
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
tau	20.4694	20.5180	20.5659	20.7938	20.8369	21.0404	21.0404	21.0785	20.9616	20.8369	20.7497	20.6594		
alpha	2.3646	2.3679	2.3711	2.3863	2.3891	2.4027	2.4027	2.4052	2.3974	2.3891	2.3833	2.3773		
util living area	0.9568	0.9310	0.8886	0.8042	0.6873	0.5436	0.4230	0.4709	0.6701	0.8572	0.9365	0.9619	(86)	
MIT	17.9535	18.3615	18.9645	19.7304	20.3395	20.7384	20.8970	20.8639	20.5423	19.7049	18.6985	17.8894	(87)	
Th 2	19.9108	19.9131	19.9154	19.9260	19.9279	19.9372	19.9372	19.9389	19.9336	19.9279	19.9239	19.9197	(88)	
util rest of house	0.9507	0.9215	0.8729	0.7766	0.6423	0.4757	0.3341	0.3803	0.6072	0.8305	0.9261	0.9565	(89)	
MIT 2	17.1374	17.5394	18.1293	18.8685	19.4291	19.7752	19.8908	19.8736	19.6255	18.8643	17.8842	17.0798	(90)	
Living area fraction														
MIT	17.3536	17.7572	18.3505	19.0968	19.6703	20.0303	20.1573	20.1360	19.8684	19.0870	18.0999	17.2943	(91)	
Temperature adjustment														
adjusted MIT	17.3536	17.7572	18.3505	19.0968	19.6703	20.0303	20.1573	20.1360	19.8684	19.0870	18.0999	17.2943	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9305	0.8964	0.8447	0.7518	0.6303	0.4821	0.3534	0.3981	0.6029	0.8047	0.9023	0.9378	(94)
Useful gains	642.6344	759.8723	841.3940	885.7508	815.8399	624.6768	437.6934	449.8435	604.5531	663.1068	630.2414	610.8539	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1759.9318	1729.3421	1590.2356	1353.3234	1055.6239	712.2638	466.5914	489.1386	759.4549	1124.0594	1463.0091	1749.1816	(97)
Space heating kWh	831.2693	651.4837	557.1381	336.6523	178.3993	0.0000	0.0000	0.0000	0.0000	342.9487	599.5927	846.9158	(98a)
Space heating requirement - total per year (kWh/year)												4344.4000	
Solar heating kWh													

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Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	831.2693	651.4837	557.1381	336.6523	178.3993	0.0000	0.0000	0.0000	0.0000	342.9487	599.5927	846.9158 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4344.4000
Space heating per m2										(98c) / (4) =		39.0368 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1232.9473	970.6181	995.0484	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7613	0.8191	0.7854	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	938.6689	795.0392	781.4849	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1451.8408	1387.9262	1264.6295	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	369.4837	441.1079	359.4596	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	92.3709	110.2770	89.8649	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												292.5128 (107)
Energy for space heating												39.0368 (99)
Energy for space cooling												2.6284 (108)
Total												41.6651 (109)
Fabric Energy Efficiency (DFEE)												41.7 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.0700 (5)

2. Ventilation rate

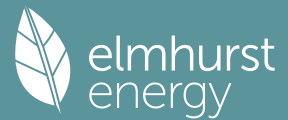
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1532 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4032 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3427 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4370	0.4284	0.4198	0.3770	0.3684	0.3256	0.3256	0.3170	0.3427	0.3684	0.3856	0.4027 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5955	0.5918	0.5881	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.0200	1.0000	2.0200		(26)
TER Opening Type (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Rooflight W			0.5400	1.4151	0.7642		(27a)
Ground Floor			81.1600	0.1300	10.5508		(28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476		(29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284		(29a)
Ashlar	27.0700		27.0700	0.1800	4.8726		(29a)
Joists GF	51.0300		51.0300	0.1100	5.6133		(30)

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Joists FF	20.0000		20.0000	0.1100	2.2000	(30)
Rafters	13.1700	0.5400	12.6300	0.1100	1.3893	(30)
D Flat	1.4500		1.4500	0.1100	0.1595	(30)
Total net area of external elements Aum(A, m2)			297.8100			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.7945	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 89.2724 (35)

List of Thermal Bridges						
K1 Element	Length	Psi-value	Total			
E16 Corner (normal)	24.0000	0.0900	2.1600			
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858			
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960			
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536			
R6 Flat ceiling	22.5300	0.0600	1.3518			
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080			
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360			
E3 Sill	15.7600	0.0500	0.7880			
E4 Jamb	38.3600	0.0500	1.9180			
E5 Ground floor (normal)	41.4300	0.1600	6.6288			
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000			
R1 Head of roof window	0.5500	0.0800	0.0440			
R2 Sill of roof window	0.5500	0.0600	0.0330			
R3 Jamb of roof window	1.9600	0.0800	0.1568			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.6678 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 85.4623 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	51.3023	50.9829	50.6698	49.1992	48.9241	47.6432	47.6432	47.4060	48.1366	48.9241	49.4807	50.0626	(38)
Heat transfer coeff	136.7646	136.4452	136.1321	134.6615	134.3864	133.1055	133.1055	132.8683	133.5989	134.3864	134.9430	135.5249	(39)
Average = Sum(39)m / 12 =												134.6602	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.2289	1.2260	1.2232	1.2100	1.2075	1.1960	1.1960	1.1939	1.2005	1.2075	1.2125	1.2178	(40)
HLP (average)												1.2100	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8224 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths 30.8883 30.4296 29.7836 28.5925 27.7006 26.7117 26.1775 26.8190 27.5174 28.5756 29.7913 30.7839 (42b)

Hot water usage for other uses 43.5337 41.9507 40.3676 38.7846 37.2015 35.6185 35.6185 37.2015 38.7846 40.3676 41.9507 43.5337 (42c)

Average daily hot water use (litres/day) 68.2145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.4220	72.3803	70.1512	67.3771	64.9022	62.3302	61.7960	64.0205	66.3020	68.9433	71.7419	74.3176	(44)
Energy conte	117.8663	103.0685	107.8198	92.2359	87.3708	76.6422	74.7369	79.2708	81.7570	93.5553	102.2095	116.3634	(45)
Energy content (annual)										Total = Sum(45)m =		1132.8965	

Distribution loss (46)m = 0.15 x (45)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (46)

Water storage loss: 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (46)

Total storage loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)

If cylinder contains dedicated solar storage 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)

Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 100.1864 87.6083 91.6469 78.4005 74.2652 65.1459 63.5264 67.3801 69.4934 79.5220 86.8781 98.9089 (62)

WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)

PV diverter 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h 100.1864 87.6083 91.6469 78.4005 74.2652 65.1459 63.5264 67.3801 69.4934 79.5220 86.8781 98.9089 (64)

Total per year (kWh/year) 962.9620 (64)

Electric shower(s) 57.2927 51.0483 55.7428 53.1946 54.1928 51.6947 53.4178 54.1928 53.1946 55.7428 54.6946 57.2927 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 651.7012 (64a)

Heat gains from water heating, kWh/month 39.3698 34.6641 36.8474 32.8988 32.1145 29.2101 29.2360 30.3932 30.6720 33.8162 35.3932 39.0504 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts (66)m 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 141.1176 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 137.9683 152.7507 137.9683 142.5673 137.9683 142.5673 137.9683 137.9683 137.9683 142.5673 137.9683 137.9683 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 273.3965 276.2335 269.0844 253.8647 234.6525 216.5958 204.5329 201.6959 208.8450 224.0647 243.2768 261.3335 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 37.1118 (69)

Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5) -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 -112.8941 (71)

Water heating gains (Table 5) 52.9164 51.5835 49.5261 45.6927 43.1646 40.5696 39.2958 40.8511 42.6000 45.4519 49.1572 52.4871 (72)

Total internal gains 529.6165 545.9030 521.9140 507.4600 481.1208 465.0680 447.1322 445.8506 459.3476 472.8202 500.3366 517.1242 (73)

6. Solar gains

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[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North			3.7400	10.6334	0.6300		0.7000		0.7700	12.1539 (74)
East			7.4600	19.6403	0.6300		0.7000		0.7700	44.7773 (76)
South			2.8300	46.7521	0.6300		0.7000		0.7700	40.4351 (78)
West			9.6800	19.6403	0.6300		0.7000		0.7700	58.1025 (80)
West			0.5400	25.9287	0.6300		0.7000		1.0000	5.5572 (82)

Solar gains	161.0260	301.8221	474.2036	670.7627	813.1806	830.7572	791.4537	684.1030	543.4081	351.2386	198.1750	134.2172 (83)
Total gains	690.6425	847.7251	996.1176	1178.2226	1294.3013	1295.8252	1238.5859	1129.9536	1002.7557	824.0588	698.5115	651.3414 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.1789	20.2261	20.2727	20.4940	20.5360	20.7336	20.7336	20.7706	20.6570	20.5360	20.4513	20.3635
alpha	2.3453	2.3484	2.3515	2.3663	2.3691	2.3822	2.3822	2.3847	2.3771	2.3691	2.3634	2.3576
util living area	0.9570	0.9315	0.8897	0.8064	0.6908	0.5480	0.4274	0.4754	0.6737	0.8588	0.9369	0.9621 (86)
MIT	17.9112	18.3194	18.9257	19.6985	20.3178	20.7270	20.8915	20.8572	20.5266	19.6768	18.6620	17.8469 (87)
Th 2	19.8969	19.8992	19.9015	19.9120	19.9140	19.9232	19.9232	19.9249	19.9196	19.9140	19.9100	19.9058 (88)
util rest of house	0.9508	0.9220	0.8740	0.7788	0.6455	0.4792	0.3367	0.3832	0.6103	0.8320	0.9265	0.9566 (89)
MIT 2	17.0871	17.4893	18.0826	18.8287	19.3992	19.7545	19.8746	19.8567	19.6015	18.8284	17.8397	17.0292 (90)
Living area fraction	17.3054	17.7092	18.3060	19.0591	19.6425	20.0121	20.1440	20.1218	fLA = Living area / (4) =	19.0531	18.0575	0.2649 (91)
MIT	17.3054	17.7092	18.3060	19.0591	19.6425	20.0121	20.1440	20.1218	19.8465	19.0531	18.0575	17.2458 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3054	17.7092	18.3060	19.0591	19.6425	20.0121	20.1440	20.1218	19.8465	19.0531	18.0575	17.2458 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9305	0.8967	0.8454	0.7534	0.6329	0.4853	0.3563	0.4011	0.6056	0.8058	0.9025	0.9378 (94)
Useful gains	642.6691	760.1395	842.1662	887.7111	819.2268	628.8191	441.2653	453.2303	607.2312	664.0260	630.4221	610.8574 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1778.6808	1747.7538	1607.1691	1368.0437	1067.3693	720.3800	471.7201	494.5036	767.7288	1135.9819	1478.6390	1768.0346 (97)
Space heating kWh	845.1927	663.6768	569.1621	345.8395	184.6180	0.0000	0.0000	0.0000	0.0000	351.1352	610.7162	860.9399 (98a)
Space heating requirement - total per year (kWh/year)												4431.2804
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	845.1927	663.6768	569.1621	345.8395	184.6180	0.0000	0.0000	0.0000	0.0000	351.1352	610.7162	860.9399 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4431.2804
Space heating per m2										(98c) / (4) =		39.8174 (99)

8c. Space cooling requirement

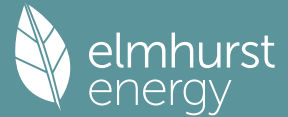
Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1251.1920	984.9810	1009.7994	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7547	0.8132	0.7790	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	944.2832	800.9601	786.6191	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1451.8408	1387.9262	1264.6295	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	365.4415	436.7027	355.6398	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	91.3604	109.1757	88.9099	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												289.4460 (107)
Energy for space heating												39.8174 (99)
Energy for space cooling												2.6008 (108)
Total												42.4182 (109)
Fabric Energy Efficiency (TFEE)												42.4 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x	2.4000 (2b) =
First floor	30.1300 (1c)	x	2.2000 (2c) =
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.0700 (5)

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2. Ventilation rate

												m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												6 * 10 = 60.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											60.0000 / (5) = 0.2298 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0000 (17)
Infiltration rate												0.4798 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.4078 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.5200	0.5098	0.4996	0.4486	0.4384	0.3875	0.3875	0.3773	0.4078	0.4384	0.4588	0.4792 (22b)
	0.6352	0.6300	0.6248	0.6006	0.5961	0.5751	0.5751	0.5712	0.5832	0.5961	0.6053	0.6148 (25)

3. Heat losses and heat loss parameter

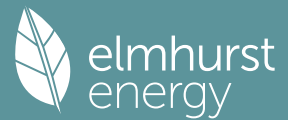
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000 (28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800 (29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200 (29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300 (29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700 (30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700 (30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500 (30)
Total net area of external elements Aum(A, m2)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3071		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			45.0000			9.0000	405.0000 (32c)
Internal Floor 1			31.0300			18.0000	558.5400 (32d)
Internal Ceiling 1			30.1300			9.0000	271.1700 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9935.1300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.2724 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				24.0000	0.0900	2.1600	
E10 Eaves (insulation at ceiling level)				41.4300	0.0600	2.4858	
E17 Corner (inverted - internal area greater than external area)				14.4000	-0.0900	-1.2960	
R8 Roof to wall (rafter)				22.5600	0.0600	1.3536	
R6 Flat ceiling				22.5300	0.0600	1.3518	
E13 Gable (insulation at rafter level)				2.6000	0.0800	0.2080	
E2 Other lintels (including other steel lintels)				16.7200	0.0500	0.8360	
E3 Sill				15.7600	0.0500	0.7880	
E4 Jamb				38.3600	0.0500	1.9180	
E5 Ground floor (normal)				41.4300	0.1500	6.2145	
E6 Intermediate floor within a dwelling				26.9200	0.0000	0.0000	
R1 Head of roof window				0.5500	0.0600	0.0330	
R2 Sill of roof window				0.5500	0.0800	0.0440	
R3 Jamb of roof window				1.9600	0.0600	0.1176	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.2143 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 83.5214 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	54.7248	54.2725	53.8292	51.7467	51.3571	49.5433	49.5433	49.2075	50.2420	51.3571	52.1453	52.9693 (38)
Average = Sum(39)m / 12 =	138.2462	137.7939	137.3505	135.2681	134.8785	133.0647	133.0647	132.7288	133.7633	134.8785	135.6667	136.4907 (39)
												135.2662
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2422	1.2382	1.2342	1.2155	1.2120	1.1957	1.1957	1.1926	1.2019	1.2120	1.2190	1.2264 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8224 (42)
Hot water usage for mixer showers													89.0841 (42a)
Hot water usage for baths													30.7839 (42b)
Hot water usage for other uses													43.5337 (42c)
Average daily hot water use (litres/day)													150.6629 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Energy conte	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017 (44)
Energy content (annual)	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2502.5121
Water storage loss:	38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
WWHRS	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	131.8626	117.1444	125.4432	112.2744	110.2660	100.8818	100.4997	103.5233	103.6229	113.7581	118.8277	130.6494 (65)
Total per year (kWh/year) = Sum(64)m =												
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.5101	29.7633	24.2052	18.3249	13.6981	11.5645	12.4958	16.2425	21.8007	27.6810	32.3078	34.4414 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.0545	412.2888	401.6184	378.9025	350.2277	323.2774	305.2729	301.0386	311.7090	334.4249	363.0998	390.0500 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941 (71)
Water heating gains (Table 5)	177.2347	174.3220	168.6064	155.9367	148.2071	140.1137	135.0803	139.1443	143.9206	152.9007	165.0384	175.6040 (72)
Total internal gains	733.0027	730.5777	708.6335	667.3675	626.3363	586.1590	564.0525	567.6289	588.6338	629.2101	674.6495	714.2989 (73)

6. Solar gains

[Jan]													
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				3.7400	10.6334		0.6300		0.7000		0.7700		12.1539 (74)
East				7.4600	19.6403		0.6300		0.7000		0.7700		44.7773 (76)
South				2.8300	46.7521		0.6300		0.7000		0.7700		40.4351 (78)
West				9.6800	19.6403		0.6300		0.7000		0.7700		58.1025 (80)
West				0.5400	25.9287		0.6300		0.7000		1.0000		5.5572 (82)
Solar gains	161.0260	301.8221	474.2036	670.7627	813.1806	830.7572	791.4537	684.1030	543.4081	351.2386	198.1750	134.2172	(83)
Total gains	894.0287	1032.3998	1182.8371	1338.1302	1439.5168	1416.9162	1355.5062	1251.7319	1132.0420	980.4487	872.8244	848.5161	(84)

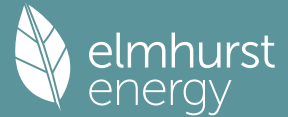
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.9626	20.0282	20.0928	20.4021	20.4611	20.7400	20.7400	20.7925	20.6316	20.4611	20.3422	20.2194
alpha	2.3308	2.3352	2.3395	2.3601	2.3641	2.3827	2.3827	2.3862	2.3754	2.3641	2.3561	2.3480
util living area	0.9299	0.9028	0.8544	0.7694	0.6530	0.5142	0.3967	0.4384	0.6292	0.8157	0.9054	0.9367 (86)
MIT	18.2018	18.5599	19.1367	19.8388	20.3982	20.7631	20.9079	20.8808	20.5950	19.8453	18.9077	18.1461 (87)
Th 2	19.8864	19.8896	19.8928	19.9077	19.9104	19.9235	19.9235	19.9259	19.9185	19.9104	19.9048	19.8989 (88)
util rest of house	0.9205	0.8901	0.8352	0.7389	0.6064	0.4469	0.3107	0.3507	0.5646	0.7839	0.8909	0.9282 (89)
MIT 2	16.6495	17.0989	17.8172	18.6802	19.3344	19.7379	19.8712	19.8540	19.5753	18.7133	17.5530	16.5865 (90)
Living area fraction									fLA = Living area / (4) =			0.2649 (91)
MIT	17.0607	17.4859	18.1667	18.9871	19.6162	20.0094	20.1458	20.1260	19.8454	19.0132	17.9119	16.9996 (92)
Temperature adjustment												0.0000
adjusted MIT	17.0607	17.4859	18.1667	18.9871	19.6162	20.0094	20.1458	20.1260	19.8454	19.0132	17.9119	16.9996 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8871	0.8535	0.7980	0.7092	0.5926	0.4526	0.3292	0.3679	0.5598	0.7522	0.8555	0.8964 (94)
Ext temp.	793.0924	881.1508	943.9318	949.0098	853.0883	641.3384	446.2201	460.4530	633.7029	737.4811	746.7115	760.6125 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1764.1126	1734.2645	1602.4269	1364.4592	1067.7222	719.8049	471.8273	494.5470	768.5243	1134.7535	1466.8082	1747.0281 (97)
	722.4391	573.2924	489.9203	299.1236	159.6876	0.0000	0.0000	0.0000	0.0000	295.5707	518.4696	733.8932 (98a)

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Space heating requirement - total per year (kWh/year)	3792.3964										
Solar heating kWh											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000										
Space heating kWh											
722.4391	573.2924	489.9203	299.1236	159.6876	0.0000	0.0000	0.0000	0.0000	295.5707	518.4696	733.8932 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3792.3964										
Space heating per m2	(98c) / (4) = 34.0767 (99)										

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	722.4391	573.2924	489.9203	299.1236	159.6876	0.0000	0.0000	0.0000	0.0000	295.5707	518.4696	733.8932 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	289.0913	229.4087	196.0465	119.6973	63.9006	0.0000	0.0000	0.0000	0.0000	118.2756	207.4708	293.6748 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	180.7375	159.8850	169.7116	148.5687	143.6433	129.0008	126.8686	132.0620	133.7087	149.6413	159.8245	178.6537 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1517.5656 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1812.3058 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												236.7193 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3566.5906 (238)

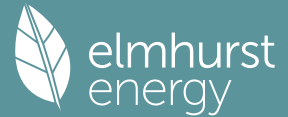
10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1517.5656	16.4900	250.2466 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1812.3058	16.4900	298.8492 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	236.7193	16.4900	39.0350 (250)
Additional standing charges			0.0000 (251)
Total energy cost			588.1308 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)										
Energy cost factor (ECF)	1.3547 (257)										
SAP value	78.0402										
SAP rating (Section 12)	78 (258)										
SAP band	C										

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12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1517.5656	0.1546	234.6565 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1812.3058	0.1410	255.4851 (264)
Space and water heating			490.1417 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Total CO2, kg/year			524.3076 (272)
CO2 emissions per m2			4.7100 (273)
EI value			95.5047
EI rating			96 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.0700 (5)

2. Ventilation rate

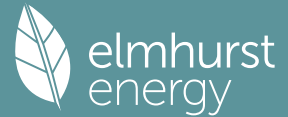
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.2298 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4798 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4078 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000 (22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000 (22a)
Adj infilt rate	0.3671	0.3365	0.3263	0.3263	0.3365	0.2957	0.3161	0.2855	0.2855	0.3059	0.2855	0.3263 (22b)
Effective ac	0.5674	0.5566	0.5532	0.5532	0.5566	0.5437	0.5500	0.5408	0.5408	0.5468	0.5408	0.5532 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000 (28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800 (29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200 (29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300 (29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700 (30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700 (30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500 (30)
Total net area of external elements Aum(A, m2)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3071		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			45.0000			9.0000	405.0000 (32c)
Internal Floor 1			31.0300			18.0000	558.5400 (32d)
Internal Ceiling 1			30.1300			9.0000	271.1700 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9935.1300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.2724 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E16 Corner (normal)				24.0000	0.0900		2.1600
E10 Eaves (insulation at ceiling level)				41.4300	0.0600		2.4858
E17 Corner (inverted - internal area greater than external area)				14.4000	-0.0900		-1.2960

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R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1500	6.2145
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.2143 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	83.5214 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.8805	47.9535	47.6624	47.6624	47.9535	46.8429	47.3803	46.5876	46.5876	47.1071	46.5876	47.6624 (38)
Average = Sum(39)m / 12 =	132.4019	131.4749	131.1838	131.1838	131.4749	130.3642	130.9017	130.1090	130.1090	130.6285	130.1090	131.1838 (39)
												130.9270
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1897	1.1814	1.1788	1.1788	1.1814	1.1714	1.1762	1.1691	1.1691	1.1738	1.1691	1.1788 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8224 (42)
Hot water usage for mixer showers	89.4267	88.0828	86.1245	82.3775	79.6124	76.5287	74.7760	76.7195	78.8500	82.1609	85.9883	89.0841 (42a)
Hot water usage for baths	30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839 (42b)
Hot water usage for other uses	43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337 (42c)
Average daily hot water use (litres/day)												150.6629 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017 (44)
Energy content (annual)	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476 (45)
Distribution loss (46)m = 0.15 x (45)m	38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226 (64)
												3173.3474 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	131.8626	117.1444	125.4432	112.2744	110.2660	100.8818	100.4997	103.5233	103.6229	113.7581	118.8277	130.6494 (65)

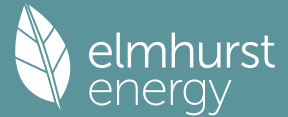
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	33.5101	29.7633	24.2052	18.3249	13.6981	11.5645	12.4958	16.2425	21.8007	27.6810	32.3078	34.4414 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	408.0545	412.2888	401.6184	378.9025	350.2277	323.2774	305.2729	301.0386	311.7090	334.4249	363.0998	390.0500 (68)
Pumps, fans	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941 (71)
Total internal gains	177.2347	174.3220	168.6064	155.9367	148.2071	140.1137	135.0803	139.1443	143.9206	152.9007	165.0384	175.6040 (72)
	733.0027	730.5777	708.6335	667.3675	626.3363	586.1590	564.0525	567.6289	588.6338	629.2101	674.6495	714.2989 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	3.7400	13.0723	0.6300	0.7000	0.7700	14.9415 (74)
East	7.4600	24.4329	0.6300	0.7000	0.7700	55.7038 (76)
South	2.8300	54.9219	0.6300	0.7000	0.7700	47.5011 (78)

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West	9.6800	24.4329	0.6300	0.7000	0.7700	72.2806	(80)
West	0.5400	32.4879	0.6300	0.7000	1.0000	6.9630	(82)

Solar gains	197.3901	324.9649	505.7488	738.0796	870.2443	962.3992	898.8515	785.3369	619.2954	403.1030	243.8022	160.3737	(83)
Total gains	930.3928	1055.5426	1214.3823	1405.4471	1496.5805	1548.5582	1462.9041	1352.9658	1207.9292	1032.3131	918.4517	874.6726	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.8438	20.9908	21.0373	21.0373	20.9908	21.1696	21.0827	21.2111	21.2111	21.1268	21.2111	21.0373	
alpha	2.3896	2.3994	2.4025	2.4025	2.3994	2.4113	2.4055	2.4141	2.4141	2.4085	2.4141	2.4025	
util living area	0.9144	0.8887	0.8283	0.7247	0.5839	0.4148	0.3075	0.3201	0.5497	0.7582	0.8773	0.9232	(86)
MIT	18.6041	18.8704	19.4663	20.1009	20.6046	20.8804	20.9585	20.9565	20.7478	20.1862	19.3280	18.5479	(87)
Th 2	19.9282	19.9349	19.9370	19.9370	19.9349	19.9430	19.9391	19.9448	19.9448	19.9410	19.9448	19.9370	(88)
util rest of house	0.9029	0.8743	0.8061	0.6899	0.5310	0.3444	0.2222	0.2296	0.4784	0.7170	0.8584	0.9127	(89)
MIT 2	17.1787	17.5125	18.2489	19.0085	19.5785	19.8612	19.9209	19.9262	19.7488	19.1357	18.0986	17.1144	(90)
Living area fraction									fLA = Living area / (4) =			0.2649	(91)
MIT	17.5563	17.8722	18.5714	19.2979	19.8503	20.1311	20.1957	20.1992	20.0134	19.4140	18.4242	17.4941	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5563	17.8722	18.5714	19.2979	19.8503	20.1311	20.1957	20.1992	20.0134	19.4140	18.4242	17.4941	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8687	0.8385	0.7719	0.6664	0.5264	0.3575	0.2434	0.2521	0.4833	0.6934	0.8236	0.8798	(94)
Useful gains	808.1879	885.0485	937.3937	936.5516	787.8718	553.5471	356.0856	341.0609	583.8480	715.7558	756.4555	769.5213	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1635.9953	1626.6329	1478.6211	1259.0869	926.9421	590.6997	365.9648	351.1846	665.3039	994.5995	1330.2654	1612.7902	(97)
Space heating kWh	615.8887	498.3448	402.6732	232.2254	103.4683	0.0000	0.0000	0.0000	0.0000	207.4597	413.1431	627.3921	(98a)
Space heating requirement - total per year (kWh/year)												3100.5954	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	615.8887	498.3448	402.6732	232.2254	103.4683	0.0000	0.0000	0.0000	0.0000	207.4597	413.1431	627.3921	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3100.5954	
Space heating per m2										(98c) / (4) =		27.8605	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	615.8887	498.3448	402.6732	232.2254	103.4683	0.0000	0.0000	0.0000	0.0000	207.4597	413.1431	627.3921	(98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating fuel (main heating system)	246.4541	199.4177	161.1337	92.9273	41.4039	0.0000	0.0000	0.0000	0.0000	83.0171	165.3234	251.0572	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	316.4714	279.9586	297.1650	260.1437	251.5194	225.8804	222.1470	231.2406	234.1240	262.0219	279.8527	312.8226	(64)	
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
Fuel for water heating, kWh/month	180.7375	159.8850	169.7116	148.5687	143.6433	129.0008	126.8686	132.0620	133.7087	149.6413	159.8245	178.6537	(219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)	
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1												1240.7344	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												175.1000		
Water heating fuel used												1812.3058	(219)	
Space cooling fuel												0.0000	(221)	

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	236.7193 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3289.7595 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1240.7344	26.0600	323.3354 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1812.3058	26.0600	472.2869 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	236.7193	26.0600	61.6890 (250)
Additional standing charges			0.0000 (251)
Total energy cost			857.3113 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1240.7344	0.1553	192.6627 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1812.3058	0.1410	255.4851 (264)
Space and water heating			448.1478 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Total CO2, kg/year			482.3137 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1240.7344	1.5749	1954.0233 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1812.3058	1.5213	2757.0039 (278)
Space and water heating			4711.0272 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	236.7193	1.5338	363.0879 (282)
Total Primary energy kWh/year			5074.1151 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:	C 78
Current environmental impact rating:	A 96

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.0	-£ 102	-49 kg (10.2%)
U Solar photovoltaic panels	+ 5.6	-£ 255	-132 kg (30.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£102	0.44 kg/m²	C 80 A 96
Solar photovoltaic panels	£255	1.18 kg/m²	B 86 A 97
Total Savings	£357	1.62 kg/m²	

Potential energy efficiency rating:	B 86
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£857	£755	£102
Space heating	£323	£345	-£21
Water heating	£472	£349	£123
Lighting	£62	£62	£0
Generated (PV)	-£10	-£255	£255
Total cost of fuels	£857	£500	£357
Total cost of uses	£857	£501	£357
Delivered energy	30 kWh/m²	17 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	3 kg/m²	2 kg/m²

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Primary energy 46 kWh/m² 27 kWh/m² 18 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.0700 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) = 0.2298 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4798 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4078 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5200	0.5098	0.4996	0.4486	0.4384	0.3875	0.3875	0.3773	0.4078	0.4384	0.4588	0.4792 (22b)
Effective ac	0.6352	0.6300	0.6248	0.6006	0.5961	0.5751	0.5751	0.5712	0.5832	0.5961	0.6053	0.6148 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000 (28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800 (29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200 (29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300 (29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700 (30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700 (30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500 (30)
Total net area of external elements Aum(A, m2)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3071		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			45.0000			9.0000	405.0000 (32c)
Internal Floor 1			31.0300			18.0000	558.5400 (32d)
Internal Ceiling 1			30.1300			9.0000	271.1700 (32e)

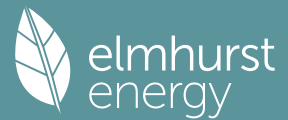
Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9935.1300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 89.2724 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.0000	0.0900	2.1600
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1500	6.2145
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.2143 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 83.5214 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.7248	54.2725	53.8292	51.7467	51.3571	49.5433	49.5433	49.2075	50.2420	51.3571	52.1453	52.9693	(38)
Heat transfer coeff	138.2462	137.7939	137.3505	135.2681	134.8785	133.0647	133.0647	132.7288	133.7633	134.8785	135.6667	136.4907	(39)
Average = Sum(39)m / 12 =												135.2662	
HLP	1.2422	1.2382	1.2342	1.2155	1.2120	1.1957	1.1957	1.1926	1.2019	1.2120	1.2190	1.2264	(40)
HLP (average)												1.2154	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8224 (42)
Hot water usage for mixer showers													
89.4267	88.0828	86.1245	82.3775	79.6124	76.5287	74.7760	76.7195	78.8500	82.1609	85.9883	89.0841	(42a)	
Hot water usage for baths													
30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839	(42b)	
Hot water usage for other uses													
43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337	(42c)	
Average daily hot water use (litres/day)												150.6629	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017	(44)
Energy conte	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476	(45)
Energy content (annual)										Total = Sum(45)m =		2502.5121	
Distribution loss (46)m = 0.15 x (45)m													
38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771	(46)	
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)	
If cylinder contains dedicated solar storage													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
316.4714	279.9586	295.7692	253.3901	238.7251	213.2736	209.1201	219.1441	228.7211	260.6262	279.8527	312.8226	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												643.0091	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												643.0091	
Solar input	-0.0000	-16.1781	-59.3926	-82.5498	-109.1021	-100.7843	-100.1538	-86.8676	-59.1534	-28.8275	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	316.4714	263.7805	236.3766	170.8403	129.6230	112.4893	108.9663	132.2765	169.5678	231.7987	279.8527	312.8226	(64)
												2464.8659	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month													
131.8626	117.1444	124.3266	106.8715	100.0306	90.7965	90.0782	93.8462	99.3006	112.6415	118.8277	130.6494	(65)	

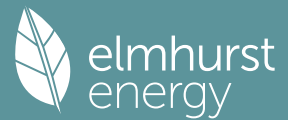
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.5101	29.7633	24.2052	18.3249	13.6981	11.5645	12.4958	16.2425	21.8007	27.6810	32.3078	34.4414	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	408.0545	412.2888	401.6184	378.9025	350.2277	323.2774	305.2729	301.0386	311.7090	334.4249	363.0998	390.0500	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	(71)
Water heating gains (Table 5)													
	177.2347	174.3220	167.1056	148.4327	134.4497	126.1062	121.0728	126.1373	137.9174	151.3999	165.0384	175.6040	(72)
Total internal gains													
	733.0027	730.5777	707.1327	659.8635	612.5789	572.1515	550.0450	554.6220	582.6306	627.7093	674.6495	714.2989	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.7400	10.6334	0.6300	0.7000	0.7700	12.1539 (74)
East	7.4600	19.6403	0.6300	0.7000	0.7700	44.7773 (76)

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South	2.8300	46.7521	0.6300	0.7000	0.7700	40.4351 (78)
West	9.6800	19.6403	0.6300	0.7000	0.7700	58.1025 (80)
West	0.5400	25.9287	0.6300	0.7000	1.0000	5.5572 (82)

Solar gains	161.0260	301.8221	474.2036	670.7627	813.1806	830.7572	791.4537	684.1030	543.4081	351.2386	198.1750	134.2172 (83)
Total gains	894.0287	1032.3998	1181.3363	1330.6262	1425.7595	1402.9087	1341.4988	1238.7250	1126.0388	978.9479	872.8244	848.5161 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.9626	20.0282	20.0928	20.4021	20.4611	20.7400	20.7400	20.7925	20.6316	20.4611	20.3422	20.2194
alpha	2.3308	2.3352	2.3395	2.3601	2.3641	2.3827	2.3827	2.3862	2.3754	2.3641	2.3561	2.3480
util living area	0.9299	0.9028	0.8547	0.7711	0.6566	0.5180	0.4001	0.4420	0.6312	0.8161	0.9054	0.9367 (86)
MIT	18.2018	18.5599	19.1349	19.8322	20.3906	20.7593	20.9062	20.8786	20.5921	19.8438	18.9077	18.1461 (87)
Th 2	19.8864	19.8896	19.8928	19.9077	19.9104	19.9235	19.9235	19.9259	19.9185	19.9104	19.9048	19.8989 (88)
util rest of house	0.9205	0.8901	0.8356	0.7408	0.6101	0.4505	0.3136	0.3539	0.5666	0.7843	0.8909	0.9282 (89)
MIT 2	16.6495	17.0989	17.8150	18.6726	19.3266	19.7346	19.8701	19.8526	19.5725	18.7115	17.5530	16.5865 (90)
Living area fraction	17.0607	17.4859	18.1647	18.9798	19.6085	20.0060	20.1446	20.1243	19.8426	19.0114	17.9119	16.9996 (92)
MIT	17.0607	17.4859	18.1647	18.9798	19.6085	20.0060	20.1446	20.1243	19.8426	19.0114	17.9119	16.9996 (93)
Temperature adjustment												0.0000
adjusted MIT	17.0607	17.4859	18.1647	18.9798	19.6085	20.0060	20.1446	20.1243	19.8426	19.0114	17.9119	16.9996 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8871	0.8535	0.7983	0.7109	0.5959	0.4560	0.3321	0.3710	0.5616	0.7526	0.8555	0.8964 (94)
Useful gains	793.0924	881.1508	943.1054	945.9553	849.5925	639.6653	445.5569	459.6012	632.4069	736.7728	746.7115	760.6125 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1764.1126	1734.2645	1602.1466	1363.4751	1066.6796	719.3541	471.6592	494.3279	768.1497	1134.5210	1466.8082	1747.0281 (97)
Space heating kWh	722.4391	573.2924	490.3267	300.6143	161.5128	0.0000	0.0000	0.0000	0.0000	295.9246	518.4696	733.8932 (98a)
Space heating requirement - total per year (kWh/year)												3796.4727
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	722.4391	573.2924	490.3267	300.6143	161.5128	0.0000	0.0000	0.0000	0.0000	295.9246	518.4696	733.8932 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3796.4727
Space heating per m2										(98c) / (4) =		34.1133 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	722.4391	573.2924	490.3267	300.6143	161.5128	0.0000	0.0000	0.0000	0.0000	295.9246	518.4696	733.8932 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	289.0913	229.4087	196.2091	120.2938	64.6310	0.0000	0.0000	0.0000	0.0000	118.4172	207.4708	293.6748 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	316.4714	263.7805	236.3766	170.8403	129.6230	112.4893	108.9663	132.2765	169.5678	231.7987	279.8527	312.8226 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	180.7375	150.6457	134.9952	97.5673	74.0280	64.2429	62.2309	75.5434	96.8405	132.3807	159.8245	178.6537 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.2044	-59.1415	-89.5739	-103.7576	-111.3589	-98.4666	-96.9938	-91.2117	-80.2976	-68.4669	-44.2117	-33.4671 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1519.1968 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1407.6904 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	80.0000 (231)
Electricity for lighting (calculated in Appendix L)	236.7193 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-916.1519 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2327.4546 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1519.1968	16.4900	250.5155 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1407.6904	16.4900	232.1282 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	236.7193	16.4900	39.0350 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-916.1519	16.4900	-151.0734
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-151.0734 (252)
Total energy cost			383.7973 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8840 (257)
SAP value		85.6697
SAP rating (Section 12)		86 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1519.1968	0.1546	234.8824 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1407.6904	0.1450	204.0916 (264)
Space and water heating			438.9740 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-916.1519	0.1344	-123.1314
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-123.1314 (269)
Total CO2, kg/year			361.1055 (272)
CO2 emissions per m2			3.2400 (273)
EI value			96.9040
EI rating			97 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

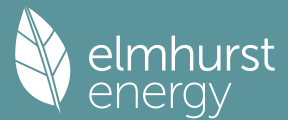
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.1600 (1b)	x 2.4000 (2b)	= 194.7840 (1b) - (3b)
First floor	30.1300 (1c)	x 2.2000 (2c)	= 66.2860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.0700 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)

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Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6f)
6 * 10 = 60.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
60.0000 / (5) = 0.2298 (8)
Yes
Blower Door
5.0000 (17)
0.4798 (18)
2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.4078 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate													
Effective ac	0.3671	0.3365	0.3263	0.3263	0.3365	0.2957	0.3161	0.2855	0.2855	0.3059	0.2855	0.3263	(22b)
	0.5674	0.5566	0.5532	0.5532	0.5566	0.5437	0.5500	0.5408	0.5408	0.5468	0.5408	0.5532	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			23.7100	1.1450	27.1489		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.1600	0.1100	8.9276	75.0000	6087.0000 (28a)
Brick	99.4300	23.6100	75.8200	0.1800	13.6476	9.0000	682.3800 (29a)
Dormer	4.5000	2.1200	2.3800	0.1800	0.4284	9.0000	21.4200 (29a)
Ashlar	27.0700		27.0700	0.1800	4.8726	9.0000	243.6300 (29a)
Joists GF	51.0300		51.0300	0.1100	5.6133	9.0000	459.2700 (30)
Joists FF	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Rafters	13.1700	0.5400	12.6300	0.1300	1.6419	9.0000	113.6700 (30)
D Flat	1.4500		1.4500	0.1300	0.1885	9.0000	13.0500 (30)
Total net area of external elements Aum(A, m2)			297.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3071		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			45.0000			9.0000	405.0000 (32c)
Internal Floor 1			31.0300			18.0000	558.5400 (32d)
Internal Ceiling 1			30.1300			9.0000	271.1700 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 9935.1300 (34)
List of Thermal Bridges 89.2724 (35)

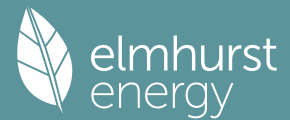
K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.0000	0.0900	2.1600
E10 Eaves (insulation at ceiling level)	41.4300	0.0600	2.4858
E17 Corner (inverted - internal area greater than external area)	14.4000	-0.0900	-1.2960
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	22.5300	0.0600	1.3518
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E2 Other lintels (including other steel lintels)	16.7200	0.0500	0.8360
E3 Sill	15.7600	0.0500	0.7880
E4 Jamb	38.3600	0.0500	1.9180
E5 Ground floor (normal)	41.4300	0.1500	6.2145
E6 Intermediate floor within a dwelling	26.9200	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.2143 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 83.5214 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	48.8805	47.9535	47.6624	47.6624	47.9535	46.8429	47.3803	46.5876	46.5876	47.1071	46.5876	47.6624	(38)
Average = Sum(39)m / 12 =	132.4019	131.4749	131.1838	131.1838	131.4749	130.3642	130.9017	130.1090	130.1090	130.6285	130.1090	131.1838	(39)
												130.9270	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1897	1.1814	1.1788	1.1788	1.1814	1.1714	1.1762	1.1691	1.1691	1.1738	1.1691	1.1788	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8224 (42)
Hot water usage for mixer showers													
	89.4267	88.0828	86.1245	82.3775	79.6124	76.5287	74.7760	76.7195	78.8500	82.1609	85.9883	89.0841	(42a)
Hot water usage for baths													
	30.8883	30.4296	29.7836	28.5925	27.7006	26.7117	26.1775	26.8190	27.5174	28.5756	29.7913	30.7839	(42b)
Hot water usage for other uses													
	43.5337	41.9507	40.3676	38.7846	37.2015	35.6185	35.6185	37.2015	38.7846	40.3676	41.9507	43.5337	(42c)
Average daily hot water use (litres/day)													150.6629 (43)
Daily hot water use													
	163.8488	160.4631	156.2757	149.7546	144.5145	138.8589	136.5720	140.7400	145.1519	151.1041	157.7302	163.4017	(44)
Energy conte	259.4964	228.4973	240.1899	205.0066	194.5444	170.7432	165.1719	174.2655	178.9869	205.0469	224.7156	255.8476	(45)
Energy content (annual)										Total = Sum(45)m =		2502.5121	
Distribution loss (46)m = 0.15 x (45)m													
	38.9245	34.2746	36.0285	30.7510	29.1817	25.6115	24.7758	26.1398	26.8480	30.7570	33.7073	38.3771	(46)
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)

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Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
WWHRS	316.4714	279.9586	295.7692	253.3901	238.7251	213.2736	209.1201	219.1441	228.7211	260.6262	279.8527	312.8226 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Aperture area of solar collector	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Zero-loss collector efficiency												3.0000 (H1)
Collector linear heat loss coefficient												0.8000 (H2)
Collector 2nd order heat loss coefficient												1.8000 (H3)
Collector loop efficiency												0.0000 (H4)
Incidence angle modifier												0.9000 (H5)
Overshading factor												1.0000 (H6)
Overall heat loss coefficient of system												0.8000 (H8)
Heat loss coefficient of collector loop												6.5000 (H10)
Dedicated solar storage volume												3.9667 (H11)
Effective solar volume												75.0000 (H12)
Reference volume												75.0000 (H14)
Storage tank correction coefficient												225.0000 (H15)
Heat delivered to hot water												1.3161 (H16)
Heat delivered to space heating												763.4754 (H24)
Solar input												0.0000 (H29)
Solar input	-1.7811	-20.9077	-66.3852	-94.2285	-118.9341	-119.7484	-116.3206	-103.9739	-72.7236	-40.8984	-7.5739	763.4754
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
	314.6904	259.0509	229.3840	159.1616	119.7910	93.5253	92.7994	115.1702	155.9976	219.7278	272.2788	312.8226 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	131.8626	117.1444	124.3266	106.8715	100.0306	90.7965	90.0782	93.8462	99.3006	112.6415	118.8277	130.6494 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	169.3411	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.5101	29.7633	24.2052	18.3249	13.6981	11.5645	12.4958	16.2425	21.8007	27.6810	32.3078	34.4414	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.0545	412.2888	401.6184	378.9025	350.2277	323.2774	305.2729	301.0386	311.7090	334.4249	363.0998	390.0500	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	54.7565	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	-112.8941	(71)
Water heating gains (Table 5)	177.2347	174.3220	167.1056	148.4327	134.4497	126.1062	121.0728	126.1373	137.9174	151.3999	165.0384	175.6040	(72)
Total internal gains	733.0027	730.5777	707.1327	659.8635	612.5789	572.1515	550.0450	554.6220	582.6306	627.7093	674.6495	714.2989	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				3.7400	13.0723		0.6300		0.7000		0.7700		14.9415 (74)
East				7.4600	24.4329		0.6300		0.7000		0.7700		55.7038 (76)
South				2.8300	54.9219		0.6300		0.7000		0.7700		47.5011 (78)
West				9.6800	24.4329		0.6300		0.7000		0.7700		72.2806 (80)
West				0.5400	32.4879		0.6300		0.7000		1.0000		6.9630 (82)
Solar gains	197.3901	324.9649	505.7488	738.0796	870.2443	962.3992	898.8515	785.3369	619.2954	403.1030	243.8022	160.3737	(83)
Total gains	930.3928	1055.5426	1212.8815	1397.9431	1482.8232	1534.5507	1448.8966	1339.9589	1201.9260	1030.8123	918.4517	874.6726	(84)

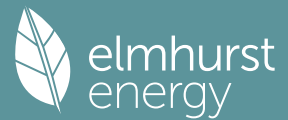
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	20.8438	20.9908	21.0373	21.0373	20.9908	21.1696	21.0827	21.2111	21.2111	21.1268	21.2111	21.0373	
alpha	2.3896	2.3994	2.4025	2.4025	2.3994	2.4113	2.4055	2.4141	2.4141	2.4085	2.4141	2.4025	
util living area	0.9144	0.8887	0.8286	0.7265	0.5875	0.4180	0.3102	0.3228	0.5516	0.7586	0.8773	0.9232	(86)
MIT	18.6041	18.8704	19.4647	20.0954	20.5992	20.8784	20.9577	20.9557	20.7458	20.1850	19.3280	18.5479	(87)
Th 2	19.9282	19.9349	19.9370	19.9370	19.9349	19.9430	19.9391	19.9448	19.9448	19.9410	19.9448	19.9370	(88)
util rest of house	0.9029	0.8743	0.8065	0.6918	0.5345	0.3472	0.2242	0.2317	0.4802	0.7175	0.8584	0.9127	(89)
MIT 2	17.1787	17.5125	18.2469	19.0023	19.5733	19.8597	19.9205	19.9259	19.7471	19.1343	18.0986	17.1144	(90)
Living area fraction	17.5563	17.8722	18.5695	19.2919	19.8450	20.1295	20.1952	20.1987	20.0117	19.4126	18.4242	17.4941	(91)
MIT	17.5563	17.8722	18.5695	19.2919	19.8450	20.1295	20.1952	20.1987	20.0117	19.4126	18.4242	17.4941	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5563	17.8722	18.5695	19.2919	19.8450	20.1295	20.1952	20.1987	20.0117	19.4126	18.4242	17.4941	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8687	0.8385	0.7722	0.6681	0.5297	0.3602	0.2456	0.2543	0.4851	0.6938	0.8236	0.8798	(94)
	808.1879	885.0485	936.6420	933.9843	785.3809	552.7219	355.8251	340.7938	583.0034	715.1881	756.4555	769.5213	(95)

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Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	1635.9953	1626.6329	1478.3763	1258.2978	926.2436	590.4908	365.9005	351.1186	665.0757	994.4231	1330.2654	1612.7902 (97)
Space heating kWh	615.8887	498.3448	403.0503	233.5057	104.8018	0.0000	0.0000	0.0000	0.0000	207.7509	413.1431	627.3921 (98a)
Space heating requirement - total per year (kWh/year)												3103.8775
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	615.8887	498.3448	403.0503	233.5057	104.8018	0.0000	0.0000	0.0000	0.0000	207.7509	413.1431	627.3921 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3103.8775
Space heating per m2										(98c) / (4) =		27.8900 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	615.8887	498.3448	403.0503	233.5057	104.8018	0.0000	0.0000	0.0000	0.0000	207.7509	413.1431	627.3921 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	246.4541	199.4177	161.2847	93.4397	41.9375	0.0000	0.0000	0.0000	0.0000	83.1336	165.3234	251.0572 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	314.6904	259.0509	229.3840	159.1616	119.7910	93.5253	92.7994	115.1702	155.9976	219.7278	272.2788	312.8226 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	179.7204	147.9445	131.0017	90.8975	68.4129	53.4125	52.9980	65.7740	89.0906	125.4870	155.4990	178.6537 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	29.3312	23.5305	21.1866	15.5222	11.9898	9.7958	10.9375	14.2170	18.4665	24.2290	27.3666	30.1464 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-46.2448	-62.0317	-92.3470	-108.0563	-112.7349	-104.8607	-102.4154	-97.4168	-86.4432	-74.2903	-51.7895	-38.7227 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1242.0478 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1338.8918 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												236.7193 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-977.3534 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												1920.3055 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1242.0478	26.0600	323.6777 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1338.8918	26.0600	348.9152 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	236.7193	26.0600	61.6890 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-977.3534	26.0600	-254.6983
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-254.6983 (252)
Total energy cost			500.4316 (255)

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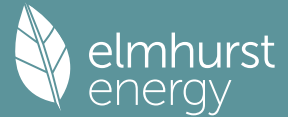
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1242.0478	0.1553	192.8453 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1338.8918	0.1458	195.2328 (264)
Space and water heating			388.0782 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	236.7193	0.1443	34.1659 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-977.3534	0.1346	-131.5688
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-131.5688 (269)
Total CO2, kg/year			301.7723 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1242.0478	1.5748	1956.0125 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1338.8918	1.5394	2061.0875 (278)
Space and water heating			4017.1000 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	236.7193	1.5338	363.0879 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-977.3534	1.4975	-1463.6118
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1463.6118 (283)
Total Primary energy kWh/year			3037.6001 (286)

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Property Reference	FURNERS LANE 27				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 27, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	78 C	DER	4.65	TER	9.37	
Environmental	96 A	% DER < TER				50.37
CO ₂ Emissions (t/year)	0.49	DFEE	40.63	TFEE	41.18	
Compliance Check	See BREL	% DFEE < TFEE				1.35
% DPER < TPER	1.20	DPER	48.82	TPER	49.41	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

2. Ventilation rate

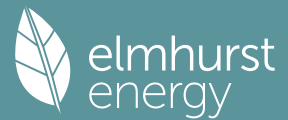
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1492 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3992 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500 (28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100 (29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200 (29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700 (29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400 (30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300 (30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000 (30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200 (30)
Total net area of external elements Aum(A, m ²)			311.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			50.0000			9.0000	450.0000 (32c)
Internal Floor 1			32.5700			18.0000	586.2600 (32d)
Internal Ceiling 1			32.5700			9.0000	293.1300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10252.2300 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.8642 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 80.2579 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591
Heat transfer coeff	132.7648	132.4433	132.1281	130.6480	130.3711	129.0819	129.0819	128.8432	129.5785	130.3711	130.9313	131.5170
Average = Sum(39)m / 12 =												130.6467

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1605	1.1577	1.1550	1.1420	1.1396	1.1283	1.1283	1.1263	1.1327	1.1396	1.1445	1.1496
HLP (average)												1.1420
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												151.2443 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Energy conte	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Energy content (annual)										Total = Sum(45)m =		2512.1698
Distribution loss (46)m = 0.15 x (45)m	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)

Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3183.0051 (64)

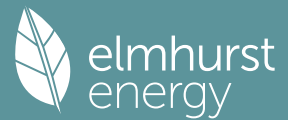
12Total per year (kWh/year)												3183 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453 (72)
Total internal gains	670.7790	686.4638	657.7369	634.4499	602.2809	577.7060	555.5062	556.7039	573.6539	596.2370	632.8311	656.8877 (73)

6. Solar gains

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[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	2.7000	10.6334	0.6300	0.7000	0.7700	8.7742 (74)	
East	3.6300	19.6403	0.6300	0.7000	0.7700	21.7884 (76)	
South	2.2000	46.7521	0.6300	0.7000	0.7700	31.4337 (78)	
West	8.7300	19.6403	0.6300	0.7000	0.7700	52.4003 (80)	
West	0.5400	25.9287	0.6300	0.7000	1.0000	5.5572 (82)	

Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274 (83)
Total gains	790.7327	910.9592	1009.7554	1131.5543	1204.3880	1192.6353	1141.4185	1063.4749	976.7485	857.2885	780.3925	756.9152 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538
alpha	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436
util living area	0.9459	0.9236	0.8883	0.8173	0.7130	0.5734	0.4487	0.4904	0.6793	0.8500	0.9242	0.9508 (86)
MIT	18.2174	18.5524	19.0664	19.7490	20.3250	20.7274	20.8930	20.8636	20.5588	19.8029	18.9068	18.1671 (87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605 (88)
util rest of house	0.9386	0.9134	0.8730	0.7914	0.6703	0.5066	0.3593	0.4008	0.6185	0.8229	0.9123	0.9441 (89)
MIT 2	16.7053	17.1277	17.7732	18.6199	19.3057	19.7566	19.9140	19.8933	19.5887	18.7051	17.5875	16.6465 (90)
Living area fraction									fLA = Living area / (4) =			0.2213 (91)
MIT	17.0400	17.4431	18.0594	18.8698	19.5313	19.9715	20.1307	20.1081	19.8034	18.9481	17.8795	16.9831 (92)
Temperature adjustment												0.0000
adjusted MIT	17.0400	17.4431	18.0594	18.8698	19.5313	19.9715	20.1307	20.1081	19.8034	18.9481	17.8795	16.9831 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9094	0.8801	0.8371	0.7585	0.6500	0.5062	0.3734	0.4128	0.6072	0.7897	0.8797	0.9164 (94)
Useful gains	719.0944	801.7306	845.2559	858.2879	782.8009	603.7177	426.2007	438.9988	593.0586	676.9788	686.5404	693.6583 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1691.4190	1661.2445	1527.3213	1302.5364	1020.9766	693.3577	455.7511	477.7602	739.0377	1088.3531	1411.3693	1681.1922 (97)
Space heating kWh	723.4095	577.5934	507.4567	319.8589	177.2027	0.0000	0.0000	0.0000	0.0000	306.0625	521.8768	734.7252 (98a)
Space heating requirement - total per year (kWh/year)												3868.1856
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	723.4095	577.5934	507.4567	319.8589	177.2027	0.0000	0.0000	0.0000	0.0000	306.0625	521.8768	734.7252 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3868.1856
Space heating per m2										(98c) / (4) =		33.8128 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	723.4095	577.5934	507.4567	319.8589	177.2027	0.0000	0.0000	0.0000	0.0000	306.0625	521.8768	734.7252 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	289.4796	231.1298	203.0639	127.9948	70.9094	0.0000	0.0000	0.0000	0.0000	122.4740	208.8343	294.0077 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1547.8934	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1817.8213	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.8419	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3617.5566	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1547.8934	0.1544	239.0117	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1817.8213	0.1410	256.2660	(264)
Space and water heating			495.2777	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Total CO2, kg/year			531.6263	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1547.8934	1.5717	2432.7675	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1817.8213	1.5213	2765.4070	(278)
Space and water heating			5198.1746	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	251.8419	1.5338	386.2835	(282)
Total Primary energy kWh/year			5584.4580	(286)
Dwelling Primary energy Rate (DPER)			48.8200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

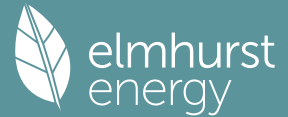
	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920	(1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	268.0460 (5)

2. Ventilation rate

	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1492 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3992	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

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Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0200	1.0000	2.0200			(26)
TER Opening Type (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
Rooflight W			0.5400	1.4151	0.7642			(27a)
Ground Floor			81.8300	0.1300	10.6379			(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442			(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484			(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214			(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186			(30)
Joists FF	18.7700		18.7700	0.1100	2.0647			(30)
Rafters	17.9400	0.5400	17.4000	0.1100	1.9140			(30)
D Flat	1.7800		1.7800	0.1100	0.1958			(30)
Total net area of external elements Aum(A, m2)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.7925			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0800	0.0440
R2 Sill of roof window	0.5500	0.0600	0.0330
R3 Jamb of roof window	1.9600	0.0800	0.1568

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.9034 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 81.6959 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591 (38)
Average = Sum(39)m / 12 =	134.2028	133.8813	133.5662	132.0860	131.8091	130.5199	130.5199	130.2812	131.0165	131.8091	132.3693	132.9550 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1731	1.1703	1.1675	1.1546	1.1522	1.1409	1.1409	1.1388	1.1452	1.1522	1.1571	1.1622 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

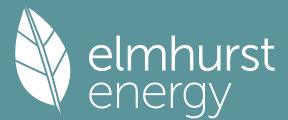
Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers												
Hot water usage for baths												
Hot water usage for other uses												
Average daily hot water use (litres/day)												134.6910 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	146.5267	143.3978	139.5874	133.7935	129.0883	124.0300	122.0861	125.8800	129.8813	135.1917	141.0749	146.1468 (44)
Energy conte	232.0625	204.1966	214.5407	183.1566	173.7777	152.5093	147.6526	155.8658	160.1566	183.4539	200.9871	228.8305 (45)
Energy content (annual)										Total = Sum(45)m =		2237.1898
Distribution loss (46)m = 0.15 x (45)m	34.8094	30.6295	32.1811	27.4735	26.0667	22.8764	22.1479	23.3799	24.0235	27.5181	30.1481	34.3246 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)

If cylinder contains dedicated solar storage												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
WWHRS	286.9693	253.7898	269.4475	236.2922	228.6845	205.6449	202.5594	210.7726	213.2922	238.3607	254.1227	283.7373 (62)
PV diverter	-32.8319	-29.0368	-30.4057	-25.1771	-23.4642	-20.0784	-18.8203	-20.0135	-20.7739	-24.4902	-27.7444	-32.2239 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	254.1374	224.7530	239.0418	211.1151	205.2203	185.5665	183.7390	190.7590	192.5183	213.8705	226.3783	251.5134 (64)
Total per year (kWh/year)												2578.6125 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)

Heat gains from water heating, kWh/month	121.0862	107.5699	115.2602	103.4080	101.7065	93.2178	93.0199	95.7508	95.7606	104.9238	109.3367	120.0116 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	162.7503	160.0743	154.9196	143.6223	136.7023	129.4692	125.0268	128.6973	133.0008	141.0267	151.8565	161.3059 (72)
Total internal gains	655.8471	671.7797	643.6359	621.7702	590.4407	566.7573	545.1678	545.9564	562.4151	584.0093	619.2487	642.1484 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				2.7000	10.6334	0.6300	0.7000	0.7700	8.7742 (74)			
East				3.6300	19.6403	0.6300	0.7000	0.7700	21.7884 (76)			
South				2.2000	46.7521	0.6300	0.7000	0.7700	31.4337 (78)			
West				8.7300	19.6403	0.6300	0.7000	0.7700	52.4003 (80)			
West				0.5400	25.9287	0.6300	0.7000	1.0000	5.5572 (82)			
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	403.0945	261.0515	147.5615	100.0274 (83)	
Total gains	775.8008	896.2752	995.6544	1118.8745	1192.5477	1181.6866	1131.0801	1052.7274	965.5096	845.0608	766.8101	742.1758 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.2204	21.2714	21.3216	21.5605	21.6058	21.8192	21.8192	21.8592	21.7365	21.6058	21.5144	21.4196
alpha	2.4147	2.4181	2.4214	2.4374	2.4404	2.4546	2.4546	2.4573	2.4491	2.4404	2.4343	2.4280
util living area	0.9482	0.9263	0.8919	0.8220	0.7190	0.5803	0.4553	0.4976	0.6864	0.8547	0.9271	0.9529 (86)
MIT	18.1616	18.4991	19.0190	19.7121	20.3002	20.7145	20.8870	20.8560	20.5404	19.7679	18.8590	18.1109 (87)
Th 2	19.9416	19.9438	19.9461	19.9565	19.9584	19.9676	19.9676	19.9693	19.9641	19.9584	19.9545	19.9504 (88)
util rest of house	0.9410	0.9164	0.8768	0.7963	0.6763	0.5128	0.3643	0.4065	0.6254	0.8281	0.9156	0.9464 (89)
MIT 2	16.6297	17.0556	17.7089	18.5696	19.2710	19.7360	19.9004	19.8785	19.5621	18.6573	17.5225	16.5704 (90)
Living area fraction	16.9688	17.3751	17.9988	18.8224	19.4988	19.9526	20.1187	20.0948	19.7786	18.9031	17.8183	16.9113 (91)
MIT	16.9688	17.3751	17.9988	18.8224	19.4988	19.9526	20.1187	20.0948	19.7786	18.9031	17.8183	16.9113 (92)
Temperature adjustment	16.9688	17.3751	17.9988	18.8224	19.4988	19.9526	20.1187	20.0948	19.7786	18.9031	17.8183	16.9113 (93)
adjusted MIT	16.9688	17.3751	17.9988	18.8224	19.4988	19.9526	20.1187	20.0948	19.7786	18.9031	17.8183	16.9113 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9122	0.8832	0.8407	0.7628	0.6550	0.5118	0.3784	0.4184	0.6131	0.7942	0.8831	0.9191 (94)
Useful gains	707.6953	791.6131	837.0579	853.4406	781.1534	604.7380	428.0209	440.4376	591.9515	671.1862	677.1846	682.1568 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1700.1848	1670.1800	1535.8565	1310.6142	1027.9538	698.6200	459.2635	481.3671	743.9931	1094.4266	1418.7786	1690.0354 (97)
Space heating kWh	738.4122	590.3970	519.9062	329.1650	183.6195	0.0000	0.0000	0.0000	0.0000	314.8909	533.9477	749.8616 (98a)
Space heating requirement - total per year (kWh/year)												3960.2000
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	738.4122	590.3970	519.9062	329.1650	183.6195	0.0000	0.0000	0.0000	0.0000	314.8909	533.9477	749.8616 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3960.2000
Space heating per m ²												34.6171 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	738.4122	590.3970	519.9062	329.1650	183.6195	0.0000	0.0000	0.0000	0.0000	314.8909	533.9477	749.8616 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	800.0132	639.6500	563.2786	356.6251	198.9377	0.0000	0.0000	0.0000	0.0000	341.1603	578.4915	812.4178 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating
Water heating requirement

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Efficiency of water heater (217)m	254.1374	224.7530	239.0418	211.1151	205.2203	185.5665	183.7390	190.7590	192.5183	213.8705	226.3783	251.5134 (64)
Fuel for water heating, kWh/month	86.3077	86.1219	85.7538	85.0518	83.8113	79.8000	79.8000	79.8000	79.8000	84.9259	85.9150	79.8000 (216)
Space cooling fuel requirement (221)m	294.4552	260.9706	278.7535	248.2194	244.8601	232.5394	230.2494	239.0464	241.2510	251.8319	263.4910	86.3538 (217)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	291.2591 (219)
Lighting	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	0.0000 (221)
Electricity generated by PVs (Appendix M) (negative quantity)	30.4985	24.4670	22.0298	16.1400	12.4670	10.1856	11.3728	14.7828	19.2014	25.1933	28.4558	7.3041 (231)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-66.9766	-89.9167	-123.1181	-131.6124	-136.3731	-125.2777	-123.6217	-119.2822	-111.0057	-99.3793	-71.9660	31.3461 (232)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year	-52.8387	-109.0157	-212.9079	-314.5272	-411.0160	-411.3088	-406.5457	-346.4762	-256.9499	-154.1854	-69.9564	4290.5742 (211)
Space heating fuel - main system 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel - main system 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel - secondary	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	79.8000
Efficiency of water heater	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3076.9270 (219)
Water heating fuel used	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Space cooling fuel												
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												246.1401 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-4044.6528 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3654.9885 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4290.5742	0.2100	901.0206 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3076.9270	0.2100	646.1547 (264)
Space and water heating			1547.1753 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	246.1401	0.1443	35.5256 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1256.9694	0.1357	-170.5285
PV Unit electricity exported	-2787.6833	0.1264	-352.3251
Total			-522.8537 (269)
Total CO2, kg/year			1071.7765 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.3700 (273)

13a. Primary energy - Individual heating systems including micro-CHP

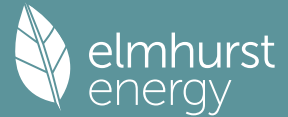
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4290.5742	1.1300	4848.3488 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3076.9270	1.1300	3476.9275 (278)
Space and water heating			8325.2764 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	246.1401	1.5338	377.5379 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1256.9694	1.5015	-1887.2887
PV Unit electricity exported	-2787.6833	0.4639	-1293.3356
Total			-3180.6243 (283)
Total Primary energy kWh/year			5652.2907 (286)
Target Primary Energy Rate (TPER)			49.4100 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

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2. Ventilation rate

												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												40.0000 / (5) =	0.1492 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000 (17)	
Infiltration rate												0.3992 (18)	
Number of sides sheltered												2 (19)	
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.3393 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)	
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)	

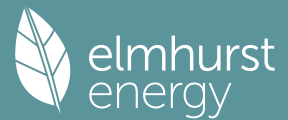
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)					
Solid Doors			2.0200	1.0000	2.0200			(26)					
Rooflight W			0.5400	1.1450	0.6183			(27a)					
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)					
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)					
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)					
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)					
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)					
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)					
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)					
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)					
Total net area of external elements Aum(A, m2)			311.1600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)					
GF			100.0000			9.0000	900.0000	(32c)					
FF			50.0000			9.0000	450.0000	(32c)					
Internal Floor 1			32.5700			18.0000	586.2600	(32d)					
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10252.2300	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.6174	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E16 Corner (normal)				14.4000	0.0900	1.2960							
E10 Eaves (insulation at ceiling level)				38.6100	0.0600	2.3166							
E17 Corner (inverted - internal area greater than external area)				4.8000	-0.0900	-0.4320							
R8 Roof to wall (rafter)				22.5600	0.0600	1.3536							
R6 Flat ceiling				30.0000	0.0600	1.8000							
E13 Gable (insulation at rafter level)				2.6000	0.0800	0.2080							
E12 Gable (insulation at ceiling level)				3.3000	0.0600	0.1980							
E2 Other lintels (including other steel lintels)				13.3100	0.0500	0.6655							
E3 Sill				12.3500	0.0500	0.6175							
E4 Jamb				32.9600	0.0500	1.6480							
E5 Ground floor (normal)				43.7400	0.1600	6.9984							
E6 Intermediate floor within a dwelling				27.3400	0.0000	0.0000							
R1 Head of roof window				0.5500	0.0600	0.0330							
R2 Sill of roof window				0.5500	0.0800	0.0440							
R3 Jamb of roof window				1.9600	0.0600	0.1176							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.8642	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	80.2579	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 52.5069	Feb 52.1854	Mar 51.8703	Apr 50.3901	May 50.1132	Jun 48.8240	Jul 48.8240	Aug 48.5853	Sep 49.3206	Oct 50.1132	Nov 50.6734	Dec 51.2591	(38)
Heat transfer coeff	132.7648	132.4433	132.1281	130.6480	130.3711	129.0819	129.0819	128.8432	129.5785	130.3711	130.9313	131.5170	(39)
Average = Sum(39)m / 12 =												130.6467	
HLP	Jan 1.1605	Feb 1.1577	Mar 1.1550	Apr 1.1420	May 1.1396	Jun 1.1283	Jul 1.1283	Aug 1.1263	Sep 1.1327	Oct 1.1396	Nov 1.1445	Dec 1.1496	(40)
HLP (average)												1.1420	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8388 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022	(42b)

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Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												68.4778 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	74.7093	72.6597	70.4220	67.6372	65.1527	62.5708	62.0345	64.2676	66.5579	69.2094	72.0189	74.6045 (44)
Distribution loss (46)m = 0.15 x (45)m	118.3213	103.4664	108.2360	92.5919	87.7080	76.9380	75.0254	79.5768	82.0726	93.9165	102.6041	116.8127 (45)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908 (64)
12Total per year (kWh/year)												966.6793 (64)
Electric shower(s)	57.5138	51.2452	55.9578	53.3999	54.4019	51.8941	53.6239	54.4019	53.3999	55.9578	54.9056	57.5138 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												654.2157 (64a)
Heat gains from water heating, kWh/month	39.5217	34.7979	36.9896	33.0257	32.2384	29.3229	29.3489	30.5105	30.7904	33.9467	35.5298	39.2011 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	53.1206	51.7826	49.7172	45.8691	43.3312	40.7262	39.4474	41.0088	42.7644	45.6273	49.3469	52.6897 (72)
Total internal gains	543.2174	560.4880	535.4334	521.0170	494.0696	478.0143	459.5884	458.2678	472.1787	485.6099	513.7391	530.5322 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.7000	10.6334		0.6300		0.7000		0.7700		8.7742 (74)
East				3.6300	19.6403		0.6300		0.7000		0.7700		21.7884 (76)
South				2.2000	46.7521		0.6300		0.7000		0.7700		31.4337 (78)
West				8.7300	19.6403		0.6300		0.7000		0.7700		52.4003 (80)
West				0.5400	25.9287		0.6300		0.7000		1.0000		5.5572 (82)
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274	(83)
Total gains	663.1711	784.9835	887.4519	1018.1213	1096.1766	1092.9436	1045.5008	965.0388	875.2733	746.6614	661.3005	630.5596	(84)

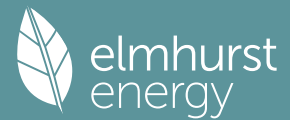
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538
util living area	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436
	0.9621	0.9426	0.9114	0.8452	0.7455	0.6072	0.4808	0.5272	0.7189	0.8811	0.9450	0.9662 (86)
MIT	18.0092	18.3602	18.8991	19.6263	20.2457	20.6885	20.8749	20.8391	20.4933	19.6678	18.7234	17.9570 (87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605 (88)
util rest of house	0.9567	0.9346	0.8986	0.8218	0.7047	0.5399	0.3876	0.4344	0.6602	0.8581	0.9360	0.9614 (89)
MIT 2	17.2178	17.5649	18.0954	18.8051	19.3855	19.7784	19.9188	19.8989	19.6235	18.8602	17.9349	17.1718 (90)
Living area fraction	17.3929	17.7409	18.2733	18.9868	19.5759	19.9798	20.1304	20.1070	19.8160	19.0390	18.1094	17.3456 (91)
MIT	17.3929	17.7409	18.2733	18.9868	19.5759	19.9798	20.1304	20.1070	19.8160	19.0390	18.1094	17.3456 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3929	17.7409	18.2733	18.9868	19.5759	19.9798	20.1304	20.1070	19.8160	19.0390	18.1094	17.3456 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9383	0.9117	0.8720	0.7952	0.6871	0.5401	0.4024	0.4469	0.6500	0.8320	0.9139	0.9442 (94)
Ext temp.	622.2222	715.7074	773.8709	809.6424	753.1692	590.2905	420.7135	431.2384	568.8904	621.2122	604.3824	595.4040 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1738.2825	1700.6914	1555.5830	1317.8235	1026.7900	694.4341	455.7106	477.6194	740.6733	1100.1995	1441.4735	1728.8658 (97)

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830.3489	661.9093	581.5939	365.8904	203.5738	0.0000	0.0000	0.0000	0.0000	356.3665	602.7056	843.2956 (98a)
Space heating requirement - total per year (kWh/year)											4445.6840
Solar heating kWh											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)	
Solar heating contribution - total per year (kWh/year)											0.0000
830.3489	661.9093	581.5939	365.8904	203.5738	0.0000	0.0000	0.0000	0.0000	356.3665	602.7056	843.2956 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											4445.6840
Space heating per m2											(98c) / (4) = 38.8609 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1213.3698	955.2060	979.2080	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7097	0.7756	0.7410	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	861.1693	740.8508	725.5704	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1206.0734	1153.9537	1063.8177	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	248.3310	307.3486	251.6560	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	62.0827	76.8371	62.9140	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												201.8339 (107)
Energy for space heating												38.8609 (99)
Energy for space cooling												1.7643 (108)
Total												40.6252 (109)
Fabric Energy Efficiency (DFEE)												40.6 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 268.0460 (5)

2. Ventilation rate

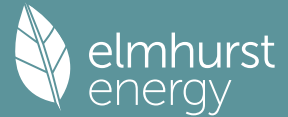
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1492 (8)
Pressure Test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3992 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.0200	1.0000	2.0200		(26)
TER Opening Type (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Rooflight W			0.5400	1.4151	0.7642		(27a)
Ground Floor			81.8300	0.1300	10.6379		(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442		(29a)

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Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	(30)
Rafters	17.9400	0.5400	17.4000	0.1100	1.9140	(30)
D Flat	1.7800		1.7800	0.1100	0.1958	(30)
Total net area of external elements Aum(A, m2)			311.1600			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	64.7925		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	14.4000	0.0900	1.2960
E16 Corner (normal)	38.6100	0.0600	2.3166
E10 Eaves (insulation at ceiling level)	4.8000	-0.0900	-0.4320
E17 Corner (inverted - internal area greater than external area)	22.5600	0.0600	1.3536
R8 Roof to wall (rafter)	30.0000	0.0600	1.8000
R6 Flat ceiling	2.6000	0.0800	0.2080
E13 Gable (insulation at rafter level)	3.3000	0.0600	0.1980
E12 Gable (insulation at ceiling level)	13.3100	0.0500	0.6655
E2 Other lintels (including other steel lintels)	12.3500	0.0500	0.6175
E3 Sill	32.9600	0.0500	1.6480
E4 Jamb	43.7400	0.1600	6.9984
E5 Ground floor (normal)	27.3400	0.0000	0.0000
E6 Intermediate floor within a dwelling	0.5500	0.0800	0.0440
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	1.9600	0.0800	0.1568
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.9034 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 81.6959 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591 (38)
Heat transfer coeff	134.2028	133.8813	133.5662	132.0860	131.8091	130.5199	130.5199	130.2812	131.0165	131.8091	132.3693	132.9550 (39)
Average = Sum(39)m / 12 =												132.0847

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1731	1.1703	1.1675	1.1546	1.1522	1.1409	1.1409	1.1388	1.1452	1.1522	1.1571	1.1622 (40)
HLP (average)												1.1546
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												68.4778 (43)
Daily hot water use	74.7093	72.6597	70.4220	67.6372	65.1527	62.5708	62.0345	64.2676	66.5579	69.2094	72.0189	74.6045 (44)
Energy content (annual)	118.3213	103.4664	108.2360	92.5919	87.7080	76.9380	75.0254	79.5768	82.0726	93.9165	102.6041	116.8127 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908 (64)
12Total per year (kWh/year)												966.6793 (64)
Electric shower(s)	57.5138	51.2452	55.9578	53.3999	54.4019	51.8941	53.6239	54.4019	53.3999	55.9578	54.9056	57.5138 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												654.2157 (64a)
Heat gains from water heating, kWh/month	39.5217	34.7979	36.9896	33.0257	32.2384	29.3229	29.3489	30.5105	30.7904	33.9467	35.5298	39.2011 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	53.1206	51.7826	49.7172	45.8691	43.3312	40.7262	39.4474	41.0088	42.7644	45.6273	49.3469	52.6897 (72)
Total internal gains	543.2174	560.4880	535.4334	521.0170	494.0696	478.0143	459.5884	458.2678	472.1787	485.6099	513.7391	530.5322 (73)

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6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	2.7000		10.6334		0.6300		0.7000		0.7700		8.7742	(74)
East	3.6300		19.6403		0.6300		0.7000		0.7700		21.7884	(76)
South	2.2000		46.7521		0.6300		0.7000		0.7700		31.4337	(78)
West	8.7300		19.6403		0.6300		0.7000		0.7700		52.4003	(80)
West	0.5400		25.9287		0.6300		0.7000		1.0000		5.5572	(82)
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274 (83)
Total gains	663.1711	784.9835	887.4519	1018.1213	1096.1766	1092.9436	1045.5008	965.0388	875.2733	746.6614	661.3005	630.5596 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.2204	21.2714	21.3216	21.5605	21.6058	21.8192	21.8192	21.8592	21.7365	21.6058	21.5144	21.4196
alpha	2.4147	2.4181	2.4214	2.4374	2.4404	2.4546	2.4546	2.4573	2.4491	2.4404	2.4343	2.4280
util living area	0.9622	0.9429	0.9120	0.8465	0.7478	0.6103	0.4842	0.5306	0.7214	0.8820	0.9453	0.9663 (86)
MIT	17.9779	18.3291	18.8704	19.6022	20.2285	20.6790	20.8701	20.8334	20.4809	19.6469	18.6963	17.9255 (87)
Th 2	19.9416	19.9438	19.9461	19.9565	19.9584	19.9676	19.9676	19.9693	19.9641	19.9584	19.9545	19.9504 (88)
util rest of house	0.9568	0.9349	0.8992	0.8231	0.7069	0.5426	0.3898	0.4367	0.6625	0.8590	0.9363	0.9615 (89)
MIT 2	17.1805	17.5279	18.0609	18.7752	19.3625	19.7624	19.9066	19.8861	19.6052	18.8335	17.9019	17.1343 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.3570	17.7052	18.2401	18.9582	19.5542	19.9652	20.1198	20.0958	19.7990	19.0136	18.0778	17.3094 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.3570	17.7052	18.2401	18.9582	19.5542	19.9652	20.1198	20.0958	19.7990	19.0136	18.0778	17.3094 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9383	0.9119	0.8724	0.7962	0.6888	0.5424	0.4047	0.4492	0.6518	0.8327	0.9141	0.9442 (94)
Useful gains	622.2291	715.8336	774.2453	810.6483	755.0344	592.8259	423.0718	433.4473	570.4914	621.7221	604.4764	595.3940 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1752.2856	1714.3813	1568.0762	1328.5512	1035.2512	700.2707	459.4101	481.4899	746.6623	1108.9829	1453.1186	1742.9591 (97)
Space heating kWh	840.7621	671.0240	590.6102	372.8901	208.4813	0.0000	0.0000	0.0000	0.0000	362.5220	611.0224	853.7885 (98a)
Space heating requirement - total per year (kWh/year)												4511.1006
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	840.7621	671.0240	590.6102	372.8901	208.4813	0.0000	0.0000	0.0000	0.0000	362.5220	611.0224	853.7885 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4511.1006
Space heating per m2												(98c) / (4) = 39.4327 (99)

8c. Space cooling requirement

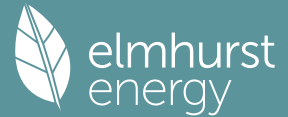
Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1226.8873	965.8475	990.1371	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7044	0.7706	0.7358	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	864.2544	744.3244	728.5349	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1206.0734	1153.9537	1063.8177	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	246.1097	304.7642	249.4504	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	61.5274	76.1911	62.3626	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												200.0811 (107)
Energy for space heating												39.4327 (99)
Energy for space cooling												1.7490 (108)
Total												41.1817 (109)
Fabric Energy Efficiency (TFEE)												41.2 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)

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Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 268.0460 (5)

2. Ventilation rate

												m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												4 * 10 = 40.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) = 0.1492 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0000 (17)
Infiltration rate												0.3992 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3393 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infiltr rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

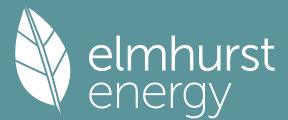
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)				
Solid Doors			2.0200	1.0000	2.0200			(26)				
Rooflight W			0.5400	1.1450	0.6183			(27a)				
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)				
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)				
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)				
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)				
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)				
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)				
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)				
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)				
Total net area of external elements Aum(A, m2)			311.1600					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)				
GF			100.0000			9.0000	900.0000	(32c)				
FF			50.0000			9.0000	450.0000	(32c)				
Internal Floor 1			32.5700			18.0000	586.2600	(32d)				
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)				
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10252.2300	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.6174	(35)				
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E16 Corner (normal)				14.4000	0.0900	1.2960						
E10 Eaves (insulation at ceiling level)				38.6100	0.0600	2.3166						
E17 Corner (inverted - internal area greater than external area)				4.8000	-0.0900	-0.4320						
R8 Roof to wall (rafter)				22.5600	0.0600	1.3536						
R6 Flat ceiling				30.0000	0.0600	1.8000						
E13 Gable (insulation at rafter level)				2.6000	0.0800	0.2080						
E12 Gable (insulation at ceiling level)				3.3000	0.0600	0.1980						
E2 Other lintels (including other steel lintels)				13.3100	0.0500	0.6655						
E3 Sill				12.3500	0.0500	0.6175						
E4 Jamb				32.9600	0.0500	1.6480						
E5 Ground floor (normal)				43.7400	0.1600	6.9984						
E6 Intermediate floor within a dwelling				27.3400	0.0000	0.0000						
R1 Head of roof window				0.5500	0.0600	0.0330						
R2 Sill of roof window				0.5500	0.0800	0.0440						
R3 Jamb of roof window				1.9600	0.0600	0.1176						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.8642	(36)				
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	80.2579	(37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.5069	Feb 52.1854	Mar 51.8703	Apr 50.3901	May 50.1132	Jun 48.8240	Jul 48.8240	Aug 48.5853	Sep 49.3206	Oct 50.1132	Nov 50.6734	Dec 51.2591 (38)
Heat transfer coeff	132.7648	132.4433	132.1281	130.6480	130.3711	129.0819	129.0819	128.8432	129.5785	130.3711	130.9313	131.5170 (39)
Average = Sum(39)m / 12 =												130.6467
HLP	Jan 1.1605	Feb 1.1577	Mar 1.1550	Apr 1.1420	May 1.1396	Jun 1.1283	Jul 1.1283	Aug 1.1263	Sep 1.1327	Oct 1.1396	Nov 1.1445	Dec 1.1496 (40)
HLP (average)												1.1420
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses												

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	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												151.2443 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy conte	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Energy content (annual)	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2512.1698
Water storage loss:	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage												
Primary loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
WWHRS	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
										Total per year (kWh/year) = Sum(64)m =		3183.0051 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month	132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	(71)
Water heating gains (Table 5)	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453	(72)
Total internal gains	742.5067	739.8983	717.4078	675.3570	633.5455	592.7733	570.4214	574.1857	595.7333	637.0802	683.3167	723.5706	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.7000	10.6334		0.6300		0.7000		0.7700		8.7742 (74)
East				3.6300	19.6403		0.6300		0.7000		0.7700		21.7884 (76)
South				2.2000	46.7521		0.6300		0.7000		0.7700		31.4337 (78)
West				8.7300	19.6403		0.6300		0.7000		0.7700		52.4003 (80)
West				0.5400	25.9287		0.6300		0.7000		1.0000		5.5572 (82)
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274	(83)
Total gains	862.4605	964.3937	1069.4263	1172.4613	1235.6526	1207.7026	1156.3338	1080.9567	998.8279	898.1317	830.8782	823.5981	(84)

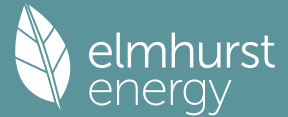
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538	
alpha	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436	
util living area	0.9359	0.9150	0.8767	0.8072	0.7039	0.5686	0.4440	0.4843	0.6710	0.8383	0.9147	0.9418	(86)
MIT	18.3296	18.6303	19.1433	19.7902	20.3460	20.7327	20.8955	20.8674	20.5717	19.8492	18.9807	18.2735	(87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605	(88)
util rest of house	0.9274	0.9039	0.8602	0.7805	0.6608	0.5019	0.3552	0.3953	0.6099	0.8099	0.9017	0.9341	(89)
MIT 2	16.8455	17.2242	17.8666	18.6679	19.3281	19.7613	19.9157	19.8960	19.6011	18.7589	17.6785	16.7800	(90)
Living area fraction									fLA = Living area / (4) =			0.2213	(91)
MIT	17.1740	17.5354	18.1492	18.9163	19.5534	19.9763	20.1325	20.1110	19.8159	19.0002	17.9667	17.1105	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1740	17.5354	18.1492	18.9163	19.5534	19.9763	20.1325	20.1110	19.8159	19.0002	17.9667	17.1105	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8961	0.8695	0.8240	0.7483	0.6413	0.5018	0.3694	0.4075	0.5994	0.7772	0.8680	0.9042	(94)
	772.8100	838.5641	881.1865	877.3598	792.4532	606.0310	427.1333	440.4660	598.6996	698.0558	721.1934	744.6743	(95)

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Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1709.2105	1673.4758	1539.1878	1308.6125	1023.8555	693.9816	455.9854	478.1349	740.6626	1095.1406	1422.7878	1697.9564 (97)
Space heating kWh	696.6820	561.0607	489.5530	310.5020	172.1633	0.0000	0.0000	0.0000	0.0000	295.4311	505.1480	709.2419 (98a)
Space heating requirement - total per year (kWh/year)												3739.7819
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	696.6820	561.0607	489.5530	310.5020	172.1633	0.0000	0.0000	0.0000	0.0000	295.4311	505.1480	709.2419 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3739.7819
Space heating per m2										(98c) / (4) =		32.6904 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	696.6820	561.0607	489.5530	310.5020	172.1633	0.0000	0.0000	0.0000	0.0000	295.4311	505.1480	709.2419 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	278.7843	224.5141	195.8995	124.2505	68.8929	0.0000	0.0000	0.0000	0.0000	118.2197	202.1400	283.8103 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1496.5114 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1817.8213 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												251.8419 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3566.1746 (238)

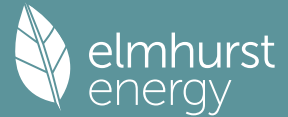
10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1496.5114	16.4900	246.7747 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1817.8213	16.4900	299.7587 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	251.8419	16.4900	41.5287 (250)
Additional standing charges			0.0000 (251)
Total energy cost			588.0622 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.3281 (257)

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SAP value
SAP rating (Section 12)
SAP band

78.4712
78 (258)
C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year	
Space heating - main system 1	1496.5114	0.1544	231.0605	(261)
Total CO ₂ associated with community systems			0.0000	(373)
Water heating (other fuel)	1817.8213	0.1410	256.2660	(264)
Space and water heating			487.3265	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Total CO ₂ , kg/year			523.6751	(272)
CO ₂ emissions per m ²			4.5800	(273)
EI value			95.5977	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920	(1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460	(5)

2. Ventilation rate

	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

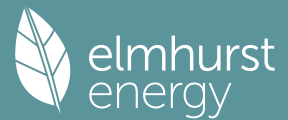
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1492 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3992	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate	0.3054	0.2800	0.2715	0.2715	0.2800	0.2460	0.2630	0.2375	0.2375	0.2545	0.2375	0.2715	(22b)
Effective ac	0.5466	0.5392	0.5368	0.5368	0.5392	0.5303	0.5346	0.5282	0.5282	0.5324	0.5282	0.5368	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Windows (U _w = 1.20)			17.2600	1.1450	19.7634			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight W			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)
Total net area of external elements A _{um} (A, m ²)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			50.0000			9.0000	450.0000	(32c)
Internal Floor 1			32.5700			18.0000	586.2600	(32d)
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)
Heat capacity C _m = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	10252.2300 (34)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K								89.6174 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.8642 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss		(33) + (36) + (36a) =	80.2579 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.3529	47.6940	47.4871	47.4871	47.6940	46.9046	47.2866	46.7232	46.7232	47.0924	46.7232	47.4871	(38)
Heat transfer coeff	128.6108	127.9519	127.7450	127.7450	127.9519	127.1625	127.5445	126.9810	126.9810	127.3503	126.9810	127.7450	(39)
Average = Sum(39)m / 12 =												127.5625	
HLP	1.1242	1.1185	1.1167	1.1167	1.1185	1.1116	1.1149	1.1100	1.1100	1.1132	1.1100	1.1167	(40)
HLP (average)												1.1151	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8388 (42)
Hot water usage for mixer showers													
89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278	(42a)	
Hot water usage for baths													
31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022	(42b)	
Hot water usage for other uses													
43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023	(42c)	
Average daily hot water use (litres/day)												151.2443	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323	(44)	
Energy content (annual)	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2512.1698	
39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252	(46)	
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)	
If cylinder contains dedicated solar storage													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100	(64)	
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Heat gains from water heating, kWh/month													
132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777	(65)	

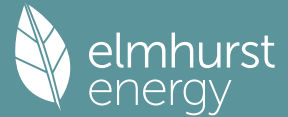
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)												
	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453 (72)
Total internal gains												
	742.5067	739.8983	717.4078	675.3570	633.5455	592.7733	570.4214	574.1857	595.7333	637.0802	683.3167	723.5706 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains

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	m2	Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	W
North	2.7000	13.0723	0.6300	0.7000	0.7700	10.7867 (74)
East	3.6300	24.4329	0.6300	0.7000	0.7700	27.1052 (76)
South	2.2000	54.9219	0.6300	0.7000	0.7700	36.9267 (78)
West	8.7300	24.4329	0.6300	0.7000	0.7700	65.1869 (80)
West	0.5400	32.4879	0.6300	0.7000	1.0000	6.9630 (82)

Solar gains	146.9685	241.5909	375.2790	546.8309	644.2318	712.2608	665.3036	581.6162	459.2161	299.4584	181.4444	119.4609 (83)
Total gains	889.4752	981.4892	1092.6868	1222.1879	1277.7773	1305.0342	1235.7250	1155.8019	1054.9495	936.5386	864.7611	843.0315 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.1431	22.2571	22.2932	22.2932	22.2571	22.3953	22.3282	22.4273	22.4273	22.3623	22.4273	22.2932
alpha	2.4762	2.4838	2.4862	2.4862	2.4838	2.4930	2.4885	2.4952	2.4952	2.4908	2.4952	2.4862
util living area	0.9229	0.9037	0.8556	0.7697	0.6399	0.4699	0.3510	0.3619	0.5975	0.7882	0.8911	0.9302 (86)
MIT	18.6752	18.8910	19.4307	20.0322	20.5545	20.8584	20.9511	20.9496	20.7217	20.1646	19.3504	18.6242 (87)
Th 2	19.9811	19.9858	19.9873	19.9873	19.9858	19.9914	19.9887	19.9927	19.9927	19.9901	19.9927	19.9873 (88)
util rest of house	0.9126	0.8911	0.8363	0.7385	0.5890	0.3968	0.2598	0.2659	0.5276	0.7508	0.8742	0.9207 (89)
MIT 2	17.2981	17.5695	18.2412	18.9707	19.5739	19.8910	19.9661	19.9700	19.7696	19.1496	18.1565	17.2385 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.6029	17.8620	18.5044	19.2057	19.7909	20.1051	20.1841	20.1868	19.9803	19.3742	18.4208	17.5452 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6029	17.8620	18.5044	19.2057	19.7909	20.1051	20.1841	20.1868	19.9803	19.3742	18.4208	17.5452 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8801	0.8569	0.8017	0.7108	0.5783	0.4055	0.2780	0.2851	0.5267	0.7240	0.8402	0.8895 (94)
Useful gains	782.8339	840.9981	876.0113	868.7848	738.9374	529.1416	343.5832	329.5571	555.6029	678.0357	726.5373	749.8428 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	1595.1460	1581.7405	1431.3111	1214.3022	894.5003	572.8773	355.0941	341.1713	645.1050	964.5800	1297.8415	1577.0404 (97)
Space heating kWh	604.3602	497.7789	413.1431	248.7725	115.7388	0.0000	0.0000	0.0000	0.0000	213.1889	411.3390	615.4350 (98a)
Space heating requirement - total per year (kWh/year)	3119.7564											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	604.3602	497.7789	413.1431	248.7725	115.7388	0.0000	0.0000	0.0000	0.0000	213.1889	411.3390	615.4350 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3119.7564											
Space heating per m2	(98c) / (4) = 27.2706 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	604.3602	497.7789	413.1431	248.7725	115.7388	0.0000	0.0000	0.0000	0.0000	213.1889	411.3390	615.4350 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	241.8408	199.1912	165.3234	99.5488	46.3140	0.0000	0.0000	0.0000	0.0000	85.3097	164.6014	246.2725 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

Full SAP Calculation Printout



Space heating fuel - main system 1	1248.4019 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	175.1000
Water heating fuel used	1817.8213 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	251.8419 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3318.0651 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1248.4019	26.0600	325.3335 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1817.8213	26.0600	473.7242 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	251.8419	26.0600	65.6300 (250)
Additional standing charges			0.0000 (251)
Total energy cost			864.6878 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1248.4019	0.1550	193.5334 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1817.8213	0.1410	256.2660 (264)
Space and water heating			449.7994 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	251.8419	0.1443	36.3486 (268)
Total CO2, kg/year			486.1480 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1248.4019	1.5740	1964.9223 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1817.8213	1.5213	2765.4070 (278)
Space and water heating			4730.3293 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	251.8419	1.5338	386.2835 (282)
Total Primary energy kWh/year			5116.6128 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:	C 78
Current environmental impact rating:	A 96

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.9	-£ 102	-49 kg (10.1%)
U Solar photovoltaic panels	+ 5.6	-£ 256	-132 kg (30.3%)

Recommended measures	Typical annual savings	Energy efficiency impact	Environmental impact
Solar water heating	£102	0.43 kg/m²	C 80 A 96
Solar photovoltaic panels	£256	1.16 kg/m²	B 86 A 97
Total Savings	£358	1.58 kg/m²	

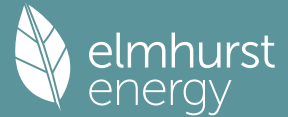
Potential energy efficiency rating:	B 86
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£865	£762	£102
Space heating	£325	£347	-£21
Water heating	£474	£350	£123
Lighting	£66	£66	£0
Generated (PV)	-£0	-£256	£256

Full SAP Calculation Printout



Total cost of fuels	£865	£506	£358
Total cost of uses	£865	£507	£358
Delivered energy	29 kWh/m²	17 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	3 kg/m²	2 kg/m²
Primary energy	45 kWh/m²	27 kWh/m²	18 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

2. Ventilation rate

												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1492 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000	(17)
Infiltration rate												0.3992	(18)
Number of sides sheltered												2	(19)
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.3393 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987	(22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795	(25)

3. Heat losses and heat loss parameter

Element	Gross m²	Openings m²	NetArea m²	U-value W/m²K	A x U W/K	K-value kJ/m²K	A x K kJ/K
Windows (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500 (28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100 (29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200 (29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700 (29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400 (30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300 (30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000 (30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200 (30)
Total net area of external elements Aum(A, m²)			311.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			50.0000			9.0000	450.0000 (32c)
Internal Floor 1			32.5700			18.0000	586.2600 (32d)
Internal Ceiling 1			32.5700			9.0000	293.1300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 10252.2300 (34)
89.6174 (35)

List of Thermal Bridges

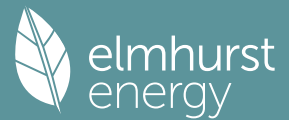
K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												151.2443 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Energy content	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Energy content (annual)	Total = Sum(45)m =											2512.1698
Distribution loss (46)m = 0.15 x (45)m	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	317.4729	280.8404	296.6962	254.1813	239.4759	213.9326	209.7575	219.8167	229.4119	261.4175	280.7200	313.8100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												643.3954 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												643.3954
Solar input	-0.0000	-16.1775	-59.4121	-82.5934	-109.1830	-100.8626	-100.2334	-86.9245	-59.1784	-28.8304	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.4729	264.6629	237.2840	171.5879	130.2929	113.0700	109.5240	132.8922	170.2335	232.5871	280.7200	313.8100 (64)
Total per year (kWh/year) = Sum(64)m =												2474.1373 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.1956	117.4376	124.6348	107.1346	100.2802	91.0156	90.2901	94.0698	99.5302	112.9047	119.1160	130.9777 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	177.6822	174.7584	167.5199	148.7980	134.7852	126.4105	121.3577	126.4379	138.2364	151.7536	165.4389	176.0453 (72)
Total internal gains	742.5067	739.8983	715.9070	667.8530	619.7882	578.7659	556.4139	561.1787	589.7301	635.5794	683.3167	723.5706 (73)

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[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					2.7000	10.6334	0.6300		0.7000	0.7700		8.7742 (74)	
East					3.6300	19.6403	0.6300		0.7000	0.7700		21.7884 (76)	
South					2.2000	46.7521	0.6300		0.7000	0.7700		31.4337 (78)	
West					8.7300	19.6403	0.6300		0.7000	0.7700		52.4003 (80)	
West					0.5400	25.9287	0.6300		0.7000	1.0000		5.5572 (82)	
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274	(83)
Total gains	862.4605	964.3937	1067.9255	1164.9573	1221.8952	1193.6952	1142.3263	1067.9498	992.8247	896.6309	830.8782	823.5981	(84)
7. Mean internal temperature (heating season)													
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538	
alpha	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436	
util living area	0.9359	0.9150	0.8770	0.8091	0.7079	0.5731	0.4484	0.4889	0.6733	0.8387	0.9147	0.9418	(86)
MIT	18.3296	18.6303	19.1414	19.7828	20.3368	20.7277	20.8932	20.8646	20.5682	19.8475	18.9807	18.2735	(87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605	(88)
util rest of house	0.9274	0.9039	0.8605	0.7825	0.6649	0.5063	0.3590	0.3993	0.6123	0.8104	0.9017	0.9341	(89)
MIT 2	16.8455	17.2242	17.8643	18.6593	19.3184	19.7569	19.9141	19.8940	19.5978	18.7569	17.6785	16.7800	(90)
Living area fraction	fLA = Living area / (4) =												0.2213 (91)
MIT	17.1740	17.5354	18.1470	18.9079	19.5438	19.9718	20.1308	20.1088	19.8126	18.9983	17.9667	17.1105	(92)
Temperature adjustment													0.0000
adjusted MIT	17.1740	17.5354	18.1470	18.9079	19.5438	19.9718	20.1308	20.1088	19.8126	18.9983	17.9667	17.1105	(93)
8. Space heating requirement													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8961	0.8695	0.8243	0.7502	0.6451	0.5059	0.3731	0.4114	0.6015	0.7777	0.8680	0.9042	(94)
Useful gains	772.8100	838.5641	880.3007	873.9117	788.2490	603.8823	426.2583	439.3798	597.1857	697.2966	721.1934	744.6743	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1709.2105	1673.4758	1538.8957	1307.5162	1022.6035	693.4022	455.7656	477.8576	740.2273	1094.8967	1422.7878	1697.9564	(97)
Space heating kWh	696.6820	561.0607	489.9946	312.1952	174.3597	0.0000	0.0000	0.0000	0.0000	295.8145	505.1480	709.2419	(98a)
Space heating requirement - total per year (kWh/year)													3744.4966
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)													0.0000
Space heating kWh	696.6820	561.0607	489.9946	312.1952	174.3597	0.0000	0.0000	0.0000	0.0000	295.8145	505.1480	709.2419	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													3744.4966
Space heating per m2	(98c) / (4) =												32.7316 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP													
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	696.6820	561.0607	489.9946	312.1952	174.3597	0.0000	0.0000	0.0000	0.0000	295.8145	505.1480	709.2419	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	278.7843	224.5141	196.0763	124.9281	69.7718	0.0000	0.0000	0.0000	0.0000	118.3731	202.1400	283.8103	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	317.4729	264.6629	237.2840	171.5879	130.2929	113.0700	109.5240	132.8922	170.2335	232.5871	280.7200	313.8100	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	181.3095	151.1496	135.5134	97.9942	74.4105	64.5745	62.5494	75.8950	97.2207	132.8310	160.3198	179.2176	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.1866	-59.1644	-89.7769	-104.3842	-112.3678	-99.0713	-97.5974	-91.7305	-80.6820	-68.6342	-44.2225	-33.4542	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1498.3980	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1412.9853	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.8419	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-920.2721	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2322.9531	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1498.3980	16.4900	247.0858	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1412.9853	16.4900	233.0013	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	251.8419	16.4900	41.5287	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-920.2721	16.4900	-151.7529	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-151.7529	(252)
Total energy cost			383.0550	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8651	(257)
SAP value		85.9764	
SAP rating (Section 12)		86	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1498.3980	0.1544	231.3213	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1412.9853	0.1450	204.8452	(264)
Space and water heating			436.1665	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-920.2721	0.1344	-123.6529	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-123.6529	(269)
Total CO2, kg/year			359.9592	(272)
CO2 emissions per m2			3.1500	(273)
EI value			96.9740	
EI rating			97	(274)
EI band			A	

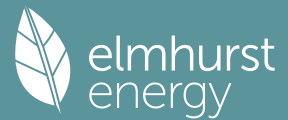
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	81.8300 (1b)	x	2.4000 (2b)	=	196.3920 (1b) - (3b)	
First floor	32.5700 (1c)	x	2.2000 (2c)	=	71.6540 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000				(4)	
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	268.0460 (5)	

2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000	Air changes per hour	(8)
Pressure test			0.1492	(8)
Pressure Test Method			Yes	
Measured/design AP50			Blower Door	
Infiltration rate			5.0000	(17)
Number of sides sheltered			0.3992	(18)
			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500		(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393		(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Adj infilt rate	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Effective ac	0.3054	0.2800	0.2715	0.2715	0.2800	0.2460	0.2630	0.2375	0.2375	0.2545	0.2375	0.2715	(22b)
	0.5466	0.5392	0.5368	0.5368	0.5392	0.5303	0.5346	0.5282	0.5282	0.5324	0.5282	0.5368	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight W			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)
Total net area of external elements Aum (A, m2)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			50.0000			9.0000	450.0000	(32c)
Internal Floor 1			32.5700			18.0000	586.2600	(32d)
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)

Heat capacity Cm = Sum (A x k)	(28)...(30) + (32) + (32a)...(32e) =	10252.2300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		89.6174	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.8642	(36)
Point Thermal bridges		0.0000	(36a)
Total fabric heat loss	(33) + (36) + (36a) =	80.2579	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

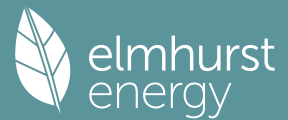
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	48.3529	47.6940	47.4871	47.4871	47.6940	46.9046	47.2866	46.7232	46.7232	47.0924	46.7232	47.4871	(38)
Average = Sum(39)m / 12 =	128.6108	127.9519	127.7450	127.7450	127.9519	127.1625	127.5445	126.9810	126.9810	127.3503	126.9810	127.7450	(39)
												127.5625	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1242	1.1185	1.1167	1.1167	1.1185	1.1116	1.1149	1.1100	1.1100	1.1132	1.1100	1.1167	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

												2.8388 (42)	
Assumed occupancy													
Hot water usage for mixer showers													
	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278	(42a)
Hot water usage for baths													
	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022	(42b)
Hot water usage for other uses													
	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023	(42c)
Average daily hot water use (litres/day)												151.2443 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323	(44)
Energy content													
	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350	(45)
Energy content (annual)													
												Total = Sum(45)m = 2512.1698	

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Distribution loss (46)m = 0.15 x (45)m	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage												
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	317.4729	280.8404	296.6962	254.1813	239.4759	213.9326	209.7575	219.8167	229.4119	261.4175	280.7200	313.8100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												763.9825 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												763.9825
Solar input	-1.7760	-20.9090	-66.4092	-94.2840	-119.0285	-119.8568	-116.4267	-104.0535	-72.7611	-40.9082	-7.5696	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	315.6969	259.9314	230.2870	159.8973	120.4473	94.0757	93.3308	115.7632	156.6508	220.5093	273.1504	313.8100 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	132.1956	117.4376	124.6348	107.1346	100.2802	91.0156	90.2901	94.0698	99.5302	112.9047	119.1160	130.9777 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	(71)
Water heating gains (Table 5)													
	177.6822	174.7584	167.5199	148.7980	134.7852	126.4105	121.3577	126.4379	138.2364	151.7536	165.4389	176.0453	(72)
Total internal gains													
	742.5067	739.8983	715.9070	667.8530	619.7882	578.7659	556.4139	561.1787	589.7301	635.5794	683.3167	723.5706	(73)

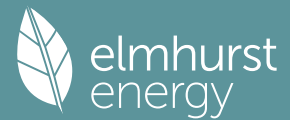
6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					2.7000	13.0723		0.6300	0.7000	0.7700		10.7867 (74)	
East					3.6300	24.4329		0.6300	0.7000	0.7700		27.1052 (76)	
South					2.2000	54.9219		0.6300	0.7000	0.7700		36.9267 (78)	
West					8.7300	24.4329		0.6300	0.7000	0.7700		65.1869 (80)	
West					0.5400	32.4879		0.6300	0.7000	1.0000		6.9630 (82)	
Solar gains	146.9685	241.5909	375.2790	546.8309	644.2318	712.2608	665.3036	581.6162	459.2161	299.4584	181.4444	119.4609	(83)
Total gains	889.4752	981.4892	1091.1860	1214.6839	1264.0199	1291.0267	1221.7176	1142.7950	1048.9463	935.0378	864.7611	843.0315	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.1431	22.2571	22.2932	22.2932	22.2571	22.3953	22.3282	22.4273	22.4273	22.3623	22.4273	22.2932	
alpha	2.4762	2.4838	2.4862	2.4862	2.4838	2.4930	2.4885	2.4952	2.4952	2.4908	2.4952	2.4862	
util living area													
	0.9229	0.9037	0.8559	0.7717	0.6440	0.4739	0.3546	0.3655	0.5997	0.7887	0.8911	0.9302	(86)
MIT	18.6752	18.8910	19.4289	20.0257	20.5476	20.8556	20.9500	20.9484	20.7192	20.1632	19.3504	18.6242	(87)
Th 2	19.9811	19.9858	19.9873	19.9873	19.9858	19.9914	19.9887	19.9927	19.9927	19.9901	19.9927	19.9873	(88)
util rest of house													
	0.9126	0.8911	0.8367	0.7406	0.5932	0.4004	0.2626	0.2687	0.5298	0.7514	0.8742	0.9207	(89)
MIT 2	17.2981	17.5695	18.2390	18.9634	19.5670	19.8889	19.9655	19.9694	19.7675	19.1480	18.1565	17.2385	(90)
Living area fraction													
	17.6029	17.8620	18.5024	19.1985	19.7840	20.1028	20.1834	20.1861	19.9781	19.3727	18.4208	17.5452	(91)
MIT													
Temperature adjustment													
adjusted MIT	17.6029	17.8620	18.5024	19.1985	19.7840	20.1028	20.1834	20.1861	19.9781	19.3727	18.4208	17.5452	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8801	0.8569	0.8021	0.7128	0.5821	0.4090	0.2809	0.2881	0.5287	0.7245	0.8402	0.8895	(94)
Useful gains	782.8339	840.9981	875.1919	865.7953	735.8049	528.0058	343.2216	329.1963	554.5641	677.4103	726.5373	749.8428	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1595.1460	1581.7405	1431.0487	1213.3854	893.6172	572.5899	355.0062	341.0834	644.8239	964.3876	1297.8415	1577.0404	(97)
Space heating kWh	604.3602	497.7789	413.5574	250.2648	117.4123	0.0000	0.0000	0.0000	0.0000	213.5111	411.3390	615.4350	(98a)
Space heating requirement - total per year (kWh/year)												3123.6588	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	604.3602	497.7789	413.5574	250.2648	117.4123	0.0000	0.0000	0.0000	0.0000	213.5111	411.3390	615.4350	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3123.6588	
Space heating per m2										(98c) / (4) =		27.3047	(99)

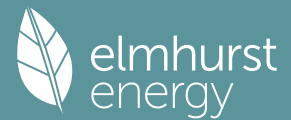
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	604.3602	497.7789	413.5574	250.2648	117.4123	0.0000	0.0000	0.0000	0.0000	213.5111	411.3390	615.4350	(98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating fuel (main heating system)	241.8408	199.1912	165.4892	100.1460	46.9837	0.0000	0.0000	0.0000	0.0000	85.4386	164.6014	246.2725	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	315.6969	259.9314	230.2870	159.8973	120.4473	94.0757	93.3308	115.7632	156.6508	220.5093	273.1504	313.8100	(64)	
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
Fuel for water heating, kWh/month	180.2952	148.4474	131.5174	91.3177	68.7877	53.7269	53.3014	66.1126	89.4636	125.9334	155.9968	179.2176	(219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)	
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-46.2673	-62.1388	-92.7382	-108.9578	-113.8911	-105.5870	-103.1224	-98.0354	-86.8985	-74.5950	-51.8699	-38.7378	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													1249.9635	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													175.1000	
Water heating fuel used													1344.1178	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													80.0000	(231)
Electricity for lighting (calculated in Appendix L)													251.8419	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-982.8393	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													1943.0839	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1249.9635	26.0600	325.7405	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1344.1178	26.0600	350.2771	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	251.8419	26.0600	65.6300	(250)
Additional standing charges			0.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-982.8393	26.0600	-256.1279
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-256.1279 (252)
Total energy cost			506.3677 (255)

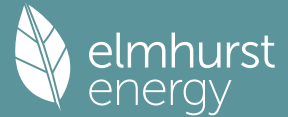
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1249.9635	0.1550	193.7501 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1344.1178	0.1458	195.9781 (264)
Space and water heating			389.7282 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	251.8419	0.1443	36.3486 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-982.8393	0.1346	-132.2775
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-132.2775 (269)
Total CO2, kg/year			304.8963 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1249.9635	1.5739	1967.2856 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1344.1178	1.5394	2069.0696 (278)
Space and water heating			4036.3552 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	251.8419	1.5338	386.2835 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-982.8393	1.4974	-1471.7154
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1471.7154 (283)
Total Primary energy kWh/year			3071.9473 (286)

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Property Reference	FURNERS LANE 28				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 28, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	78 C	DER	4.65	TER	9.37	
Environmental	96 A	% DER < TER				50.37
CO ₂ Emissions (t/year)	0.49	DFEE	40.63	TFEE	41.18	
Compliance Check	See BREL	% DFEE < TFEE				1.35
% DPER < TPER	1.20	DPER	48.82	TPER	49.41	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1492 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3992 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500 (28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100 (29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200 (29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700 (29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400 (30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300 (30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000 (30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200 (30)
Total net area of external elements Aum(A, m ²)			311.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			50.0000			9.0000	450.0000 (32c)
Internal Floor 1			32.5700			18.0000	586.2600 (32d)
Internal Ceiling 1			32.5700			9.0000	293.1300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10252.2300 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.8642 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 80.2579 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591
Heat transfer coeff	132.7648	132.4433	132.1281	130.6480	130.3711	129.0819	129.0819	128.8432	129.5785	130.3711	130.9313	131.5170
Average = Sum(39)m / 12 =												130.6467

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1605	1.1577	1.1550	1.1420	1.1396	1.1283	1.1283	1.1263	1.1327	1.1396	1.1445	1.1496
HLP (average)												1.1420
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

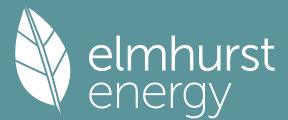
Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												151.2443 (43)
Daily hot water use	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Energy conte	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Energy content (annual)										Total = Sum(45)m =		2512.1698
Distribution loss (46)m = 0.15 x (45)m	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3183.0051 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453 (72)
Total internal gains	670.7790	686.4638	657.7369	634.4499	602.2809	577.7060	555.5062	556.7039	573.6539	596.2370	632.8311	656.8877 (73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b		Specific data or Table 6c	FF	Access factor Table 6d		Gains W	
North	2.7000				10.6334	0.6300		0.7000		0.7700		8.7742 (74)	
East	3.6300				19.6403	0.6300		0.7000		0.7700		21.7884 (76)	
South	2.2000				46.7521	0.6300		0.7000		0.7700		31.4337 (78)	
West	8.7300				19.6403	0.6300		0.7000		0.7700		52.4003 (80)	
West	0.5400				25.9287	0.6300		0.7000		1.0000		5.5572 (82)	
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274	(83)
Total gains	790.7327	910.9592	1009.7554	1131.5543	1204.3880	1192.6353	1141.4185	1063.4749	976.7485	857.2885	780.3925	756.9152	(84)
7. Mean internal temperature (heating season)													
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538	
alpha	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436	
util living area	0.9459	0.9236	0.8883	0.8173	0.7130	0.5734	0.4487	0.4904	0.6793	0.8500	0.9242	0.9508	(86)
MIT	18.2174	18.5524	19.0664	19.7490	20.3250	20.7274	20.8930	20.8636	20.5588	19.8029	18.9068	18.1671	(87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605	(88)
util rest of house	0.9386	0.9134	0.8730	0.7914	0.6703	0.5066	0.3593	0.4008	0.6185	0.8229	0.9123	0.9441	(89)
MIT 2	16.7053	17.1277	17.7732	18.6199	19.3057	19.7566	19.9140	19.8933	19.5887	18.7051	17.5875	16.6465	(90)
Living area fraction	fLA = Living area / (4) =												0.2213 (91)
MIT	17.0400	17.4431	18.0594	18.8698	19.5313	19.9715	20.1307	20.1081	19.8034	18.9481	17.8795	16.9831	(92)
Temperature adjustment													0.0000
adjusted MIT	17.0400	17.4431	18.0594	18.8698	19.5313	19.9715	20.1307	20.1081	19.8034	18.9481	17.8795	16.9831	(93)
8. Space heating requirement													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9094	0.8801	0.8371	0.7585	0.6500	0.5062	0.3734	0.4128	0.6072	0.7897	0.8797	0.9164	(94)
Useful gains	719.0944	801.7306	845.2559	858.2879	782.8009	603.7177	426.2007	438.9988	593.0586	676.9788	686.5404	693.6583	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1691.4190	1661.2445	1527.3213	1302.5364	1020.9766	693.3577	455.7511	477.7602	739.0377	1088.3531	1411.3693	1681.1922	(97)
Space heating kWh	723.4095	577.5934	507.4567	319.8589	177.2027	0.0000	0.0000	0.0000	0.0000	306.0625	521.8768	734.7252	(98a)
Space heating requirement - total per year (kWh/year)													3868.1856
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)													0.0000
Space heating kWh	723.4095	577.5934	507.4567	319.8589	177.2027	0.0000	0.0000	0.0000	0.0000	306.0625	521.8768	734.7252	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													3868.1856
Space heating per m2	(98c) / (4) =												33.8128 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP													
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	723.4095	577.5934	507.4567	319.8589	177.2027	0.0000	0.0000	0.0000	0.0000	306.0625	521.8768	734.7252	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	289.4796	231.1298	203.0639	127.9948	70.9094	0.0000	0.0000	0.0000	0.0000	122.4740	208.8343	294.0077	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100	(64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1547.8934	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1817.8213	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.8419	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3617.5566	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1547.8934	0.1544	239.0117	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1817.8213	0.1410	256.2660	(264)
Space and water heating			495.2777	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Total CO2, kg/year			531.6263	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1547.8934	1.5717	2432.7675	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1817.8213	1.5213	2765.4070	(278)
Space and water heating			5198.1746	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	251.8419	1.5338	386.2835	(282)
Total Primary energy kWh/year			5584.4580	(286)
Dwelling Primary energy Rate (DPER)			48.8200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

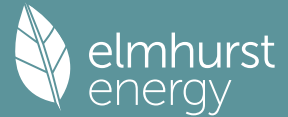
	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920	(1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	268.0460 (5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1492 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3992	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

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Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0200	1.0000	2.0200			(26)
TER Opening Type (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
Rooflight W			0.5400	1.4151	0.7642			(27a)
Ground Floor			81.8300	0.1300	10.6379			(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442			(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484			(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214			(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186			(30)
Joists FF	18.7700		18.7700	0.1100	2.0647			(30)
Rafters	17.9400	0.5400	17.4000	0.1100	1.9140			(30)
D Flat	1.7800		1.7800	0.1100	0.1958			(30)
Total net area of external elements Aum(A, m2)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.7925			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E16 Corner (normal)	14.4000	0.0900	1.2960	
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166	
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320	
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536	
R6 Flat ceiling	30.0000	0.0600	1.8000	
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080	
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980	
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655	
E3 Sill	12.3500	0.0500	0.6175	
E4 Jamb	32.9600	0.0500	1.6480	
E5 Ground floor (normal)	43.7400	0.1600	6.9984	
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000	
R1 Head of roof window	0.5500	0.0800	0.0440	
R2 Sill of roof window	0.5500	0.0600	0.0330	
R3 Jamb of roof window	1.9600	0.0800	0.1568	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				16.9034 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	81.6959 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591	(38)
Average = Sum(39)m / 12 =	134.2028	133.8813	133.5662	132.0860	131.8091	130.5199	130.5199	130.2812	131.0165	131.8091	132.3693	132.9550	(39)
												132.0847	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1731	1.1703	1.1675	1.1546	1.1522	1.1409	1.1409	1.1388	1.1452	1.1522	1.1571	1.1622	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers												
71.8174	70.7381	69.1654	66.1563	63.9356	61.4592	60.0516	61.6124	63.3233	65.9823	69.0560	71.5422	(42a)
Hot water usage for baths												
31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022	(42b)
Hot water usage for other uses												
43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023	(42c)
Average daily hot water use (litres/day)												134.6910 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	146.5267	143.3978	139.5874	133.7935	129.0883	124.0300	122.0861	125.8800	129.8813	135.1917	141.0749	146.1468	(44)
Energy conte	232.0625	204.1966	214.5407	183.1566	173.7777	152.5093	147.6526	155.8658	160.1566	183.4539	200.9871	228.8305	(45)
Energy content (annual)													
										Total = Sum(45)m =		2237.1898	

Distribution loss (46)m = 0.15 x (45)m											
34.8094	30.6295	32.1811	27.4735	26.0667	22.8764	22.1479	23.3799	24.0235	27.5181	30.1481	34.3246 (46)

Store volume

250.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):

1.8903 (48)

Temperature factor from Table 2b

0.5400 (49)

Enter (49) or (54) in (55)

1.0208 (55)

Total storage loss

31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)

If cylinder contains dedicated solar storage

31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)

Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

286.9693	253.7898	269.4475	236.2922	228.6845	205.6449	202.5594	210.7726	213.2922	238.3607	254.1227	283.7373	(62)

WWHRS	-32.8319	-29.0368	-30.4057	-25.1771	-23.4642	-20.0784	-18.8203	-20.0135	-20.7739	-24.4902	-27.7444	-32.2239	(63a)

PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)

FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

254.1374	224.7530	239.0418	211.1151	205.2203	185.5665	183.7390	190.7590	192.5183	213.8705	226.3783	251.5134	(64)

12Total per year (kWh/year)

Electric shower(s)												2578.6125	(64a)

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

Full SAP Calculation Printout



5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	162.7503	160.0743	154.9196	143.6223	136.7023	129.4692	125.0268	128.6973	133.0008	141.0267	151.8565	161.3059 (72)
Total internal gains	655.8471	671.7797	643.6359	621.7702	590.4407	566.7573	545.1678	545.9564	562.4151	584.0093	619.2487	642.1484 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W

North					2.7000	10.6334	0.6300	0.7000				0.7700			8.7742 (74)
East					3.6300	19.6403	0.6300	0.7000				0.7700			21.7884 (76)
South					2.2000	46.7521	0.6300	0.7000				0.7700			31.4337 (78)
West					8.7300	19.6403	0.6300	0.7000				0.7700			52.4003 (80)
West					0.5400	25.9287	0.6300	0.7000				1.0000			5.5572 (82)

Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274			(83)
Total gains	775.8008	896.2752	995.6544	1118.8745	1192.5477	1181.6866	1131.0801	1052.7274	965.5096	845.0608	766.8101	742.1758			(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.2204	21.2714	21.3216	21.5605	21.6058	21.8192	21.8192	21.8592	21.7365	21.6058	21.5144	21.4196
alpha	2.4147	2.4181	2.4214	2.4374	2.4404	2.4546	2.4546	2.4573	2.4491	2.4404	2.4343	2.4280
util living area	0.9482	0.9263	0.8919	0.8220	0.7190	0.5803	0.4553	0.4976	0.6864	0.8547	0.9271	0.9529 (86)
MIT	18.1616	18.4991	19.0190	19.7121	20.3002	20.7145	20.8870	20.8560	20.5404	19.7679	18.8590	18.1109 (87)
Th 2	19.9416	19.9438	19.9461	19.9565	19.9584	19.9676	19.9676	19.9693	19.9641	19.9584	19.9545	19.9504 (88)
util rest of house	0.9410	0.9164	0.8768	0.7963	0.6763	0.5128	0.3643	0.4065	0.6254	0.8281	0.9156	0.9464 (89)
MIT 2	16.6297	17.0556	17.7089	18.5696	19.2710	19.7360	19.9004	19.8785	19.5621	18.6573	17.5225	16.5704 (90)
Living area fraction	16.9688	17.3751	17.9988	18.8224	19.4988	19.9526	20.1187	20.0948	19.7786	18.9031	17.8183	16.9113 (91)
MIT	16.9688	17.3751	17.9988	18.8224	19.4988	19.9526	20.1187	20.0948	19.7786	18.9031	17.8183	16.9113 (92)
Temperature adjustment	16.9688	17.3751	17.9988	18.8224	19.4988	19.9526	20.1187	20.0948	19.7786	18.9031	17.8183	16.9113 (93)
adjusted MIT	16.9688	17.3751	17.9988	18.8224	19.4988	19.9526	20.1187	20.0948	19.7786	18.9031	17.8183	16.9113 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9122	0.8832	0.8407	0.7628	0.6550	0.5118	0.3784	0.4184	0.6131	0.7942	0.8831	0.9191 (94)
Useful gains	707.6953	791.6131	837.0579	853.4406	781.1534	604.7380	428.0209	440.4376	591.9515	671.1862	677.1846	682.1568 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1700.1848	1670.1800	1535.8565	1310.6142	1027.9538	698.6200	459.2635	481.3671	743.9931	1094.4266	1418.7786	1690.0354 (97)
Space heating kWh	738.4122	590.3970	519.9062	329.1650	183.6195	0.0000	0.0000	0.0000	0.0000	314.8909	533.9477	749.8616 (98a)
Space heating requirement - total per year (kWh/year)												3960.2000
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	738.4122	590.3970	519.9062	329.1650	183.6195	0.0000	0.0000	0.0000	0.0000	314.8909	533.9477	749.8616 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3960.2000
Space heating per m ²												(98c) / (4) = 34.6171 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	738.4122	590.3970	519.9062	329.1650	183.6195	0.0000	0.0000	0.0000	0.0000	314.8909	533.9477	749.8616 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	800.0132	639.6500	563.2786	356.6251	198.9377	0.0000	0.0000	0.0000	0.0000	341.1603	578.4915	812.4178 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating
Water heating requirement

Full SAP Calculation Printout



Efficiency of water heater (217)m	254.1374	224.7530	239.0418	211.1151	205.2203	185.5665	183.7390	190.7590	192.5183	213.8705	226.3783	251.5134 (64)
Fuel for water heating, kWh/month	86.3077	86.1219	85.7538	85.0518	83.8113	79.8000	79.8000	79.8000	79.8000	84.9259	85.9150	79.8000 (216)
Space cooling fuel requirement (221)m	294.4552	260.9706	278.7535	248.2194	244.8601	232.5394	230.2494	239.0464	241.2510	251.8319	263.4910	86.3538 (217)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	291.2591 (219)
Lighting	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	0.0000 (221)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	30.4985	24.4670	22.0298	16.1400	12.4670	10.1856	11.3728	14.7828	19.2014	25.1933	28.4558	7.3041 (231)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-66.9766	-89.9167	-123.1181	-131.6124	-136.3731	-125.2777	-123.6217	-119.2822	-111.0057	-99.3793	-71.9660	7.0685 (232)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	31.3461 (233a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Annual totals kWh/year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Space heating fuel - main system 1	-52.8387	-109.0157	-212.9079	-314.5272	-411.0160	-411.3088	-406.5457	-346.4762	-256.9499	-154.1854	-69.9564	-41.9555 (233b)
Space heating fuel - main system 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Space heating fuel - secondary	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Efficiency of water heater	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Water heating fuel used	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Space cooling fuel	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Electricity for pumps and fans:												4290.5742 (211)
Total electricity for the above, kWh/year												0.0000 (213)
Electricity for lighting (calculated in Appendix L)												0.0000 (215)
Energy saving/generation technologies (Appendices M ,N and Q)												79.8000
PV generation												3076.9270 (219)
Wind generation												0.0000 (221)
Hydro-electric generation (Appendix N)												86.0000 (231)
Electricity generated - Micro CHP (Appendix N)												246.1401 (232)
Appendix Q - special features												
Energy saved or generated												-4044.6528 (233)
Energy used												0.0000 (234)
Total delivered energy for all uses												0.0000 (235a)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4290.5742	0.2100	901.0206 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3076.9270	0.2100	646.1547 (264)
Space and water heating			1547.1753 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	246.1401	0.1443	35.5256 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1256.9694	0.1357	-170.5285
PV Unit electricity exported	-2787.6833	0.1264	-352.3251
Total			-522.8537 (269)
Total CO2, kg/year			1071.7765 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.3700 (273)

13a. Primary energy - Individual heating systems including micro-CHP

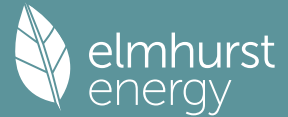
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4290.5742	1.1300	4848.3488 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3076.9270	1.1300	3476.9275 (278)
Space and water heating			8325.2764 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	246.1401	1.5338	377.5379 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1256.9694	1.5015	-1887.2887
PV Unit electricity exported	-2787.6833	0.4639	-1293.3356
Total			-3180.6243 (283)
Total Primary energy kWh/year			5652.2907 (286)
Target Primary Energy Rate (TPER)			49.4100 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

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2. Ventilation rate

												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												40.0000 / (5) =	0.1492 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000 (17)	
Infiltration rate												0.3992 (18)	
Number of sides sheltered												2 (19)	
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.3393 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)	
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)	

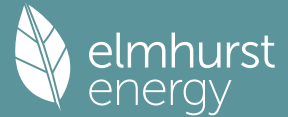
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)					
Solid Doors			2.0200	1.0000	2.0200			(26)					
Rooflight W			0.5400	1.1450	0.6183			(27a)					
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)					
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)					
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)					
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)					
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)					
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)					
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)					
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)					
Total net area of external elements Aum(A, m2)			311.1600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)					
GF			100.0000			9.0000	900.0000	(32c)					
FF			50.0000			9.0000	450.0000	(32c)					
Internal Floor 1			32.5700			18.0000	586.2600	(32d)					
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	10252.2300		(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						89.6174		(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E16 Corner (normal)				14.4000	0.0900	1.2960							
E10 Eaves (insulation at ceiling level)				38.6100	0.0600	2.3166							
E17 Corner (inverted - internal area greater than external area)				4.8000	-0.0900	-0.4320							
R8 Roof to wall (rafter)				22.5600	0.0600	1.3536							
R6 Flat ceiling				30.0000	0.0600	1.8000							
E13 Gable (insulation at rafter level)				2.6000	0.0800	0.2080							
E12 Gable (insulation at ceiling level)				3.3000	0.0600	0.1980							
E2 Other lintels (including other steel lintels)				13.3100	0.0500	0.6655							
E3 Sill				12.3500	0.0500	0.6175							
E4 Jamb				32.9600	0.0500	1.6480							
E5 Ground floor (normal)				43.7400	0.1600	6.9984							
E6 Intermediate floor within a dwelling				27.3400	0.0000	0.0000							
R1 Head of roof window				0.5500	0.0600	0.0330							
R2 Sill of roof window				0.5500	0.0800	0.0440							
R3 Jamb of roof window				1.9600	0.0600	0.1176							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.8642	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	80.2579	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591	(38)
Average = Sum(39)m / 12 =	132.7648	132.4433	132.1281	130.6480	130.3711	129.0819	129.0819	128.8432	129.5785	130.3711	130.9313	131.5170	(39)
												130.6467	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1605	1.1577	1.1550	1.1420	1.1396	1.1283	1.1283	1.1263	1.1327	1.1396	1.1445	1.1496	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)

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Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												68.4778 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	74.7093	72.6597	70.4220	67.6372	65.1527	62.5708	62.0345	64.2676	66.5579	69.2094	72.0189	74.6045 (44)
Distribution loss (46)m = 0.15 x (45)m	118.3213	103.4664	108.2360	92.5919	87.7080	76.9380	75.0254	79.5768	82.0726	93.9165	102.6041	116.8127 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908 (64)
12Total per year (kWh/year)												966.6793 (64)
Electric shower(s)	57.5138	51.2452	55.9578	53.3999	54.4019	51.8941	53.6239	54.4019	53.3999	55.9578	54.9056	57.5138 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												654.2157 (64a)
Heat gains from water heating, kWh/month	39.5217	34.7979	36.9896	33.0257	32.2384	29.3229	29.3489	30.5105	30.7904	33.9467	35.5298	39.2011 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	53.1206	51.7826	49.7172	45.8691	43.3312	40.7262	39.4474	41.0088	42.7644	45.6273	49.3469	52.6897 (72)
Total internal gains	543.2174	560.4880	535.4334	521.0170	494.0696	478.0143	459.5884	458.2678	472.1787	485.6099	513.7391	530.5322 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.7000	10.6334		0.6300		0.7000		0.7700		8.7742 (74)
East				3.6300	19.6403		0.6300		0.7000		0.7700		21.7884 (76)
South				2.2000	46.7521		0.6300		0.7000		0.7700		31.4337 (78)
West				8.7300	19.6403		0.6300		0.7000		0.7700		52.4003 (80)
West				0.5400	25.9287		0.6300		0.7000		1.0000		5.5572 (82)
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274	(83)
Total gains	663.1711	784.9835	887.4519	1018.1213	1096.1766	1092.9436	1045.5008	965.0388	875.2733	746.6614	661.3005	630.5596	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538
util living area	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436
	0.9621	0.9426	0.9114	0.8452	0.7455	0.6072	0.4808	0.5272	0.7189	0.8811	0.9450	0.9662 (86)
MIT	18.0092	18.3602	18.8991	19.6263	20.2457	20.6885	20.8749	20.8391	20.4933	19.6678	18.7234	17.9570 (87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605 (88)
util rest of house	0.9567	0.9346	0.8986	0.8218	0.7047	0.5399	0.3876	0.4344	0.6602	0.8581	0.9360	0.9614 (89)
MIT 2	17.2178	17.5649	18.0954	18.8051	19.3855	19.7784	19.9188	19.8989	19.6235	18.8602	17.9349	17.1718 (90)
Living area fraction	17.3929	17.7409	18.2733	18.9868	19.5759	19.9798	20.1304	20.1070	19.8160	19.0390	18.1094	17.3456 (91)
MIT	17.3929	17.7409	18.2733	18.9868	19.5759	19.9798	20.1304	20.1070	19.8160	19.0390	18.1094	17.3456 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3929	17.7409	18.2733	18.9868	19.5759	19.9798	20.1304	20.1070	19.8160	19.0390	18.1094	17.3456 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9383	0.9117	0.8720	0.7952	0.6871	0.5401	0.4024	0.4469	0.6500	0.8320	0.9139	0.9442 (94)
Ext temp.	622.2222	715.7074	773.8709	809.6424	753.1692	590.2905	420.7135	431.2384	568.8904	621.2122	604.3824	595.4040 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1738.2825	1700.6914	1555.5830	1317.8235	1026.7900	694.4341	455.7106	477.6194	740.6733	1100.1995	1441.4735	1728.8658 (97)

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	830.3489	661.9093	581.5939	365.8904	203.5738	0.0000	0.0000	0.0000	0.0000	356.3665	602.7056	843.2956 (98a)
Space heating requirement - total per year (kWh/year)	4445.6840											
Solar heating kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)	
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh												
	830.3489	661.9093	581.5939	365.8904	203.5738	0.0000	0.0000	0.0000	0.0000	356.3665	602.7056	843.2956 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4445.6840											
Space heating per m2	(98c) / (4) = 38.8609 (99)											

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1213.3698	955.2060	979.2080	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7097	0.7756	0.7410	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	861.1693	740.8508	725.5704	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1206.0734	1153.9537	1063.8177	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	248.3310	307.3486	251.6560	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	62.0827	76.8371	62.9140	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												201.8339 (107)
Energy for space heating												38.8609 (99)
Energy for space cooling												1.7643 (108)
Total												40.6252 (109)
Fabric Energy Efficiency (DFEE)												40.6 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 268.0460 (5)

2. Ventilation rate

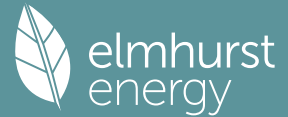
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1492 (8)
Pressure Test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3992 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.0200	1.0000	2.0200		(26)
TER Opening Type (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Rooflight W			0.5400	1.4151	0.7642		(27a)
Ground Floor			81.8300	0.1300	10.6379		(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442		(29a)

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Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	(30)
Rafters	17.9400	0.5400	17.4000	0.1100	1.9140	(30)
D Flat	1.7800		1.7800	0.1100	0.1958	(30)
Total net area of external elements Aum(A, m2)			311.1600			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	64.7925		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0800	0.0440
R2 Sill of roof window	0.5500	0.0600	0.0330
R3 Jamb of roof window	1.9600	0.0800	0.1568

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.9034 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 81.6959 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591
Average = Sum(39)m / 12 =	134.2028	133.8813	133.5662	132.0860	131.8091	130.5199	130.5199	130.2812	131.0165	131.8091	132.3693	132.9550

132.0847 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1731	1.1703	1.1675	1.1546	1.1522	1.1409	1.1409	1.1388	1.1452	1.1522	1.1571	1.1622
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

1.1546 (40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8388 (42)
Hot water usage for mixer showers													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022		(42b)
Hot water usage for other uses													
43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023		(42c)
Average daily hot water use (litres/day)													68.4778 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.7093	72.6597	70.4220	67.6372	65.1527	62.5708	62.0345	64.2676	66.5579	69.2094	72.0189	74.6045	(44)
Energy conte	118.3213	103.4664	108.2360	92.5919	87.7080	76.9380	75.0254	79.5768	82.0726	93.9165	102.6041	116.8127	(45)
Energy content (annual)										Total = Sum(45)m =		1137.2698	
Distribution loss (46)m = 0.15 x (45)m													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908		(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908	(64)
12Total per year (kWh/year)													966.6793 (64)
Electric shower(s)	57.5138	51.2452	55.9578	53.3999	54.4019	51.8941	53.6239	54.4019	53.3999	55.9578	54.9056	57.5138	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												654.2157	(64a)
Heat gains from water heating, kWh/month													
39.5217	34.7979	36.9896	33.0257	32.2384	29.3229	29.3489	30.5105	30.7904	33.9467	35.5298	39.2011		(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941		(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)													
-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526		(71)
Water heating gains (Table 5)													
53.1206	51.7826	49.7172	45.8691	43.3312	40.7262	39.4474	41.0088	42.7644	45.6273	49.3469	52.6897		(72)
Total internal gains	543.2174	560.4880	535.4334	521.0170	494.0696	478.0143	459.5884	458.2678	472.1787	485.6099	513.7391	530.5322	(73)

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6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	2.7000		10.6334		0.6300		0.7000		0.7700		8.7742 (74)	
East	3.6300		19.6403		0.6300		0.7000		0.7700		21.7884 (76)	
South	2.2000		46.7521		0.6300		0.7000		0.7700		31.4337 (78)	
West	8.7300		19.6403		0.6300		0.7000		0.7700		52.4003 (80)	
West	0.5400		25.9287		0.6300		0.7000		1.0000		5.5572 (82)	
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274 (83)
Total gains	663.1711	784.9835	887.4519	1018.1213	1096.1766	1092.9436	1045.5008	965.0388	875.2733	746.6614	661.3005	630.5596 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.2204	21.2714	21.3216	21.5605	21.6058	21.8192	21.8192	21.8592	21.7365	21.6058	21.5144	21.4196	
alpha	2.4147	2.4181	2.4214	2.4374	2.4404	2.4546	2.4546	2.4573	2.4491	2.4404	2.4343	2.4280	
util living area	0.9622	0.9429	0.9120	0.8465	0.7478	0.6103	0.4842	0.5306	0.7214	0.8820	0.9453	0.9663 (86)	
MIT	17.9779	18.3291	18.8704	19.6022	20.2285	20.6790	20.8701	20.8334	20.4809	19.6469	18.6963	17.9255 (87)	
Th 2	19.9416	19.9438	19.9461	19.9565	19.9584	19.9676	19.9676	19.9693	19.9641	19.9584	19.9545	19.9504 (88)	
util rest of house	0.9568	0.9349	0.8992	0.8231	0.7069	0.5426	0.3898	0.4367	0.6625	0.8590	0.9363	0.9615 (89)	
MIT 2	17.1805	17.5279	18.0609	18.7752	19.3625	19.7624	19.9066	19.8861	19.6052	18.8335	17.9019	17.1343 (90)	
Living area fraction	fLA = Living area / (4) =												0.2213 (91)
MIT	17.3570	17.7052	18.2401	18.9582	19.5542	19.9652	20.1198	20.0958	19.7990	19.0136	18.0778	17.3094 (92)	
Temperature adjustment													0.0000
adjusted MIT	17.3570	17.7052	18.2401	18.9582	19.5542	19.9652	20.1198	20.0958	19.7990	19.0136	18.0778	17.3094 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9383	0.9119	0.8724	0.7962	0.6888	0.5424	0.4047	0.4492	0.6518	0.8327	0.9141	0.9442 (94)
Useful gains	622.2291	715.8336	774.2453	810.6483	755.0344	592.8259	423.0718	433.4473	570.4914	621.7221	604.4764	595.3940 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1752.2856	1714.3813	1568.0762	1328.5512	1035.2512	700.2707	459.4101	481.4899	746.6623	1108.9829	1453.1186	1742.9591 (97)
Space heating kWh	840.7621	671.0240	590.6102	372.8901	208.4813	0.0000	0.0000	0.0000	0.0000	362.5220	611.0224	853.7885 (98a)
Space heating requirement - total per year (kWh/year)												4511.1006
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	840.7621	671.0240	590.6102	372.8901	208.4813	0.0000	0.0000	0.0000	0.0000	362.5220	611.0224	853.7885 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4511.1006
Space heating per m2												(98c) / (4) = 39.4327 (99)

8c. Space cooling requirement

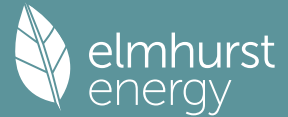
Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1226.8873	965.8475	990.1371	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7044	0.7706	0.7358	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	864.2544	744.3244	728.5349	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1206.0734	1153.9537	1063.8177	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	246.1097	304.7642	249.4504	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	61.5274	76.1911	62.3626	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												200.0811 (107)
Energy for space heating												39.4327 (99)
Energy for space cooling												1.7490 (108)
Total												41.1817 (109)
Fabric Energy Efficiency (TFEE)												41.2 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)

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Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 268.0460 (5)

2. Ventilation rate

												m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												4 * 10 = 40.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) = 0.1492 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0000 (17)
Infiltration rate												0.3992 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3393 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infiltr rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

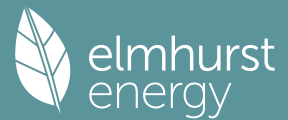
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)				
Solid Doors			2.0200	1.0000	2.0200			(26)				
Rooflight W			0.5400	1.1450	0.6183			(27a)				
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)				
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)				
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)				
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)				
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)				
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)				
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)				
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)				
Total net area of external elements Aum(A, m2)			311.1600					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)				
GF			100.0000			9.0000	900.0000	(32c)				
FF			50.0000			9.0000	450.0000	(32c)				
Internal Floor 1			32.5700			18.0000	586.2600	(32d)				
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)				
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10252.2300	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.6174	(35)				
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E16 Corner (normal)				14.4000	0.0900	1.2960						
E10 Eaves (insulation at ceiling level)				38.6100	0.0600	2.3166						
E17 Corner (inverted - internal area greater than external area)				4.8000	-0.0900	-0.4320						
R8 Roof to wall (rafter)				22.5600	0.0600	1.3536						
R6 Flat ceiling				30.0000	0.0600	1.8000						
E13 Gable (insulation at rafter level)				2.6000	0.0800	0.2080						
E12 Gable (insulation at ceiling level)				3.3000	0.0600	0.1980						
E2 Other lintels (including other steel lintels)				13.3100	0.0500	0.6655						
E3 Sill				12.3500	0.0500	0.6175						
E4 Jamb				32.9600	0.0500	1.6480						
E5 Ground floor (normal)				43.7400	0.1600	6.9984						
E6 Intermediate floor within a dwelling				27.3400	0.0000	0.0000						
R1 Head of roof window				0.5500	0.0600	0.0330						
R2 Sill of roof window				0.5500	0.0800	0.0440						
R3 Jamb of roof window				1.9600	0.0600	0.1176						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.8642	(36)				
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	80.2579	(37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.5069	Feb 52.1854	Mar 51.8703	Apr 50.3901	May 50.1132	Jun 48.8240	Jul 48.8240	Aug 48.5853	Sep 49.3206	Oct 50.1132	Nov 50.6734	Dec 51.2591 (38)
Heat transfer coeff	132.7648	132.4433	132.1281	130.6480	130.3711	129.0819	129.0819	128.8432	129.5785	130.3711	130.9313	131.5170 (39)
Average = Sum(39)m / 12 =												130.6467
HLP	Jan 1.1605	Feb 1.1577	Mar 1.1550	Apr 1.1420	May 1.1396	Jun 1.1283	Jul 1.1283	Aug 1.1263	Sep 1.1327	Oct 1.1396	Nov 1.1445	Dec 1.1496 (40)
HLP (average)												1.1420
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses												

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Average daily hot water use (litres/day)	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c) 151.2443 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Distribution loss (46)m = 0.15 x (45)m	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Water storage loss:	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)m
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357	(68)
Pumps, fans	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	(71)
Total internal gains	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453	(72)
	742.5067	739.8983	717.4078	675.3570	633.5455	592.7733	570.4214	574.1857	595.7333	637.0802	683.3167	723.5706	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.7000	10.6334		0.6300		0.7000		0.7700		8.7742 (74)
East				3.6300	19.6403		0.6300		0.7000		0.7700		21.7884 (76)
South				2.2000	46.7521		0.6300		0.7000		0.7700		31.4337 (78)
West				8.7300	19.6403		0.6300		0.7000		0.7700		52.4003 (80)
West				0.5400	25.9287		0.6300		0.7000		1.0000		5.5572 (82)
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274	(83)
Total gains	862.4605	964.3937	1069.4263	1172.4613	1235.6526	1207.7026	1156.3338	1080.9567	998.8279	898.1317	830.8782	823.5981	(84)

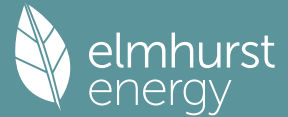
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538	
alpha	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436	
util living area	0.9359	0.9150	0.8767	0.8072	0.7039	0.5686	0.4440	0.4843	0.6710	0.8383	0.9147	0.9418	(86)
MIT	18.3296	18.6303	19.1433	19.7902	20.3460	20.7327	20.8955	20.8674	20.5717	19.8492	18.9807	18.2735	(87)
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605	(88)
util rest of house	0.9274	0.9039	0.8602	0.7805	0.6608	0.5019	0.3552	0.3953	0.6099	0.8099	0.9017	0.9341	(89)
MIT 2	16.8455	17.2242	17.8666	18.6679	19.3281	19.7613	19.9157	19.8960	19.6011	18.7589	17.6785	16.7800	(90)
Living area fraction	17.1740	17.5354	18.1492	18.9163	19.5534	19.9763	20.1325	20.1110	19.8159	19.0002	17.9667	17.1105	(91)
MIT	17.1740	17.5354	18.1492	18.9163	19.5534	19.9763	20.1325	20.1110	19.8159	19.0002	17.9667	17.1105	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1740	17.5354	18.1492	18.9163	19.5534	19.9763	20.1325	20.1110	19.8159	19.0002	17.9667	17.1105	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8961	0.8695	0.8240	0.7483	0.6413	0.5018	0.3694	0.4075	0.5994	0.7772	0.8680	0.9042	(94)
	772.8100	838.5641	881.1865	877.3598	792.4532	606.0310	427.1333	440.4660	598.6996	698.0558	721.1934	744.6743	(95)

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Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1709.2105	1673.4758	1539.1878	1308.6125	1023.8555	693.9816	455.9854	478.1349	740.6626	1095.1406	1422.7878	1697.9564 (97)
Space heating kWh	696.6820	561.0607	489.5530	310.5020	172.1633	0.0000	0.0000	0.0000	0.0000	295.4311	505.1480	709.2419 (98a)
Space heating requirement - total per year (kWh/year)												3739.7819
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	696.6820	561.0607	489.5530	310.5020	172.1633	0.0000	0.0000	0.0000	0.0000	295.4311	505.1480	709.2419 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3739.7819
Space heating per m2										(98c) / (4) =		32.6904 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	696.6820	561.0607	489.5530	310.5020	172.1633	0.0000	0.0000	0.0000	0.0000	295.4311	505.1480	709.2419 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	278.7843	224.5141	195.8995	124.2505	68.8929	0.0000	0.0000	0.0000	0.0000	118.2197	202.1400	283.8103 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1496.5114 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1817.8213 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												251.8419 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3566.1746 (238)

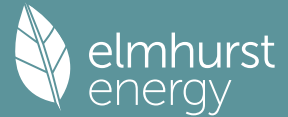
10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1496.5114	16.4900	246.7747 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1817.8213	16.4900	299.7587 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	251.8419	16.4900	41.5287 (250)
Additional standing charges			0.0000 (251)
Total energy cost			588.0622 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] = 1.3281 (257)$

Full SAP Calculation Printout



SAP value
SAP rating (Section 12)
SAP band

78.4712
78 (258)
C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1496.5114	0.1544	231.0605	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1817.8213	0.1410	256.2660	(264)
Space and water heating			487.3265	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Total CO2, kg/year			523.6751	(272)
CO2 emissions per m2			4.5800	(273)
EI value			95.5977	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920	(1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	268.0460 (5)

2. Ventilation rate

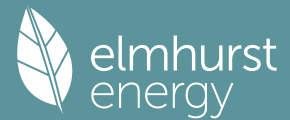
	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1492 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3992	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate	0.3054	0.2800	0.2715	0.2715	0.2800	0.2460	0.2630	0.2375	0.2375	0.2545	0.2375	0.2715	(22b)
Effective ac	0.5466	0.5392	0.5368	0.5368	0.5392	0.5303	0.5346	0.5282	0.5282	0.5324	0.5282	0.5368	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight W			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)
Total net area of external elements Aum(A, m2)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			50.0000			9.0000	450.0000	(32c)
Internal Floor 1			32.5700			18.0000	586.2600	(32d)
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)
Heat capacity Cm = Sum(A x k)								(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								(35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.8642 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss		(33) + (36) + (36a) =	80.2579 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.3529	47.6940	47.4871	47.4871	47.6940	46.9046	47.2866	46.7232	46.7232	47.0924	46.7232	47.4871	(38)
Heat transfer coeff	128.6108	127.9519	127.7450	127.7450	127.9519	127.1625	127.5445	126.9810	126.9810	127.3503	126.9810	127.7450	(39)
Average = Sum(39)m / 12 =												127.5625	
HLP	1.1242	1.1185	1.1167	1.1167	1.1185	1.1116	1.1149	1.1100	1.1100	1.1132	1.1100	1.1167	(40)
HLP (average)												1.1151	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8388 (42)
Hot water usage for mixer showers													
89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278	(42a)	
Hot water usage for baths													
31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022	(42b)	
Hot water usage for other uses													
43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023	(42c)	
Average daily hot water use (litres/day)												151.2443	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323	(44)	
Energy content (annual)	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2512.1698	
39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252	(46)	
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)	
If cylinder contains dedicated solar storage													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month													
317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h													
317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100	(64)	
Electric shower(s)									Total per year (kWh/year) = Sum(64)m =		3183.0051	(64)	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
												0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													
Heat gains from water heating, kWh/month													
132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777	(65)	

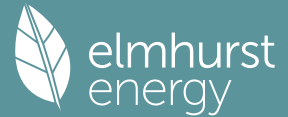
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453 (72)
Total internal gains	742.5067	739.8983	717.4078	675.3570	633.5455	592.7733	570.4214	574.1857	595.7333	637.0802	683.3167	723.5706 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains

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	m2	Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	W
North	2.7000	13.0723	0.6300	0.7000	0.7700	10.7867 (74)
East	3.6300	24.4329	0.6300	0.7000	0.7700	27.1052 (76)
South	2.2000	54.9219	0.6300	0.7000	0.7700	36.9267 (78)
West	8.7300	24.4329	0.6300	0.7000	0.7700	65.1869 (80)
West	0.5400	32.4879	0.6300	0.7000	1.0000	6.9630 (82)

Solar gains	146.9685	241.5909	375.2790	546.8309	644.2318	712.2608	665.3036	581.6162	459.2161	299.4584	181.4444	119.4609 (83)
Total gains	889.4752	981.4892	1092.6868	1222.1879	1277.7773	1305.0342	1235.7250	1155.8019	1054.9495	936.5386	864.7611	843.0315 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.1431	22.2571	22.2932	22.2932	22.2571	22.3953	22.3282	22.4273	22.4273	22.3623	22.4273	22.2932
alpha	2.4762	2.4838	2.4862	2.4862	2.4838	2.4930	2.4885	2.4952	2.4952	2.4908	2.4952	2.4862
util living area	0.9229	0.9037	0.8556	0.7697	0.6399	0.4699	0.3510	0.3619	0.5975	0.7882	0.8911	0.9302 (86)
MIT	18.6752	18.8910	19.4307	20.0322	20.5545	20.8584	20.9511	20.9496	20.7217	20.1646	19.3504	18.6242 (87)
Th 2	19.9811	19.9858	19.9873	19.9873	19.9858	19.9914	19.9887	19.9927	19.9927	19.9901	19.9927	19.9873 (88)
util rest of house	0.9126	0.8911	0.8363	0.7385	0.5890	0.3968	0.2598	0.2659	0.5276	0.7508	0.8742	0.9207 (89)
MIT 2	17.2981	17.5695	18.2412	18.9707	19.5739	19.8910	19.9661	19.9700	19.7696	19.1496	18.1565	17.2385 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.6029	17.8620	18.5044	19.2057	19.7909	20.1051	20.1841	20.1868	19.9803	19.3742	18.4208	17.5452 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6029	17.8620	18.5044	19.2057	19.7909	20.1051	20.1841	20.1868	19.9803	19.3742	18.4208	17.5452 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8801	0.8569	0.8017	0.7108	0.5783	0.4055	0.2780	0.2851	0.5267	0.7240	0.8402	0.8895 (94)
Useful gains	782.8339	840.9981	876.0113	868.7848	738.9374	529.1416	343.5832	329.5571	555.6029	678.0357	726.5373	749.8428 (95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000 (96)
Heat loss rate W	1595.1460	1581.7405	1431.3111	1214.3022	894.5003	572.8773	355.0941	341.1713	645.1050	964.5800	1297.8415	1577.0404 (97)
Space heating kWh	604.3602	497.7789	413.1431	248.7725	115.7388	0.0000	0.0000	0.0000	0.0000	213.1889	411.3390	615.4350 (98a)
Space heating requirement - total per year (kWh/year)	3119.7564											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	604.3602	497.7789	413.1431	248.7725	115.7388	0.0000	0.0000	0.0000	0.0000	213.1889	411.3390	615.4350 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3119.7564											
Space heating per m2	(98c) / (4) = 27.2706 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	604.3602	497.7789	413.1431	248.7725	115.7388	0.0000	0.0000	0.0000	0.0000	213.1889	411.3390	615.4350 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	241.8408	199.1912	165.3234	99.5488	46.3140	0.0000	0.0000	0.0000	0.0000	85.3097	164.6014	246.2725 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	1248.4019 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	175.1000
Water heating fuel used	1817.8213 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	251.8419 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3318.0651 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1248.4019	26.0600	325.3335 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1817.8213	26.0600	473.7242 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	251.8419	26.0600	65.6300 (250)
Additional standing charges			0.0000 (251)
Total energy cost			864.6878 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1248.4019	0.1550	193.5334 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1817.8213	0.1410	256.2660 (264)
Space and water heating			449.7994 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	251.8419	0.1443	36.3486 (268)
Total CO2, kg/year			486.1480 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1248.4019	1.5740	1964.9223 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1817.8213	1.5213	2765.4070 (278)
Space and water heating			4730.3293 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	251.8419	1.5338	386.2835 (282)
Total Primary energy kWh/year			5116.6128 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:	C 78
Current environmental impact rating:	A 96

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.9	-£ 102	-49 kg (10.1%)
U Solar photovoltaic panels	+ 5.6	-£ 256	-132 kg (30.3%)

Recommended measures	Typical annual savings	Energy efficiency impact	Environmental impact
Solar water heating	£102	0.43 kg/m²	C 80 A 96
Solar photovoltaic panels	£256	1.16 kg/m²	B 86 A 97
Total Savings	£358	1.58 kg/m²	

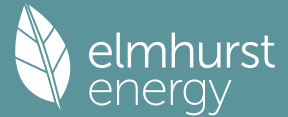
Potential energy efficiency rating:	B 86
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£865	£762	£102
Space heating	£325	£347	-£21
Water heating	£474	£350	£123
Lighting	£66	£66	£0
Generated (PV)	-£0	-£256	£256

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Total cost of fuels	£865	£506	£358
Total cost of uses	£865	£507	£358
Delivered energy	29 kWh/m²	17 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	3 kg/m²	2 kg/m²
Primary energy	45 kWh/m²	27 kWh/m²	18 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

2. Ventilation rate

												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1492 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000	(17)
Infiltration rate												0.3992	(18)
Number of sides sheltered												2	(19)
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.3393 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)	
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)	

3. Heat losses and heat loss parameter

Element	Gross m²	Openings m²	NetArea m²	U-value W/m²K	A x U W/K	K-value kJ/m²K	A x K kJ/K
Windows (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight W			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500 (28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100 (29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200 (29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700 (29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400 (30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300 (30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000 (30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200 (30)
Total net area of external elements Aum(A, m²)			311.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			50.0000			9.0000	450.0000 (32c)
Internal Floor 1			32.5700			18.0000	586.2600 (32d)
Internal Ceiling 1			32.5700			9.0000	293.1300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 10252.2300 (34)
89.6174 (35)

List of Thermal Bridges

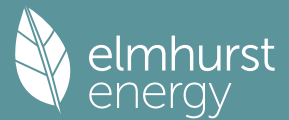
K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												
Hot water usage for mixer showers												2.8388 (42)
89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278 (42a)	
Hot water usage for baths												
31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)	
Hot water usage for other uses												
43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)	
Average daily hot water use (litres/day)												151.2443 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Energy content	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Energy content (annual)												Total = Sum(45)m = 2512.1698
Distribution loss (46)m = 0.15 x (45)m												
39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)	
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	317.4729	280.8404	296.6962	254.1813	239.4759	213.9326	209.7575	219.8167	229.4119	261.4175	280.7200	313.8100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												643.3954 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												643.3954
Solar input	-0.0000	-16.1775	-59.4121	-82.5934	-109.1830	-100.8626	-100.2334	-86.9245	-59.1784	-28.8304	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.4729	264.6629	237.2840	171.5879	130.2929	113.0700	109.5240	132.8922	170.2335	232.5871	280.7200	313.8100 (64)
Total per year (kWh/year) = Sum(64)m =												2474.1373 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.1956	117.4376	124.6348	107.1346	100.2802	91.0156	90.2901	94.0698	99.5302	112.9047	119.1160	130.9777 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	177.6822	174.7584	167.5199	148.7980	134.7852	126.4105	121.3577	126.4379	138.2364	151.7536	165.4389	176.0453 (72)
Total internal gains	742.5067	739.8983	715.9070	667.8530	619.7882	578.7659	556.4139	561.1787	589.7301	635.5794	683.3167	723.5706 (73)

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[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d	Gains W
North					2.7000	10.6334	0.6300	0.7000				0.7700	8.7742 (74)
East					3.6300	19.6403	0.6300	0.7000				0.7700	21.7884 (76)
South					2.2000	46.7521	0.6300	0.7000				0.7700	31.4337 (78)
West					8.7300	19.6403	0.6300	0.7000				0.7700	52.4003 (80)
West					0.5400	25.9287	0.6300	0.7000				1.0000	5.5572 (82)
Solar gains	119.9538	224.4954	352.0185	497.1043	602.1070	614.9293	585.9124	506.7710	403.0945	261.0515	147.5615	100.0274 (83)	
Total gains	862.4605	964.3937	1067.9255	1164.9573	1221.8952	1193.6952	1142.3263	1067.9498	992.8247	896.6309	830.8782	823.5981 (84)	
7. Mean internal temperature (heating season)													
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.4503	21.5023	21.5536	21.7978	21.8441	22.0623	22.0623	22.1032	21.9777	21.8441	21.7507	21.6538	
alpha	2.4300	2.4335	2.4369	2.4532	2.4563	2.4708	2.4708	2.4735	2.4652	2.4563	2.4500	2.4436	
util living area	0.9359	0.9150	0.8770	0.8091	0.7079	0.5731	0.4484	0.4889	0.6733	0.8387	0.9147	0.9418 (86)	
MIT	18.3296	18.6303	19.1414	19.7828	20.3368	20.7277	20.8932	20.8646	20.5682	19.8475	18.9807	18.2735 (87)	
Th 2	19.9517	19.9540	19.9562	19.9667	19.9686	19.9778	19.9778	19.9795	19.9742	19.9686	19.9647	19.9605 (88)	
util rest of house	0.9274	0.9039	0.8605	0.7825	0.6649	0.5063	0.3590	0.3993	0.6123	0.8104	0.9017	0.9341 (89)	
MIT 2	16.8455	17.2242	17.8643	18.6593	19.3184	19.7569	19.9141	19.8940	19.5978	18.7569	17.6785	16.7800 (90)	
Living area fraction	fLA = Living area / (4) =											0.2213 (91)	
MIT	17.1740	17.5354	18.1470	18.9079	19.5438	19.9718	20.1308	20.1088	19.8126	18.9983	17.9667	17.1105 (92)	
Temperature adjustment	0.0000												
adjusted MIT	17.1740	17.5354	18.1470	18.9079	19.5438	19.9718	20.1308	20.1088	19.8126	18.9983	17.9667	17.1105 (93)	
8. Space heating requirement													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8961	0.8695	0.8243	0.7502	0.6451	0.5059	0.3731	0.4114	0.6015	0.7777	0.8680	0.9042 (94)	
Useful gains	772.8100	838.5641	880.3007	873.9117	788.2490	603.8823	426.2583	439.3798	597.1857	697.2966	721.1934	744.6743 (95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)	
Heat loss rate W	1709.2105	1673.4758	1538.8957	1307.5162	1022.6035	693.4022	455.7656	477.8576	740.2273	1094.8967	1422.7878	1697.9564 (97)	
Space heating kWh	696.6820	561.0607	489.9946	312.1952	174.3597	0.0000	0.0000	0.0000	0.0000	295.8145	505.1480	709.2419 (98a)	
Space heating requirement - total per year (kWh/year)	3744.4966												
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)	
Solar heating contribution - total per year (kWh/year)	0.0000												
Space heating kWh	696.6820	561.0607	489.9946	312.1952	174.3597	0.0000	0.0000	0.0000	0.0000	295.8145	505.1480	709.2419 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)	3744.4966												
Space heating per m2	(98c) / (4) = 32.7316 (99)												
9a. Energy requirements - Individual heating systems, including micro-CHP													
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.9000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	696.6820	561.0607	489.9946	312.1952	174.3597	0.0000	0.0000	0.0000	0.0000	295.8145	505.1480	709.2419 (98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)	
Space heating fuel (main heating system)	278.7843	224.5141	196.0763	124.9281	69.7718	0.0000	0.0000	0.0000	0.0000	118.3731	202.1400	283.8103 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating	317.4729	264.6629	237.2840	171.5879	130.2929	113.0700	109.5240	132.8922	170.2335	232.5871	280.7200	313.8100 (64)	
Water heating requirement	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)	
Efficiency of water heater (217)m	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)	
Fuel for water heating, kWh/month	181.3095	151.1496	135.5134	97.9942	74.4105	64.5745	62.5494	75.8950	97.2207	132.8310	160.3198	179.2176 (219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)	
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-39.1866	-59.1644	-89.7769	-104.3842	-112.3678	-99.0713	-97.5974	-91.7305	-80.6820	-68.6342	-44.2225	-33.4542 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)	

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1498.3980	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1412.9853	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.8419	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-920.2721	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2322.9531	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1498.3980	16.4900	247.0858	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1412.9853	16.4900	233.0013	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	251.8419	16.4900	41.5287	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-920.2721	16.4900	-151.7529	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-151.7529	(252)
Total energy cost			383.0550	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8651	(257)
SAP value		85.9764	
SAP rating (Section 12)		86	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1498.3980	0.1544	231.3213	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1412.9853	0.1450	204.8452	(264)
Space and water heating			436.1665	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-920.2721	0.1344	-123.6529	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-123.6529	(269)
Total CO2, kg/year			359.9592	(272)
CO2 emissions per m2			3.1500	(273)
EI value			96.9740	
EI rating			97	(274)
EI band			A	

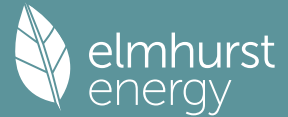
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)	
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	268.0460	(5)

2. Ventilation rate

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			m3 per hour
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000	Air changes per hour	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.3992	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500		(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393		(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Adj infilt rate	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Effective ac	0.3054	0.2800	0.2715	0.2715	0.2800	0.2460	0.2630	0.2375	0.2375	0.2545	0.2375	0.2715	(22b)
	0.5466	0.5392	0.5368	0.5368	0.5392	0.5303	0.5346	0.5282	0.5282	0.5324	0.5282	0.5368	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight W			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)
Total net area of external elements Aum (A, m2)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			50.0000			9.0000	450.0000	(32c)
Internal Floor 1			32.5700			18.0000	586.2600	(32d)
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)

Heat capacity Cm = Sum (A x k)	(28)...(30) + (32) + (32a)...(32e) =	10252.2300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		89.6174	(35)

List of Thermal Bridges	K1 Element	Length	Psi-value	Total	
E16 Corner (normal)		14.4000	0.0900	1.2960	
E10 Eaves (insulation at ceiling level)		38.6100	0.0600	2.3166	
E17 Corner (inverted - internal area greater than external area)		4.8000	-0.0900	-0.4320	
R8 Roof to wall (rafter)		22.5600	0.0600	1.3536	
R6 Flat ceiling		30.0000	0.0600	1.8000	
E13 Gable (insulation at rafter level)		2.6000	0.0800	0.2080	
E12 Gable (insulation at ceiling level)		3.3000	0.0600	0.1980	
E2 Other lintels (including other steel lintels)		13.3100	0.0500	0.6655	
E3 Sill		12.3500	0.0500	0.6175	
E4 Jamb		32.9600	0.0500	1.6480	
E5 Ground floor (normal)		43.7400	0.1600	6.9984	
E6 Intermediate floor within a dwelling		27.3400	0.0000	0.0000	
R1 Head of roof window		0.5500	0.0600	0.0330	
R2 Sill of roof window		0.5500	0.0800	0.0440	
R3 Jamb of roof window		1.9600	0.0600	0.1176	

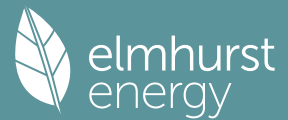
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.8642	(36)
Point Thermal bridges			0.0000	(36a)
Total fabric heat loss	(33) + (36) + (36a) =		80.2579	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	48.3529	47.6940	47.4871	47.4871	47.6940	46.9046	47.2866	46.7232	46.7232	47.0924	46.7232	47.4871	(38)
Average = Sum(39)m / 12 =	128.6108	127.9519	127.7450	127.7450	127.9519	127.1625	127.5445	126.9810	126.9810	127.3503	126.9810	127.7450	(39)
												127.5625	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1242	1.1185	1.1167	1.1167	1.1185	1.1116	1.1149	1.1100	1.1100	1.1132	1.1100	1.1167	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

												2.8388 (42)		
Assumed occupancy														
Hot water usage for mixer showers	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278	(42a)	
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022	(42b)	
Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023	(42c)	
Average daily hot water use (litres/day)													151.2443 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323	(44)	
Energy content (annual)	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350	(45)	
	Total = Sum(45)m =												2512.1698	

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Distribution loss (46)m = 0.15 x (45)m	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage												
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	317.4729	280.8404	296.6962	254.1813	239.4759	213.9326	209.7575	219.8167	229.4119	261.4175	280.7200	313.8100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												763.9825 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												763.9825
Solar input	-1.7760	-20.9090	-66.4092	-94.2840	-119.0285	-119.8568	-116.4267	-104.0535	-72.7611	-40.9082	-7.5696	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	315.6969	259.9314	230.2870	159.8973	120.4473	94.0757	93.3308	115.7632	156.6508	220.5093	273.1504	313.8100 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	132.1956	117.4376	124.6348	107.1346	100.2802	91.0156	90.2901	94.0698	99.5302	112.9047	119.1160	130.9777 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	(71)
Water heating gains (Table 5)													
	177.6822	174.7584	167.5199	148.7980	134.7852	126.4105	121.3577	126.4379	138.2364	151.7536	165.4389	176.0453	(72)
Total internal gains													
	742.5067	739.8983	715.9070	667.8530	619.7882	578.7659	556.4139	561.1787	589.7301	635.5794	683.3167	723.5706	(73)

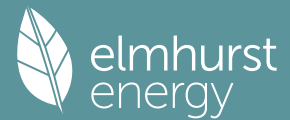
6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North					2.7000	13.0723		0.6300	0.7000		0.7700		10.7867 (74)	
East					3.6300	24.4329		0.6300	0.7000		0.7700		27.1052 (76)	
South					2.2000	54.9219		0.6300	0.7000		0.7700		36.9267 (78)	
West					8.7300	24.4329		0.6300	0.7000		0.7700		65.1869 (80)	
West					0.5400	32.4879		0.6300	0.7000		1.0000		6.9630 (82)	
Solar gains	146.9685	241.5909	375.2790	546.8309	644.2318	712.2608	665.3036	581.6162	459.2161	299.4584	181.4444	119.4609	(83)	
Total gains	889.4752	981.4892	1091.1860	1214.6839	1264.0199	1291.0267	1221.7176	1142.7950	1048.9463	935.0378	864.7611	843.0315	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.1431	22.2571	22.2932	22.2932	22.2571	22.3953	22.3282	22.4273	22.4273	22.3623	22.4273	22.2932	
alpha	2.4762	2.4838	2.4862	2.4862	2.4838	2.4930	2.4885	2.4952	2.4952	2.4908	2.4952	2.4862	
util living area													
	0.9229	0.9037	0.8559	0.7717	0.6440	0.4739	0.3546	0.3655	0.5997	0.7887	0.8911	0.9302	(86)
MIT	18.6752	18.8910	19.4289	20.0257	20.5476	20.8556	20.9500	20.9484	20.7192	20.1632	19.3504	18.6242	(87)
Th 2	19.9811	19.9858	19.9873	19.9873	19.9858	19.9914	19.9887	19.9927	19.9927	19.9901	19.9927	19.9873	(88)
util rest of house													
	0.9126	0.8911	0.8367	0.7406	0.5932	0.4004	0.2626	0.2687	0.5298	0.7514	0.8742	0.9207	(89)
MIT 2	17.2981	17.5695	18.2390	18.9634	19.5670	19.8889	19.9655	19.9694	19.7675	19.1480	18.1565	17.2385	(90)
Living area fraction													
	17.6029	17.8620	18.5024	19.1985	19.7840	20.1028	20.1834	20.1861	19.9781	19.3727	18.4208	17.5452	(91)
MIT													
Temperature adjustment													
adjusted MIT	17.6029	17.8620	18.5024	19.1985	19.7840	20.1028	20.1834	20.1861	19.9781	19.3727	18.4208	17.5452	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8801	0.8569	0.8021	0.7128	0.5821	0.4090	0.2809	0.2881	0.5287	0.7245	0.8402	0.8895	(94)
Useful gains	782.8339	840.9981	875.1919	865.7953	735.8049	528.0058	343.2216	329.1963	554.5641	677.4103	726.5373	749.8428	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1595.1460	1581.7405	1431.0487	1213.3854	893.6172	572.5899	355.0062	341.0834	644.8239	964.3876	1297.8415	1577.0404	(97)
Space heating kWh	604.3602	497.7789	413.5574	250.2648	117.4123	0.0000	0.0000	0.0000	0.0000	213.5111	411.3390	615.4350	(98a)
Space heating requirement - total per year (kWh/year)												3123.6588	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	604.3602	497.7789	413.5574	250.2648	117.4123	0.0000	0.0000	0.0000	0.0000	213.5111	411.3390	615.4350	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3123.6588	
Space heating per m2										(98c) / (4) =		27.3047	(99)

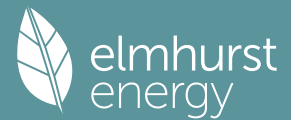
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	604.3602	497.7789	413.5574	250.2648	117.4123	0.0000	0.0000	0.0000	0.0000	213.5111	411.3390	615.4350	(98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating fuel (main heating system)	241.8408	199.1912	165.4892	100.1460	46.9837	0.0000	0.0000	0.0000	0.0000	85.4386	164.6014	246.2725	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	315.6969	259.9314	230.2870	159.8973	120.4473	94.0757	93.3308	115.7632	156.6508	220.5093	273.1504	313.8100	(64)	
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
Fuel for water heating, kWh/month	180.2952	148.4474	131.5174	91.3177	68.7877	53.7269	53.3014	66.1126	89.4636	125.9334	155.9968	179.2176	(219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)	
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-46.2673	-62.1388	-92.7382	-108.9578	-113.8911	-105.5870	-103.1224	-98.0354	-86.8985	-74.5950	-51.8699	-38.7378	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1												1249.9635	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												175.1000		
Water heating fuel used												1344.1178	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
pump for solar water heating												80.0000	(230g)	
Total electricity for the above, kWh/year												80.0000	(231)	
Electricity for lighting (calculated in Appendix L)												251.8419	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation												-982.8393	(233)	
Wind generation												0.0000	(234)	
Hydro-electric generation (Appendix N)												0.0000	(235a)	
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)	
Appendix Q - special features														
Energy saved or generated												-0.0000	(236)	
Energy used												0.0000	(237)	
Total delivered energy for all uses												1943.0839	(238)	

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1249.9635	26.0600	325.7405	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1344.1178	26.0600	350.2771	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	251.8419	26.0600	65.6300	(250)
Additional standing charges			0.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-982.8393	26.0600	-256.1279
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-256.1279 (252)
Total energy cost			506.3677 (255)

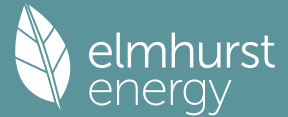
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1249.9635	0.1550	193.7501 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1344.1178	0.1458	195.9781 (264)
Space and water heating			389.7282 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	251.8419	0.1443	36.3486 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-982.8393	0.1346	-132.2775
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-132.2775 (269)
Total CO2, kg/year			304.8963 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1249.9635	1.5739	1967.2856 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1344.1178	1.5394	2069.0696 (278)
Space and water heating			4036.3552 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	251.8419	1.5338	386.2835 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-982.8393	1.4974	-1471.7154
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1471.7154 (283)
Total Primary energy kWh/year			3071.9473 (286)

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Property Reference	FURNERS LANE 29				Issued on Date	12/09/2024
Assessment Reference	PLANNING		Prop Type Ref			
Property	Plot 29, Furners Lane, Henfield, West Sussex, BN5					
SAP Rating	79 C	DER	4.57	TER	9.11	
Environmental	96 A	% DER < TER				49.84
CO ₂ Emissions (t/year)	0.48	DFEE	39.06	TFEE	39.78	
Compliance Check	See BREL	% DFEE < TFEE				1.83
% DPER < TPER	0.03	DPER	48.00	TPER	48.01	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	ELIVIA HOMES EASTERN, Pete Bland					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

2. Ventilation rate

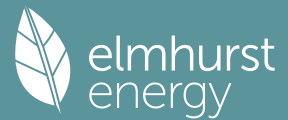
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1492 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3992 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			17.2600	1.1450	19.7634		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight S			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500 (28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100 (29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200 (29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700 (29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400 (30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300 (30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000 (30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200 (30)
Total net area of external elements A _{um} (A, m ²)			311.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			50.0000			9.0000	450.0000 (32c)
Internal Floor 1			32.5700			18.0000	586.2600 (32d)
Internal Ceiling 1			32.5700			9.0000	293.1300 (32e)
Heat capacity C _m = Sum (A x k)						(28)...(30) + (32) + (32a)...(32e) =	10252.2300 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1500	6.5610
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.4268 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 79.8205 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591
Average = Sum(39)m / 12 =	132.3274	132.0059	131.6907	130.2106	129.9337	128.6445	128.6445	128.4058	129.1411	129.9337	130.4939	131.0796

130.2093 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1567	1.1539	1.1511	1.1382	1.1358	1.1245	1.1245	1.1224	1.1289	1.1358	1.1407	1.1458
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

1.1382 (40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8388 (42)											
Hot water usage for mixer showers	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022
Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023
Average daily hot water use (litres/day)	151.2443 (43)											

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323
Energy conte	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350
Energy content (annual)	2512.1698 (45)											
Distribution loss (46)m = 0.15 x (45)m	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252
Water storage loss:	250.0000 (47)											
Store volume	250.0000 (47)											
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0103 (51)											
Volume factor from Table 2a	0.7830 (52)											
Temperature factor from Table 2b	0.5400 (53)											
Enter (49) or (54) in (55)	1.0875 (55)											

Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100

3183.0051 (64)

12Total per year (kWh/year)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)											

Heat gains from water heating, kWh/month

	132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777

130.9777 (65)

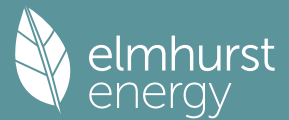
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526
Water heating gains (Table 5)	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453
Total internal gains	670.7790	686.4638	657.7369	634.4499	602.2809	577.7060	555.5062	556.7039	573.6539	596.2370	632.8311	656.8877

656.8877 (73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North	3.6300				10.6334	0.6300		0.7000		0.7700		11.7964 (74)
East	2.7000				19.6403	0.6300		0.7000		0.7700		16.2063 (76)
South	8.7300				46.7521	0.6300		0.7000		0.7700		124.7346 (78)
West	2.2000				19.6403	0.6300		0.7000		0.7700		13.2051 (80)
South	0.5400				47.0123	0.6300		0.7000		1.0000		10.0760 (82)
Solar gains	176.0183	302.3432	419.5824	528.4914	598.8809	597.3483	574.7613	521.9842	457.3449	335.8214	211.3072	150.3155 (83)
Total gains	846.7973	988.8070	1077.3193	1162.9413	1201.1618	1175.0543	1130.2675	1078.6881	1030.9989	932.0583	844.1383	807.2032 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.5212	21.5736	21.6252	21.8710	21.9177	22.1373	22.1373	22.1785	22.0522	21.9177	21.8236	21.7260
alpha	2.4347	2.4382	2.4417	2.4581	2.4612	2.4758	2.4758	2.4786	2.4701	2.4612	2.4549	2.4484
util living area	0.9380	0.9108	0.8748	0.8090	0.7132	0.5782	0.4512	0.4841	0.6583	0.8281	0.9120	0.9440 (86)
MIT	18.3153	18.6749	19.1621	19.7880	20.3278	20.7237	20.8924	20.8684	20.5930	19.8925	19.0081	18.2576 (87)
Th 2	19.9548	19.9571	19.9593	19.9698	19.9717	19.9809	19.9809	19.9826	19.9773	19.9717	19.9677	19.9636 (88)
util rest of house	0.9298	0.8993	0.8582	0.7825	0.6706	0.5114	0.3617	0.3953	0.5969	0.7987	0.8987	0.9365 (89)
MIT 2	16.8294	17.2811	17.8914	18.6676	19.3113	19.7562	19.9166	19.8996	19.6243	18.8110	17.7141	16.7618 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.1583	17.5896	18.1726	18.9156	19.5362	19.9703	20.1326	20.1140	19.8387	19.0504	18.0005	17.0929 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.1583	17.5896	18.1726	18.9156	19.5362	19.9703	20.1326	20.1140	19.8387	19.0504	18.0005	17.0929 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8989	0.8646	0.8221	0.7503	0.6503	0.5107	0.3758	0.4075	0.5877	0.7667	0.8648	0.9072 (94)
Useful gains	761.2226	854.8994	885.6158	872.5636	781.1234	600.1048	424.7186	439.5298	605.9212	714.6183	730.0016	732.2763 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1701.5056	1675.1040	1537.1781	1304.1310	1018.1917	690.8593	454.4452	476.9049	741.1047	1097.9879	1422.4499	1689.9923 (97)
Space heating kWh	699.5706	551.1775	484.7624	310.7285	176.3788	0.0000	0.0000	0.0000	0.0000	285.2269	498.5628	712.5407 (98a)
Space heating requirement - total per year (kWh/year)	3718.9482											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	699.5706	551.1775	484.7624	310.7285	176.3788	0.0000	0.0000	0.0000	0.0000	285.2269	498.5628	712.5407 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3718.9482											
Space heating per m2	(98c) / (4) =											
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	249.9000 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	699.5706	551.1775	484.7624	310.7285	176.3788	0.0000	0.0000	0.0000	0.0000	285.2269	498.5628	712.5407 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	279.9402	220.5592	193.9825	124.3411	70.5798	0.0000	0.0000	0.0000	0.0000	114.1364	199.5049	285.1303 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Water heating requirement	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Efficiency of water heater (217)m	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176 (219)
Fuel for water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1488.1745	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1817.8213	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.8419	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3557.8378	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1488.1745	0.1544	229.8204	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1817.8213	0.1410	256.2660	(264)
Space and water heating			486.0864	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Total CO2, kg/year			522.4350	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.5700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1488.1745	1.5717	2339.0126	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1817.8213	1.5213	2765.4070	(278)
Space and water heating			5104.4197	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	251.8419	1.5338	386.2835	(282)
Total Primary energy kWh/year			5490.7031	(286)
Dwelling Primary energy Rate (DPER)			48.0000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

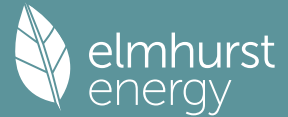
	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920	(1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	268.0460 (5)

2. Ventilation rate

	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1492 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3992	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

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Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0200	1.0000	2.0200			(26)
TER Opening Type (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
Rooflight S			0.5400	1.4151	0.7642			(27a)
Ground Floor			81.8300	0.1300	10.6379			(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442			(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484			(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214			(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186			(30)
Joists FF	18.7700		18.7700	0.1100	2.0647			(30)
Rafters	17.9400	0.5400	17.4000	0.1100	1.9140			(30)
D Flat	1.7800		1.7800	0.1100	0.1958			(30)
Total net area of external elements Aum(A, m2)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	64.7925		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0800	0.0440
R2 Sill of roof window	0.5500	0.0600	0.0330
R3 Jamb of roof window	1.9600	0.0800	0.1568

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.9034 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 81.6959 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591	(38)
Average = Sum(39)m / 12 =	134.2028	133.8813	133.5662	132.0860	131.8091	130.5199	130.5199	130.2812	131.0165	131.8091	132.3693	132.9550	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1731	1.1703	1.1675	1.1546	1.1522	1.1409	1.1409	1.1388	1.1452	1.1522	1.1571	1.1622	(40)
HLP (average)												1.1546	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers												
71.8174	70.7381	69.1654	66.1563	63.9356	61.4592	60.0516	61.6124	63.3233	65.9823	69.0560	71.5422	(42a)
Hot water usage for baths												
31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022	(42b)
Hot water usage for other uses												
43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023	(42c)
Average daily hot water use (litres/day)												134.6910 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.5267	143.3978	139.5874	133.7935	129.0883	124.0300	122.0861	125.8800	129.8813	135.1917	141.0749	146.1468	(44)
Energy conte	232.0625	204.1966	214.5407	183.1566	173.7777	152.5093	147.6526	155.8658	160.1566	183.4539	200.9871	228.8305	(45)
Energy content (annual)										Total = Sum(45)m =			2237.1898

Distribution loss (46)m = 0.15 x (45)m

34.8094	30.6295	32.1811	27.4735	26.0667	22.8764	22.1479	23.3799	24.0235	27.5181	30.1481	34.3246	(46)

Water storage loss:

Store volume 250.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):

Temperature factor from Table 2b

Enter (49) or (54) in (55) 1.8903 (48)

Total storage loss 0.5400 (49)

31.6444 28.5820 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 30.6236 31.6444 30.6236 31.6444 (56)

If cylinder contains dedicated solar storage 1.0208 (55)

31.6444 28.5820 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 30.6236 31.6444 30.6236 31.6444 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 286.9693 253.7898 269.4475 236.2922 228.6845 205.6449 202.5594 210.7726 213.2922 238.3607 254.1227 283.7373 (62)

WWHRS -32.8319 -29.0368 -30.4057 -25.1771 -23.4642 -20.0784 -18.8203 -20.0135 -20.7739 -24.4902 -27.7444 -32.2239 (63a)

PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h 254.1374 224.7530 239.0418 211.1151 205.2203 185.5665 183.7390 190.7590 192.5183 213.8705 226.3783 251.5134 (64)

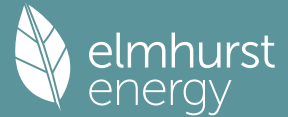
12Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 2578.6125 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month 121.0862 107.5699 115.2602 103.4080 101.7065 93.2178 93.0199 95.7508 95.7606 104.9238 109.3367 120.0116 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	162.7503	160.0743	154.9196	143.6223	136.7023	129.4692	125.0268	128.6973	133.0008	141.0267	151.8565	161.3059 (72)
Total internal gains	655.8471	671.7797	643.6359	621.7702	590.4407	566.7573	545.1678	545.9564	562.4151	584.0093	619.2487	642.1484 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					3.6300	10.6334	0.6300	0.7000			0.7700			11.7964 (74)
East					2.7000	19.6403	0.6300	0.7000			0.7700			16.2063 (76)
South					8.7300	46.7521	0.6300	0.7000			0.7700			124.7346 (78)
West					2.2000	19.6403	0.6300	0.7000			0.7700			13.2051 (80)
South					0.5400	47.0123	0.6300	0.7000			1.0000			10.0760 (82)
Solar gains	176.0183	302.3432	419.5824	528.4914	598.8809	597.3483	574.7613	521.9842	457.3449	335.8214	211.3072			150.3155 (83)
Total gains	831.8654	974.1229	1063.2182	1150.2616	1189.3216	1164.1055	1119.9291	1067.9406	1019.7600	919.8306	830.5559			792.4639 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.2204	21.2714	21.3216	21.5605	21.6058	21.8192	21.8192	21.8592	21.7365	21.6058	21.5144	21.4196
alpha	2.4147	2.4181	2.4214	2.4374	2.4404	2.4546	2.4546	2.4573	2.4491	2.4404	2.4343	2.4280
util living area	0.9405	0.9140	0.8789	0.8143	0.7200	0.5860	0.4589	0.4923	0.6662	0.8336	0.9154	0.9463 (86)
MIT	18.2499	18.6125	19.1066	19.7443	20.2980	20.7079	20.8849	20.8595	20.5721	19.8524	18.9526	18.1917 (87)
Th 2	19.9416	19.9438	19.9461	19.9565	19.9584	19.9676	19.9676	19.9693	19.9641	19.9584	19.9545	19.9504 (88)
util rest of house	0.9326	0.9027	0.8625	0.7880	0.6773	0.5185	0.3675	0.4017	0.6044	0.8045	0.9024	0.9391 (89)
MIT 2	16.7403	17.1961	17.8155	18.6072	19.2686	19.7301	19.8990	19.8809	19.5928	18.7554	17.6378	16.6718 (90)
Living area fraction	17.0744	17.5096	18.1013	18.8589	19.4964	19.9466	20.1173	20.0975	19.8096	18.9982	17.9288	0.2213 (91)
MIT	17.0744	17.5096	18.1013	18.8589	19.4964	19.9466	20.1173	20.0975	19.8096	18.9982	17.9288	17.0082 (92)
Temperature adjustment	17.0744	17.5096	18.1013	18.8589	19.4964	19.9466	20.1173	20.0975	19.8096	18.9982	17.9288	0.0000
adjusted MIT	17.0744	17.5096	18.1013	18.8589	19.4964	19.9466	20.1173	20.0975	19.8096	18.9982	17.9288	17.0082 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9019	0.8679	0.8260	0.7550	0.6559	0.5170	0.3815	0.4137	0.5942	0.7717	0.8684	0.9100 (94)
Useful gains	750.2554	845.4704	878.1717	868.3966	780.1108	601.8536	427.2652	441.7840	605.9127	709.8056	721.2479	721.1474 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1714.3587	1688.1857	1549.5390	1315.4275	1027.6385	697.8316	459.0717	481.7143	748.0459	1106.9538	1433.3976	1702.9158 (97)
Space heating kWh	717.2928	566.3047	499.4973	321.8622	184.1606	0.0000	0.0000	0.0000	0.0000	295.4783	512.7478	730.4357 (98a)
Space heating requirement - total per year (kWh/year)												3827.7793
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	717.2928	566.3047	499.4973	321.8622	184.1606	0.0000	0.0000	0.0000	0.0000	295.4783	512.7478	730.4357 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3827.7793
Space heating per m ²										(98c) / (4) =		33.4596 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	717.2928	566.3047	499.4973	321.8622	184.1606	0.0000	0.0000	0.0000	0.0000	295.4783	512.7478	730.4357 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	777.1320	613.5479	541.1672	348.7132	199.5239	0.0000	0.0000	0.0000	0.0000	320.1281	555.5231	791.3713 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating
Water heating requirement

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Efficiency of water heater (217)m	254.1374	224.7530	239.0418	211.1151	205.2203	185.5665	183.7390	190.7590	192.5183	213.8705	226.3783	251.5134 (64)
Fuel for water heating, kWh/month	86.2550	86.0429	85.6726	85.0026	83.8178	79.8000	79.8000	79.8000	79.8000	84.7849	85.8350	79.8000 (216)
Space cooling fuel requirement (221)m	294.6349	261.2103	279.0177	248.3630	244.8410	232.5394	230.2494	239.0464	241.2510	252.2506	263.7365	86.3068 (217)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	291.4178 (219)
Lighting	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	0.0000 (221)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	30.4985	24.4670	22.0298	16.1400	12.4670	10.1856	11.3728	14.7828	19.2014	25.1933	28.4558	7.3041 (231)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-66.9766	-89.9167	-123.1181	-131.6124	-136.3731	-125.2777	-123.6217	-119.2822	-111.0057	-99.3793	-71.9660	7.0685 (232)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	31.3461 (233a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Annual totals kWh/year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Space heating fuel - main system 1	-52.8387	-109.0157	-212.9079	-314.5272	-411.0160	-411.3088	-406.5457	-346.4762	-256.9499	-154.1854	-69.9564	-41.9555 (233b)
Space heating fuel - main system 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Space heating fuel - secondary	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Efficiency of water heater	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Water heating fuel used	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Space cooling fuel	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity for pumps and fans:												4147.1065 (211)
Total electricity for the above, kWh/year												0.0000 (213)
Electricity for lighting (calculated in Appendix L)												0.0000 (215)
Energy saving/generation technologies (Appendices M ,N and Q)												79.8000
PV generation												3078.5581 (219)
Wind generation												0.0000 (221)
Hydro-electric generation (Appendix N)												86.0000 (231)
Electricity generated - Micro CHP (Appendix N)												246.1401 (232)
Appendix Q - special features												-4044.6528 (233)
Energy saved or generated												0.0000 (234)
Energy used												0.0000 (235a)
Total delivered energy for all uses												0.0000 (235)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4147.1065	0.2100	870.8924 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3078.5581	0.2100	646.4972 (264)
Space and water heating			1517.3896 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	246.1401	0.1443	35.5256 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1256.9694	0.1357	-170.5285
PV Unit electricity exported	-2787.6833	0.1264	-352.3251
Total			-522.8537 (269)
Total CO2, kg/year			1041.9908 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.1100 (273)

13a. Primary energy - Individual heating systems including micro-CHP

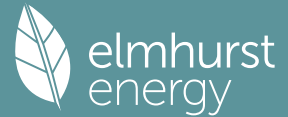
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4147.1065	1.1300	4686.2304 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3078.5581	1.1300	3478.7706 (278)
Space and water heating			8165.0010 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	246.1401	1.5338	377.5379 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1256.9694	1.5015	-1887.2887
PV Unit electricity exported	-2787.6833	0.4639	-1293.3356
Total			-3180.6243 (283)
Total Primary energy kWh/year			5492.0153 (286)
Target Primary Energy Rate (TPER)			48.0100 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

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2. Ventilation rate

											m3 per hour			
Number of open chimneys	0 * 80 =											0.0000	(6a)	
Number of open flues	0 * 20 =											0.0000	(6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =											0.0000	(6c)	
Number of flues attached to solid fuel boiler	0 * 20 =											0.0000	(6d)	
Number of flues attached to other heater	0 * 35 =											0.0000	(6e)	
Number of blocked chimneys	0 * 20 =											0.0000	(6f)	
Number of intermittent extract fans	4 * 10 =											40.0000	(7a)	
Number of passive vents	0 * 10 =											0.0000	(7b)	
Number of flueless gas fires	0 * 40 =											0.0000	(7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000	Air changes per hour		
Pressure test												/ (5) =	0.1492	(8)
Pressure Test Method												Yes		
Measured/design AP50												Blower Door		
Infiltration rate												5.0000	(17)	
Number of sides sheltered												0.3992	(18)	
												2	(19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500	(20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.3393	(21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)		
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)		
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)		
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)		
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)		
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)		

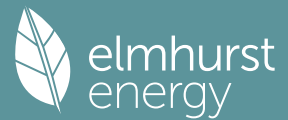
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)				
Solid Doors			2.0200	1.0000	2.0200			(26)				
Rooflight S			0.5400	1.1450	0.6183			(27a)				
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)				
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)				
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)				
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)				
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)				
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)				
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)				
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)				
Total net area of external elements Aum(A, m2)			311.1600					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)				
GF			100.0000			9.0000	900.0000	(32c)				
FF			50.0000			9.0000	450.0000	(32c)				
Internal Floor 1			32.5700			18.0000	586.2600	(32d)				
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)				
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	10252.2300		(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						89.6174		(35)				
List of Thermal Bridges												
K1 Element				Length	Psi-value		Total					
E16 Corner (normal)				14.4000	0.0900		1.2960					
E10 Eaves (insulation at ceiling level)				38.6100	0.0600		2.3166					
E17 Corner (inverted - internal area greater than external area)				4.8000	-0.0900		-0.4320					
R8 Roof to wall (rafter)				22.5600	0.0600		1.3536					
R6 Flat ceiling				30.0000	0.0600		1.8000					
E13 Gable (insulation at rafter level)				2.6000	0.0800		0.2080					
E12 Gable (insulation at ceiling level)				3.3000	0.0600		0.1980					
E2 Other lintels (including other steel lintels)				13.3100	0.0500		0.6655					
E3 Sill				12.3500	0.0500		0.6175					
E4 Jamb				32.9600	0.0500		1.6480					
E5 Ground floor (normal)				43.7400	0.1500		6.5610					
E6 Intermediate floor within a dwelling				27.3400	0.0000		0.0000					
R1 Head of roof window				0.5500	0.0600		0.0330					
R2 Sill of roof window				0.5500	0.0800		0.0440					
R3 Jamb of roof window				1.9600	0.0600		0.1176					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.4268	(36)				
Point Thermal bridges							(36a) =	0.0000				
Total fabric heat loss							(33) + (36) + (36a) =	79.8205 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591 (38)
Average = Sum(39)m / 12 =	132.3274	132.0059	131.6907	130.2106	129.9337	128.6445	128.6445	128.4058	129.1411	129.9337	130.4939	131.0796 (39)
												130.2093
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1567	1.1539	1.1511	1.1382	1.1358	1.1245	1.1245	1.1224	1.1289	1.1358	1.1407	1.1458 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												31.0071 (42b)
	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)

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Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												68.4778 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	74.7093	72.6597	70.4220	67.6372	65.1527	62.5708	62.0345	64.2676	66.5579	69.2094	72.0189	74.6045 (44)
Distribution loss (46)m = 0.15 x (45)m	118.3213	103.4664	108.2360	92.5919	87.7080	76.9380	75.0254	79.5768	82.0726	93.9165	102.6041	116.8127 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908 (64)
12Total per year (kWh/year)												966.6793 (64)
Electric shower(s)	57.5138	51.2452	55.9578	53.3999	54.4019	51.8941	53.6239	54.4019	53.3999	55.9578	54.9056	57.5138 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												654.2157 (64a)
Heat gains from water heating, kWh/month	39.5217	34.7979	36.9896	33.0257	32.2384	29.3229	29.3489	30.5105	30.7904	33.9467	35.5298	39.2011 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823	146.7823 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	53.1206	51.7826	49.7172	45.8691	43.3312	40.7262	39.4474	41.0088	42.7644	45.6273	49.3469	52.6897 (72)
Total internal gains	543.2174	560.4880	535.4334	521.0170	494.0696	478.0143	459.5884	458.2678	472.1787	485.6099	513.7391	530.5322 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					3.6300	10.6334	0.6300	0.7000			0.7700			11.7964 (74)
East					2.7000	19.6403	0.6300	0.7000			0.7700			16.2063 (76)
South					8.7300	46.7521	0.6300	0.7000			0.7700			124.7346 (78)
West					2.2000	19.6403	0.6300	0.7000			0.7700			13.2051 (80)
South					0.5400	47.0123	0.6300	0.7000			1.0000			10.0760 (82)
Solar gains	176.0183	302.3432	419.5824	528.4914	598.8809	597.3483	574.7613	521.9842	457.3449	335.8214	211.3072	150.3155	(83)	
Total gains	719.2357	862.8312	955.0158	1049.5084	1092.9505	1075.3625	1034.3498	980.2521	929.5237	821.4313	725.0463	680.8477	(84)	

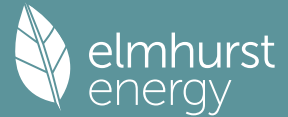
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	21.5212	21.5736	21.6252	21.8710	21.9177	22.1373	22.1373	22.1785	22.0522	21.9177	21.8236	21.7260
util living area	2.4347	2.4382	2.4417	2.4581	2.4612	2.4758	2.4758	2.4786	2.4701	2.4612	2.4549	2.4484
	0.9552	0.9309	0.8986	0.8370	0.7458	0.6124	0.4837	0.5202	0.6966	0.8598	0.9340	0.9603 (86)
MIT	18.1118	18.4900	19.0019	19.6688	20.2484	20.6838	20.8739	20.8449	20.5333	19.7671	18.8314	18.0516 (87)
Th 2	19.9548	19.9571	19.9593	19.9698	19.9717	19.9809	19.9809	19.9826	19.9773	19.9717	19.9677	19.9636 (88)
util rest of house	0.9490	0.9216	0.8843	0.8129	0.7051	0.5454	0.3905	0.4281	0.6368	0.8340	0.9235	0.9548 (89)
MIT 2	17.3204	17.6931	18.1958	18.8464	19.3904	19.7779	19.9213	19.9051	19.6571	18.9537	18.0416	17.2668 (90)
Living area fraction	17.4956	17.8695	18.3742	19.0285	19.5803	19.9784	20.1321	20.1131	19.8510	19.1337	18.2164	17.4405 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4956	17.8695	18.3742	19.0285	19.5803	19.9784	20.1321	20.1131	19.8510	19.1337	18.2164	17.4405 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9288	0.8969	0.8570	0.7867	0.6875	0.5452	0.4052	0.4408	0.6285	0.8083	0.8997	0.9360 (94)
Ext temp.	667.9981	773.8931	818.4738	825.6680	751.4427	586.2897	419.1254	432.1090	584.1693	663.9228	652.3390	637.2638 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1746.1325	1712.0496	1563.7278	1318.8322	1023.9174	691.9040	454.3898	476.7814	742.6948	1108.8189	1450.6250	1735.5554 (97)

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Space heating requirement - total per year (kWh/year)	802.1320	630.4411	554.4690	355.0783	202.7212	0.0000	0.0000	0.0000	0.0000	331.0027	574.7660	817.1289 (98a)
Solar heating kWh												4267.7392
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh												0.0000
Space heating requirement after solar contribution - total per year (kWh/year)	802.1320	630.4411	554.4690	355.0783	202.7212	0.0000	0.0000	0.0000	0.0000	331.0027	574.7660	817.1289 (98c)
Space heating per m2												4267.7392
										(98c) / (4) =		37.3054 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1209.2583	951.9693	975.8838	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7051	0.7734	0.7479	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	852.5879	736.2056	729.8689	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1185.0156	1140.3538	1080.7738	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	239.3479	300.6863	261.0732	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	59.8370	75.1716	65.2683	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												200.2769 (107)
Energy for space heating												37.3054 (99)
Energy for space cooling												1.7507 (108)
Total												39.0561 (109)
Fabric Energy Efficiency (DFEE)												39.1 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	268.0460 (5)

2. Ventilation rate

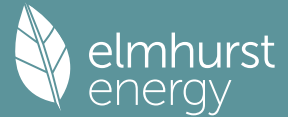
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1492 (8)
Pressure Test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3992 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.0200	1.0000	2.0200		(26)
TER Opening Type (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Rooflight S			0.5400	1.4151	0.7642		(27a)
Ground Floor			81.8300	0.1300	10.6379		(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442		(29a)

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Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	(30)
Rafters	17.9400	0.5400	17.4000	0.1100	1.9140	(30)
D Flat	1.7800		1.7800	0.1100	0.1958	(30)
Total net area of external elements Aum(A, m2)			311.1600			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	64.7925		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

89.6174 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1600	6.9984
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0800	0.0440
R2 Sill of roof window	0.5500	0.0600	0.0330
R3 Jamb of roof window	1.9600	0.0800	0.1568

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

16.9034 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 81.6959 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.5069	52.1854	51.8703	50.3901	50.1132	48.8240	48.8240	48.5853	49.3206	50.1132	50.6734	51.2591
Average = Sum(39)m / 12 =	134.2028	133.8813	133.5662	132.0860	131.8091	130.5199	130.5199	130.2812	131.0165	131.8091	132.3693	132.9550

132.0847 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1731	1.1703	1.1675	1.1546	1.1522	1.1409	1.1409	1.1388	1.1452	1.1522	1.1571	1.1622
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

1.1546 (40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8388 (42)
Hot water usage for mixer showers													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022		(42b)
Hot water usage for other uses													
43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023		(42c)
Average daily hot water use (litres/day)													68.4778 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.7093	72.6597	70.4220	67.6372	65.1527	62.5708	62.0345	64.2676	66.5579	69.2094	72.0189	74.6045	(44)
Energy conte	118.3213	103.4664	108.2360	92.5919	87.7080	76.9380	75.0254	79.5768	82.0726	93.9165	102.6041	116.8127	(45)
Energy content (annual)										Total = Sum(45)m =		1137.2698	
Distribution loss (46)m = 0.15 x (45)m													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908		(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	100.5731	87.9464	92.0006	78.7031	74.5518	65.3973	63.7716	67.6402	69.7617	79.8290	87.2135	99.2908	(64)
12Total per year (kWh/year)													966.6793 (64)
Electric shower(s)	57.5138	51.2452	55.9578	53.3999	54.4019	51.8941	53.6239	54.4019	53.3999	55.9578	54.9056	57.5138	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												654.2157	(64a)
Heat gains from water heating, kWh/month													
39.5217	34.7979	36.9896	33.0257	32.2384	29.3229	29.3489	30.5105	30.7904	33.9467	35.5298	39.2011		(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	141.9407	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
146.7823	162.5090	146.7823	151.6751	146.7823	151.6751	146.7823	146.7823	151.6751	146.7823	151.6751	146.7823		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
277.7322	280.6142	273.3517	257.8906	238.3738	220.0308	207.7765	204.8945	212.1570	227.6181	247.1349	265.4779		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941	37.1941		(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)													
-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526		(71)
Water heating gains (Table 5)													
53.1206	51.7826	49.7172	45.8691	43.3312	40.7262	39.4474	41.0088	42.7644	45.6273	49.3469	52.6897		(72)
Total internal gains	543.2174	560.4880	535.4334	521.0170	494.0696	478.0143	459.5884	458.2678	472.1787	485.6099	513.7391	530.5322	(73)

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6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	3.6300		10.6334		0.6300		0.7000		0.7700		11.7964 (74)	
East	2.7000		19.6403		0.6300		0.7000		0.7700		16.2063 (76)	
South	8.7300		46.7521		0.6300		0.7000		0.7700		124.7346 (78)	
West	2.2000		19.6403		0.6300		0.7000		0.7700		13.2051 (80)	
South	0.5400		47.0123		0.6300		0.7000		1.0000		10.0760 (82)	
Solar gains	176.0183	302.3432	419.5824	528.4914	598.8809	597.3483	574.7613	521.9842	457.3449	335.8214	211.3072	150.3155 (83)
Total gains	719.2357	862.8312	955.0158	1049.5084	1092.9505	1075.3625	1034.3498	980.2521	929.5237	821.4313	725.0463	680.8477 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.2204	21.2714	21.3216	21.5605	21.6058	21.8192	21.8192	21.8592	21.7365	21.6058	21.5144	21.4196
alpha	2.4147	2.4181	2.4214	2.4374	2.4404	2.4546	2.4546	2.4573	2.4491	2.4404	2.4343	2.4280
util living area	0.9554	0.9315	0.8996	0.8389	0.7488	0.6166	0.4882	0.5246	0.7001	0.8613	0.9345	0.9605 (86)
MIT	18.0704	18.4490	18.9644	19.6375	20.2260	20.6713	20.8677	20.8377	20.5177	19.7399	18.7958	18.0100 (87)
Th 2	19.9416	19.9438	19.9461	19.9565	19.9584	19.9676	19.9676	19.9693	19.9641	19.9584	19.9545	19.9504 (88)
util rest of house	0.9492	0.9221	0.8853	0.8147	0.7079	0.5488	0.3934	0.4312	0.6399	0.8355	0.9240	0.9549 (89)
MIT 2	17.2713	17.6444	18.1506	18.8075	19.3603	19.7569	19.9053	19.8885	19.6335	18.9189	17.9982	17.2174 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.4482	17.8225	18.3307	18.9912	19.5519	19.9593	20.1183	20.0985	19.8292	19.1006	18.1748	17.3928 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.4482	17.8225	18.3307	18.9912	19.5519	19.9593	20.1183	20.0985	19.8292	19.1006	18.1748	17.3928 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9288	0.8973	0.8577	0.7881	0.6898	0.5482	0.4082	0.4438	0.6310	0.8094	0.9000	0.9360 (94)
Useful gains	668.0560	774.1838	819.1369	827.1126	753.8697	589.5268	422.1788	435.0509	586.5401	664.8485	652.5615	637.2873 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1764.5215	1730.0823	1580.1862	1332.9103	1034.9556	699.4967	459.2117	481.8508	750.6235	1120.4600	1465.9599	1754.0502 (97)
Space heating kWh	815.7703	642.3638	566.2207	364.1743	209.1279	0.0000	0.0000	0.0000	0.0000	338.9750	585.6469	830.8716 (98a)
Space heating requirement - total per year (kWh/year)	4353.1504											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	815.7703	642.3638	566.2207	364.1743	209.1279	0.0000	0.0000	0.0000	0.0000	338.9750	585.6469	830.8716 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4353.1504											
Space heating per m2	(98c) / (4) = 38.0520 (99)											

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1226.8873	965.8475	990.1371	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6981	0.7669	0.7412	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	856.4838	740.6622	733.8630	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1185.0156	1140.3538	1080.7738	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	236.5429	297.3706	258.1017	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	59.1357	74.3427	64.5254	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	198.0038 (107)											
Energy for space heating	38.0520 (99)											
Energy for space cooling	1.7308 (108)											
Total	39.7828 (109)											
Fabric Energy Efficiency (TFEE)	39.8 (109)											

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

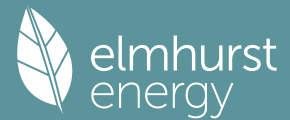
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		

elmhurst
energy

$$(3a) + (3b) + (3c) + (3d) + (3e) \dots (3n) = 268.0460 \quad (5)$$
[illegible]

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Average daily hot water use (litres/day)	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c) 151.2443 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Distribution loss (46)m = 0.15 x (45)m	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Water storage loss:	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)m
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357	(68)
Pumps, fans	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	(71)
Total internal gains	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453	(72)
	742.5067	739.8983	717.4078	675.3570	633.5455	592.7733	570.4214	574.1857	595.7333	637.0802	683.3167	723.5706	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				3.6300	10.6334		0.6300		0.7000		0.7700		11.7964 (74)
East				2.7000	19.6403		0.6300		0.7000		0.7700		16.2063 (76)
South				8.7300	46.7521		0.6300		0.7000		0.7700		124.7346 (78)
West				2.2000	19.6403		0.6300		0.7000		0.7700		13.2051 (80)
South				0.5400	47.0123		0.6300		0.7000		1.0000		10.0760 (82)
Solar gains	176.0183	302.3432	419.5824	528.4914	598.8809	597.3483	574.7613	521.9842	457.3449	335.8214	211.3072	150.3155	(83)
Total gains	918.5251	1042.2415	1136.9901	1203.8483	1232.4264	1190.1216	1145.1827	1096.1699	1053.0783	972.9016	894.6239	873.8861	(84)

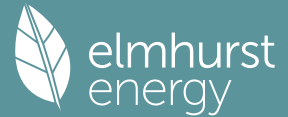
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.5212	21.5736	21.6252	21.8710	21.9177	22.1373	22.1373	22.1785	22.0522	21.9177	21.8236	21.7260
alpha	2.4347	2.4382	2.4417	2.4581	2.4612	2.4758	2.4758	2.4786	2.4701	2.4612	2.4549	2.4484
util living area	0.9275	0.9018	0.8629	0.7990	0.7040	0.5732	0.4465	0.4781	0.6503	0.8164	0.9021	0.9345 (86)
MIT	18.4246	18.7495	19.2356	19.8280	20.3488	20.7291	20.8949	20.8721	20.6048	19.9352	19.0791	18.3618 (87)
Th 2	19.9548	19.9571	19.9593	19.9698	19.9717	19.9809	19.9809	19.9826	19.9773	19.9717	19.9677	19.9636 (88)
util rest of house	0.9182	0.8894	0.8451	0.7716	0.6610	0.5066	0.3576	0.3899	0.5887	0.7858	0.8876	0.9260 (89)
MIT 2	16.9657	17.3732	17.9802	18.7140	19.3337	19.7610	19.9182	19.9022	19.6355	18.8602	17.8010	16.8920 (90)
Living area fraction	17.2886	17.6778	18.2581	18.9606	19.5584	19.9753	20.1344	20.1168	19.8500	19.0981	18.0839	17.2173 (91)
MIT	17.2886	17.6778	18.2581	18.9606	19.5584	19.9753	20.1344	20.1168	19.8500	19.0981	18.0839	17.2173 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2886	17.6778	18.2581	18.9606	19.5584	19.9753	20.1344	20.1168	19.8500	19.0981	18.0839	17.2173 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8854	0.8540	0.8090	0.7402	0.6416	0.5062	0.3717	0.4023	0.5803	0.7546	0.8530	0.8947 (94)
	813.2791	890.0370	919.8716	891.0813	790.7746	602.4715	425.6654	440.9368	611.0660	734.1118	763.1078	781.8934 (95)

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Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1718.7507	1686.7478	1548.4271	1309.9933	1021.0642	691.4979	454.6829	477.2626	742.5650	1104.1894	1433.3333	1706.3043 (97)
Space heating kWh	673.6709	535.3896	467.6453	301.6167	171.3355	0.0000	0.0000	0.0000	0.0000	275.3377	482.5624	687.7617 (98a) 3595.3197
Space heating requirement - total per year (kWh/year)												
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b) 0.0000
Solar heating contribution - total per year (kWh/year)												
Space heating kWh	673.6709	535.3896	467.6453	301.6167	171.3355	0.0000	0.0000	0.0000	0.0000	275.3377	482.5624	687.7617 (98c) 3595.3197
Space heating requirement after solar contribution - total per year (kWh/year)												
Space heating per m2										(98c) / (4) =		31.4276 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	673.6709	535.3896	467.6453	301.6167	171.3355	0.0000	0.0000	0.0000	0.0000	275.3377	482.5624	687.7617 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	269.5762	214.2415	187.1330	120.6949	68.5616	0.0000	0.0000	0.0000	0.0000	110.1792	193.1022	275.2147 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1438.7034 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1817.8213 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												251.8419 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3508.3666 (238)

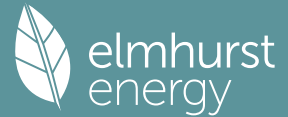
10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1438.7034	16.4900	237.2422 (240)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1817.8213	16.4900	299.7587 (247)	
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)	
Energy for lighting	251.8419	16.4900	41.5287 (250)	
Additional standing charges			0.0000 (251)	
Total energy cost			578.5296 (255)	

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.3066 (257)

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SAP value
SAP rating (Section 12)
SAP band

78.8202
79 (258)
C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year	
Space heating - main system 1	1438.7034	0.1544	222.1632	(261)
Total CO ₂ associated with community systems			0.0000	(373)
Water heating (other fuel)	1817.8213	0.1410	256.2660	(264)
Space and water heating			478.4292	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Total CO ₂ , kg/year			514.7778	(272)
CO ₂ emissions per m ²			4.5000	(273)
EI value			95.6725	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920	(1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460	(5)

2. Ventilation rate

	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1492 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3992	(18)
Number of sides sheltered	2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393 (21)

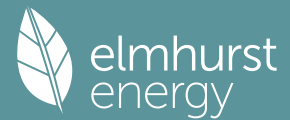
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Wind factor	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Adj infilt rate	0.3054	0.2800	0.2715	0.2715	0.2800	0.2460	0.2630	0.2375	0.2375	0.2545	0.2375	0.2715	(22b)
Effective ac	0.5466	0.5392	0.5368	0.5368	0.5392	0.5303	0.5346	0.5282	0.5282	0.5324	0.5282	0.5368	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Windows (U _w = 1.20)			17.2600	1.1450	19.7634			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight S			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)
Total net area of external elements A _{um} (A, m ²)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			50.0000			9.0000	450.0000	(32c)
Internal Floor 1			32.5700			18.0000	586.2600	(32d)
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)

Heat capacity C _m = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10252.2300 (34)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K		89.6174 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1500	6.5610
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.4268 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss		(33) + (36) + (36a) =	79.8205 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.3529	47.6940	47.4871	47.4871	47.6940	46.9046	47.2866	46.7232	46.7232	47.0924	46.7232	47.4871	(38)
Heat transfer coeff	128.1734	127.5145	127.3076	127.3076	127.5145	126.7251	127.1071	126.5436	126.5436	126.9129	126.5436	127.3076	(39)
Average = Sum(39)m / 12 =												127.1251	
HLP	1.1204	1.1146	1.1128	1.1128	1.1146	1.1077	1.1111	1.1062	1.1062	1.1094	1.1062	1.1128	(40)
HLP (average)												1.1112	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8388 (42)
Hot water usage for mixer showers													
89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278	(42a)	
Hot water usage for baths													
31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022	(42b)	
Hot water usage for other uses													
43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023	(42c)	
Average daily hot water use (litres/day)												151.2443	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323	(44)
Energy content	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350	(45)
Energy content (annual)										Total = Sum(45)m =		2512.1698	
Distribution loss (46)m = 0.15 x (45)m													
39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252	(46)	
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)	
If cylinder contains dedicated solar storage													
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100	(64)	
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
132.1956	117.4376	125.7514	112.5375	110.5157	101.1009	100.7117	103.7469	103.8525	114.0212	119.1160	130.9777	(65)	

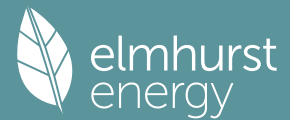
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	(71)
Water heating gains (Table 5)													
	177.6822	174.7584	169.0207	156.3020	148.5426	140.4180	135.3651	139.4448	144.2396	153.2544	165.4389	176.0453	(72)
Total internal gains													
	742.5067	739.8983	717.4078	675.3570	633.5455	592.7733	570.4214	574.1857	595.7333	637.0802	683.3167	723.5706	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains

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	m2		Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W	
North	3.6300		13.0723		0.6300		0.7000		0.7700		14.5021	(74)
East	2.7000		24.4329		0.6300		0.7000		0.7700		20.1609	(76)
South	8.7300		54.9219		0.6300		0.7000		0.7700		146.5318	(78)
West	2.2000		24.4329		0.6300		0.7000		0.7700		16.4274	(80)
South	0.5400		56.7286		0.6300		0.7000		1.0000		12.1584	(82)

Solar gains	209.7805	316.0527	435.1004	568.9602	631.2894	683.7929	644.1191	587.9452	507.7953	374.2005	252.6004	174.7434	(83)
Total gains	952.2873	1055.9510	1152.5082	1244.3171	1264.8349	1276.5662	1214.5405	1162.1309	1103.5287	1011.2807	935.9171	898.3141	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.2187	22.3335	22.3698	22.3698	22.3335	22.4726	22.4051	22.5048	22.5048	22.4393	22.5048	22.3698	
alpha	2.4812	2.4889	2.4913	2.4913	2.4889	2.4982	2.4937	2.5003	2.5003	2.4960	2.5003	2.4913	
util living area	0.9122	0.8898	0.8420	0.7633	0.6428	0.4770	0.3555	0.3592	0.5790	0.7632	0.8745	0.9210 (86)	
MIT	18.7769	19.0024	19.5084	20.0576	20.5520	20.8544	20.9501	20.9508	20.7430	20.2361	19.4514	18.7173 (87)	
Th 2	19.9842	19.9889	19.9904	19.9904	19.9889	19.9945	19.9918	19.9958	19.9958	19.9932	19.9958	19.9904 (88)	
util rest of house	0.9007	0.8759	0.8216	0.7317	0.5921	0.4035	0.2635	0.2641	0.5096	0.7238	0.8558	0.9105 (89)	
MIT 2	17.4258	17.7082	18.3362	19.0019	19.5741	19.8909	19.9686	19.9736	19.7911	19.2307	18.2803	17.3559 (90)	
Living area fraction	fLA = Living area / (4) =												0.2213 (91)
MIT	17.7248	17.9946	18.5956	19.2356	19.7905	20.1041	20.1858	20.1899	20.0018	19.4532	18.5395	17.6572 (92)	
Temperature adjustment													0.0000
adjusted MIT	17.7248	17.9946	18.5956	19.2356	19.7905	20.1041	20.1858	20.1899	20.0018	19.4532	18.5395	17.6572 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.8671	0.8410	0.7875	0.7047	0.5812	0.4119	0.2819	0.2832	0.5100	0.6994	0.8216	0.8780	(94)	
Useful gains	825.7150	888.0482	907.5704	876.8799	735.1347	525.8474	342.3368	329.0664	562.8002	707.3029	768.9424	788.7354	(95)	
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)	
Heat loss rate W	1605.3509	1593.2443	1438.0186	1213.9528	891.3910	570.7862	354.0994	340.3914	645.6017	971.2925	1308.3969	1585.8964	(97)	
Space heating kWh	580.0491	473.8918	394.6535	242.6925	116.2547	0.0000	0.0000	0.0000	0.0000	196.4083	388.4072	593.0878	(98a)	
Space heating requirement - total per year (kWh/year)													2985.4449	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)	
Solar heating contribution - total per year (kWh/year)													0.0000	
Space heating kWh	580.0491	473.8918	394.6535	242.6925	116.2547	0.0000	0.0000	0.0000	0.0000	196.4083	388.4072	593.0878	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)													2985.4449	
Space heating per m2													(98c) / (4) = 26.0965	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												249.9000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	580.0491	473.8918	394.6535	242.6925	116.2547	0.0000	0.0000	0.0000	0.0000	196.4083	388.4072	593.0878	(98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)	232.1125	189.6326	157.9245	97.1158	46.5205	0.0000	0.0000	0.0000	0.0000	78.5948	155.4251	237.3300	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	317.4729	280.8404	298.0919	260.9349	252.2702	226.5393	222.7844	231.9131	234.8148	262.8133	280.7200	313.8100	(64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)
Fuel for water heating, kWh/month	181.3095	160.3886	170.2409	149.0205	144.0721	129.3771	127.2327	132.4461	134.1032	150.0932	160.3198	179.2176	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

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Space heating fuel - main system 1	1194.6558 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	175.1000
Water heating fuel used	1817.8213 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	251.8419 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3264.3190 (238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1194.6558	26.0600	311.3273 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1817.8213	26.0600	473.7242 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	251.8419	26.0600	65.6300 (250)
Additional standing charges			0.0000 (251)
Total energy cost			850.6815 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1194.6558	0.1550	185.2091 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1817.8213	0.1410	256.2660 (264)
Space and water heating			441.4751 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	251.8419	0.1443	36.3486 (268)
Total CO2, kg/year			477.8237 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1194.6558	1.5740	1880.3540 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1817.8213	1.5213	2765.4070 (278)
Space and water heating			4645.7610 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	251.8419	1.5338	386.2835 (282)
Total Primary energy kWh/year			5032.0445 (286)

SAP 10 EPC IMPROVEMENTS

PLANNING

Current energy efficiency rating:	C 79
Current environmental impact rating:	A 96

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.9	-£ 102	-49 kg (10.3%)
U Solar photovoltaic panels	+ 5.5	-£ 256	-132 kg (30.8%)

Recommended measures	Typical annual savings	Energy efficiency impact	Environmental impact
Solar water heating	£102	0.43 kg/m²	B 81 A 96
Solar photovoltaic panels	£256	1.15 kg/m²	B 86 A 97
Total Savings	£358	1.58 kg/m²	

Potential energy efficiency rating:	B 86
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£851	£748	£102
Space heating	£311	£333	-£21
Water heating	£474	£350	£123
Lighting	£66	£66	£0
Generated (PV)	-£0	-£256	£256

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Total cost of fuels	£851	£492	£358
Total cost of uses	£851	£493	£358
Delivered energy	29 kWh/m²	17 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	3 kg/m²	2 kg/m²
Primary energy	44 kWh/m²	26 kWh/m²	18 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	81.8300 (1b)	x 2.4000 (2b)	= 196.3920 (1b) - (3b)
First floor	32.5700 (1c)	x 2.2000 (2c)	= 71.6540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 268.0460 (5)

2. Ventilation rate

	m³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1492 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3992 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3393 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3393	0.3648	0.3818	0.3987 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m²	Openings m²	NetArea m²	U-value W/m²K	A x U W/K	K-value kJ/m²K	A x K kJ/K
Windows (Uw = 1.20)			17.2600	1.1450	19.7634		(27)
Solid Doors			2.0200	1.0000	2.0200		(26)
Rooflight S			0.5400	1.1450	0.6183		(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500 (28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100 (29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200 (29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700 (29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400 (30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300 (30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000 (30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200 (30)
Total net area of external elements Aum(A, m²)			311.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937		(33)
GF			100.0000			9.0000	900.0000 (32c)
FF			50.0000			9.0000	450.0000 (32c)
Internal Floor 1			32.5700			18.0000	586.2600 (32d)
Internal Ceiling 1			32.5700			9.0000	293.1300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 10252.2300 (34)
89.6174 (35)

List of Thermal Bridges

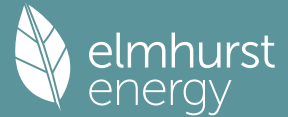
K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1500	6.5610
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.8388 (42)
Hot water usage for mixer showers	89.7717	88.4227	86.4568	82.6954	79.9196	76.8240	75.0645	77.0155	79.1542	82.4779	86.3200	89.4278 (42a)
Hot water usage for baths	31.0071	30.5466	29.8981	28.7024	27.8071	26.8143	26.2781	26.9220	27.6232	28.6855	29.9058	30.9022 (42b)
Hot water usage for other uses	43.7023	42.1131	40.5239	38.9348	37.3456	35.7564	35.7564	37.3456	38.9348	40.5239	42.1131	43.7023 (42c)
Average daily hot water use (litres/day)												151.2443 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323 (44)
Energy content (annual)	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2512.1698
39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)	
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)	
If cylinder contains dedicated solar storage												
33.7127	30.4501	33.7127	32.6252	33.7127	33.7127	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month												
317.4729	280.8404	296.6962	254.1813	239.4759	213.9326	209.7575	219.8167	229.4119	261.4175	280.7200	313.8100 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												643.3954 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												643.3954
Solar input	-0.0000	-16.1775	-59.4121	-82.5934	-109.1830	-100.8626	-100.2334	-86.9245	-59.1784	-28.8304	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
317.4729	264.6629	237.2840	171.5879	130.2929	113.0700	109.5240	132.8922	170.2335	232.5871	280.7200	313.8100 (64)	
Total per year (kWh/year) = Sum(64)m =											2474.1373 (64)	
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)	
Heat gains from water heating, kWh/month												
132.1956	117.4376	124.6348	107.1346	100.2802	91.0156	90.2901	94.0698	99.5302	112.9047	119.1160	130.9777 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526 (71)
Water heating gains (Table 5)	177.6822	174.7584	167.5199	148.7980	134.7852	126.4105	121.3577	126.4379	138.2364	151.7536	165.4389	176.0453 (72)
Total internal gains	742.5067	739.8983	715.9070	667.8530	619.7882	578.7659	556.4139	561.1787	589.7301	635.5794	683.3167	723.5706 (73)

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[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W
North	3.6300	10.6334	0.6300	0.7000	0.7700	11.7964 (74)
East	2.7000	19.6403	0.6300	0.7000	0.7700	16.2063 (76)
South	8.7300	46.7521	0.6300	0.7000	0.7700	124.7346 (78)
West	2.2000	19.6403	0.6300	0.7000	0.7700	13.2051 (80)
South	0.5400	47.0123	0.6300	0.7000	1.0000	10.0760 (82)

Solar gains	176.0183	302.3432	419.5824	528.4914	598.8809	597.3483	574.7613	521.9842	457.3449	335.8214	211.3072	150.3155 (83)
Total gains	918.5251	1042.2415	1135.4893	1196.3443	1218.6691	1176.1141	1131.1753	1083.1630	1047.0751	971.4008	894.6239	873.8861 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.5212	21.5736	21.6252	21.8710	21.9177	22.1373	22.1373	22.1785	22.0522	21.9177	21.8236	21.7260
alpha	2.4347	2.4382	2.4417	2.4581	2.4612	2.4758	2.4758	2.4786	2.4701	2.4612	2.4549	2.4484
util living area	0.9275	0.9018	0.8632	0.8008	0.7081	0.5778	0.4509	0.4825	0.6525	0.8168	0.9021	0.9345 (86)
MIT	18.4246	18.7495	19.2338	19.8208	20.3397	20.7241	20.8926	20.8694	20.6016	19.9337	19.0791	18.3618 (87)
Th 2	19.9548	19.9571	19.9593	19.9698	19.9717	19.9809	19.9809	19.9826	19.9773	19.9717	19.9677	19.9636 (88)
util rest of house	0.9182	0.8894	0.8455	0.7736	0.6652	0.5111	0.3615	0.3939	0.5910	0.7862	0.8876	0.9260 (89)
MIT 2	16.9657	17.3732	17.9780	18.7056	19.3239	19.7565	19.9167	19.9003	19.6325	18.8584	17.8010	16.8920 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.2886	17.6778	18.2560	18.9525	19.5487	19.9707	20.1327	20.1148	19.8470	19.0964	18.0839	17.2173 (92)
Temperature adjustment												
adjusted MIT	17.2886	17.6778	18.2560	18.9525	19.5487	19.9707	20.1327	20.1148	19.8470	19.0964	18.0839	17.2173 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8854	0.8540	0.8094	0.7420	0.6454	0.5104	0.3755	0.4061	0.5823	0.7550	0.8530	0.8947 (94)
Useful gains	813.2791	890.0370	919.0273	887.7337	786.5711	600.2733	424.7771	439.8951	609.6852	733.4098	763.1078	781.8934 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1718.7507	1686.7478	1548.1503	1308.9357	1019.8151	690.9048	454.4599	476.9979	742.1738	1103.9667	1433.3333	1706.3043 (97)
Space heating kWh	673.6709	535.3896	468.0676	303.2655	173.5335	0.0000	0.0000	0.0000	0.0000	275.6943	482.5624	687.7617 (98a)
Space heating requirement - total per year (kWh/year)	3599.9454											
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	673.6709	535.3896	468.0676	303.2655	173.5335	0.0000	0.0000	0.0000	0.0000	275.6943	482.5624	687.7617 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3599.9454											
Space heating per m2	(98c) / (4) = 31.4681 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	673.6709	535.3896	468.0676	303.2655	173.5335	0.0000	0.0000	0.0000	0.0000	275.6943	482.5624	687.7617 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	269.5762	214.2415	187.3019	121.3547	69.4412	0.0000	0.0000	0.0000	0.0000	110.3218	193.1022	275.2147 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.4729	264.6629	237.2840	171.5879	130.2929	113.0700	109.5240	132.8922	170.2335	232.5871	280.7200	313.8100 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	181.3095	151.1496	135.5134	97.9942	74.4105	64.5745	62.5494	75.8950	97.2207	132.8310	160.3198	179.2176 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.1313	-59.0107	-89.5030	-104.1709	-112.3364	-99.0713	-97.5974	-91.7305	-80.6820	-68.4069	-44.1332	-33.4133 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1440.5544	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.1000	
Water heating fuel used												1412.9853	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.8419	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-919.1869	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2266.1947	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1440.5544	16.4900	237.5474	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1412.9853	16.4900	233.0013	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	251.8419	16.4900	41.5287	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-919.1869	16.4900	-151.5739	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-151.5739	(252)
Total energy cost			373.6955	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8440	(257)
SAP value		86.3191	
SAP rating (Section 12)		86	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1440.5544	0.1544	222.4189	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1412.9853	0.1450	204.8452	(264)
Space and water heating			427.2641	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	251.8419	0.1443	36.3486	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-919.1869	0.1343	-123.4916	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-123.4916	(269)
Total CO2, kg/year			351.2180	(272)
CO2 emissions per m2			3.0700	(273)
EI value			97.0475	
EI rating			97	(274)
EI band			A	

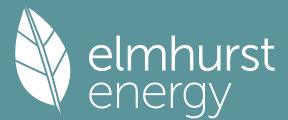
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	81.8300 (1b)	x	2.4000 (2b)	=	196.3920 (1b) - (3b)	
First floor	32.5700 (1c)	x	2.2000 (2c)	=	71.6540 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4000				(4)	
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	268.0460 (5)	

2. Ventilation rate

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			m3 per hour
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000	Air changes per hour	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.3992	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500		(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3393		(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	3.6000	3.3000	3.2000	3.2000	3.3000	2.9000	3.1000	2.8000	2.8000	3.0000	2.8000	3.2000	(22)
Adj infilt rate	0.9000	0.8250	0.8000	0.8000	0.8250	0.7250	0.7750	0.7000	0.7000	0.7500	0.7000	0.8000	(22a)
Effective ac	0.3054	0.2800	0.2715	0.2715	0.2800	0.2460	0.2630	0.2375	0.2375	0.2545	0.2375	0.2715	(22b)
	0.5466	0.5392	0.5368	0.5368	0.5392	0.5303	0.5346	0.5282	0.5282	0.5324	0.5282	0.5368	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			17.2600	1.1450	19.7634			(27)
Solid Doors			2.0200	1.0000	2.0200			(26)
Rooflight S			0.5400	1.1450	0.6183			(27a)
Ground Floor			81.8300	0.1100	9.0013	75.0000	6137.2500	(28a)
Brick	111.8500	17.1600	94.6900	0.1800	17.0442	9.0000	852.2100	(29a)
Dormer	3.5000	2.1200	1.3800	0.1800	0.2484	9.0000	12.4200	(29a)
Ashlar	26.2300		26.2300	0.1800	4.7214	9.0000	236.0700	(29a)
Joists GF	49.2600		49.2600	0.1100	5.4186	9.0000	443.3400	(30)
Joists FF	18.7700		18.7700	0.1100	2.0647	9.0000	168.9300	(30)
Rafters	17.9400	0.5400	17.4000	0.1300	2.2620	9.0000	156.6000	(30)
D Flat	1.7800		1.7800	0.1300	0.2314	9.0000	16.0200	(30)
Total net area of external elements Aum (A, m2)			311.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.3937			(33)
GF			100.0000			9.0000	900.0000	(32c)
FF			50.0000			9.0000	450.0000	(32c)
Internal Floor 1			32.5700			18.0000	586.2600	(32d)
Internal Ceiling 1			32.5700			9.0000	293.1300	(32e)

Heat capacity Cm = Sum (A x k)	(28)...(30) + (32) + (32a)...(32e) =	10252.2300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		89.6174	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	14.4000	0.0900	1.2960
E10 Eaves (insulation at ceiling level)	38.6100	0.0600	2.3166
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
R8 Roof to wall (rafter)	22.5600	0.0600	1.3536
R6 Flat ceiling	30.0000	0.0600	1.8000
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E12 Gable (insulation at ceiling level)	3.3000	0.0600	0.1980
E2 Other lintels (including other steel lintels)	13.3100	0.0500	0.6655
E3 Sill	12.3500	0.0500	0.6175
E4 Jamb	32.9600	0.0500	1.6480
E5 Ground floor (normal)	43.7400	0.1500	6.5610
E6 Intermediate floor within a dwelling	27.3400	0.0000	0.0000
R1 Head of roof window	0.5500	0.0600	0.0330
R2 Sill of roof window	0.5500	0.0800	0.0440
R3 Jamb of roof window	1.9600	0.0600	0.1176

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.4268	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	79.8205	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

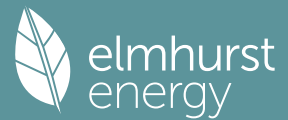
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	48.3529	47.6940	47.4871	47.4871	47.6940	46.9046	47.2866	46.7232	46.7232	47.0924	46.7232	47.4871	(38)
Average = Sum(39)m / 12 =	128.1734	127.5145	127.3076	127.3076	127.5145	126.7251	127.1071	126.5436	126.5436	126.9129	126.5436	127.3076	(39)
												127.1251	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1204	1.1146	1.1128	1.1128	1.1146	1.1077	1.1111	1.1062	1.1062	1.1094	1.1062	1.1128	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8388												(42)
Hot water usage for mixer showers	89.4278												(42a)
Hot water usage for baths	30.9022												(42b)
Hot water usage for other uses	43.7023												(42c)
Average daily hot water use (litres/day)	151.2443												(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	164.4811	161.0823	156.8788	150.3325	145.0722	139.3948	137.0990	141.2831	145.7121	151.6873	158.3389	164.0323	(44)
Energy content (annual)	260.4978	229.3791	241.1168	205.7977	195.2951	171.4021	165.8094	174.9380	179.6776	205.8382	225.5828	256.8350	(45)
	Total = Sum(45)m = 2512.1698												

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Distribution loss (46)m = 0.15 x (45)m	39.0747	34.4069	36.1675	30.8697	29.2943	25.7103	24.8714	26.2407	26.9516	30.8757	33.8374	38.5252 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
33.7127 30.4501 33.7127 32.6252 33.7127 32.6252 33.7127 33.7127 32.6252 33.7127 32.6252 33.7127 (56)												
If cylinder contains dedicated solar storage												
33.7127 30.4501 33.7127 32.6252 33.7127 32.6252 33.7127 33.7127 32.6252 33.7127 32.6252 33.7127 (57)												
Primary loss 23.2624 21.0112 21.8667 15.7584 10.4681 9.9053 10.2355 11.1660 17.1091 21.8667 22.5120 23.2624 (59)												
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)												
Total heat required for water heating calculated for each month												
317.4729 280.8404 296.6962 254.1813 239.4759 213.9326 209.7575 219.8167 229.4119 261.4175 280.7200 313.8100 (62)												
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)												
PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)												
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												763.9825 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												763.9825
Solar input -1.7760 -20.9090 -66.4092 -94.2840 -119.0285 -119.8568 -116.4267 -104.0535 -72.7611 -40.9082 -7.5696 -0.0000 (63c)												
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)												
Output from w/h												
315.6969 259.9314 230.2870 159.8973 120.4473 94.0757 93.3308 115.7632 156.6508 220.5093 273.1504 313.8100 (64)												
Electric shower(s)												
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)												
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
132.1956 117.4376 124.6348 107.1346 100.2802 91.0156 90.2901 94.0698 99.5302 112.9047 119.1160 130.9777 (65)												

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	170.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.6508	31.6647	25.7515	19.4955	14.5731	12.3033	13.2941	17.2802	23.1934	29.4494	34.3718	36.6417	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	414.5257	418.8272	407.9876	384.9114	355.7818	328.4041	310.1142	305.8127	316.6523	339.7285	368.8580	396.2357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	54.8717	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	-113.5526	(71)
Water heating gains (Table 5)	177.6822	174.7584	167.5199	148.7980	134.7852	126.4105	121.3577	126.4379	138.2364	151.7536	165.4389	176.0453	(72)
Total internal gains	742.5067	739.8983	715.9070	667.8530	619.7882	578.7659	556.4139	561.1787	589.7301	635.5794	683.3167	723.5706	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North					3.6300	13.0723	0.6300	0.7000	0.7700	14.5021 (74)				
East					2.7000	24.4329	0.6300	0.7000	0.7700	20.1609 (76)				
South					8.7300	54.9219	0.6300	0.7000	0.7700	146.5318 (78)				
West					2.2000	24.4329	0.6300	0.7000	0.7700	16.4274 (80)				
South					0.5400	56.7286	0.6300	0.7000	1.0000	12.1584 (82)				
Solar gains	209.7805	316.0527	435.1004	568.9602	631.2894	683.7929	644.1191	587.9452	507.7953	374.2005	252.6004	174.7434	(83)	
Total gains	952.2873	1055.9510	1151.0074	1236.8131	1251.0776	1262.5588	1200.5330	1149.1239	1097.5255	1009.7799	935.9171	898.3141	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	22.2187	22.3335	22.3698	22.3698	22.3335	22.4726	22.4051	22.5048	22.5048	22.4393	22.5048	22.3698	
alpha	2.4812	2.4889	2.4913	2.4913	2.4889	2.4982	2.4937	2.5003	2.5003	2.4960	2.5003	2.4913	
util living area	0.9122	0.8898	0.8423	0.7652	0.6470	0.4811	0.3591	0.3628	0.5811	0.7637	0.8745	0.9210	(86)
MIT	18.7769	19.0024	19.5067	20.0513	20.5450	20.8515	20.9490	20.9497	20.7408	20.2348	19.4514	18.7173	(87)
Th 2	19.9842	19.9889	19.9904	19.9904	19.9889	19.9945	19.9918	19.9958	19.9958	19.9932	19.9958	19.9904	(88)
util rest of house	0.9007	0.8759	0.8219	0.7338	0.5963	0.4073	0.2664	0.2669	0.5116	0.7243	0.8558	0.9105	(89)
MIT 2	17.4258	17.7082	18.3342	18.9948	19.5671	19.8887	19.9680	19.9731	19.7892	19.2293	18.2803	17.3559	(90)
Living area fraction									fLA = Living area / (4) =			0.2213	(91)
MIT	17.7248	17.9946	18.5937	19.2286	19.7835	20.1018	20.1851	20.1892	19.9998	19.4519	18.5395	17.6572	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7248	17.9946	18.5937	19.2286	19.7835	20.1018	20.1851	20.1892	19.9998	19.4519	18.5395	17.6572	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8671	0.8410	0.7878	0.7066	0.5851	0.4156	0.2848	0.2861	0.5119	0.6999	0.8216	0.8780	(94)
Useful gains	825.7150	888.0482	906.7892	873.9626	731.9639	524.6606	341.9615	328.7151	561.8555	706.7334	768.9424	788.7354	(95)
Ext temp.	5.2000	5.5000	7.3000	9.7000	12.8000	15.6000	17.4000	17.5000	14.9000	11.8000	8.2000	5.2000	(96)
Heat loss rate W	1605.3509	1593.2443	1437.7702	1213.0634	890.4975	570.4856	354.0082	340.3061	645.3492	971.1202	1308.3969	1585.8964	(97)
Space heating kWh	580.0491	473.8918	395.0499	244.1526	117.9490	0.0000	0.0000	0.0000	0.0000	196.7038	388.4072	593.0878	(98a)
Space heating requirement - total per year (kWh/year)												2989.2911	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	580.0491	473.8918	395.0499	244.1526	117.9490	0.0000	0.0000	0.0000	0.0000	196.7038	388.4072	593.0878	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2989.2911	
Space heating per m2											(98c) / (4) =	26.1302	(99)

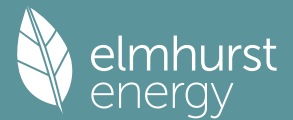
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	580.0491	473.8918	395.0499	244.1526	117.9490	0.0000	0.0000	0.0000	0.0000	196.7038	388.4072	593.0878	(98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating fuel (main heating system)	232.1125	189.6326	158.0832	97.7001	47.1985	0.0000	0.0000	0.0000	0.0000	78.7130	155.4251	237.3300	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	315.6969	259.9314	230.2870	159.8973	120.4473	94.0757	93.3308	115.7632	156.6508	220.5093	273.1504	313.8100	(64)	
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
Fuel for water heating, kWh/month	180.2952	148.4474	131.5174	91.3177	68.7877	53.7269	53.3014	66.1126	89.4636	125.9334	155.9968	179.2176	(219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)	
Lighting	31.2050	25.0338	22.5401	16.5139	12.7558	10.4216	11.6363	15.1252	19.6462	25.7769	29.1149	32.0722	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-46.1853	-61.9734	-92.4721	-108.7832	-113.9147	-105.5870	-103.1224	-98.0354	-86.8985	-74.3481	-51.7401	-38.6799	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1												1196.1949	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												175.1000		
Water heating fuel used												1344.1178	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
pump for solar water heating												80.0000	(230g)	
Total electricity for the above, kWh/year												80.0000	(231)	
Electricity for lighting (calculated in Appendix L)												251.8419	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation												-981.7403	(233)	
Wind generation												0.0000	(234)	
Hydro-electric generation (Appendix N)												0.0000	(235a)	
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)	
Appendix Q - special features														
Energy saved or generated												-0.0000	(236)	
Energy used												0.0000	(237)	
Total delivered energy for all uses												1890.4144	(238)	

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1196.1949	26.0600	311.7284	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1344.1178	26.0600	350.2771	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	251.8419	26.0600	65.6300	(250)
Additional standing charges			0.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-981.7403	26.0600	-255.8415
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-255.8415 (252)
Total energy cost			492.6420 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1196.1949	0.1550	185.4225 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1344.1178	0.1458	195.9781 (264)
Space and water heating			381.4006 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	251.8419	0.1443	36.3486 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-981.7403	0.1346	-132.1125
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-132.1125 (269)
Total CO2, kg/year			296.7337 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1196.1949	1.5739	1882.6826 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1344.1178	1.5394	2069.0696 (278)
Space and water heating			3951.7522 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	251.8419	1.5338	386.2835 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-981.7403	1.4973	-1470.0050
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1470.0050 (283)
Total Primary energy kWh/year			2989.0547 (286)