

Full SAP Calculation Printout



Property Reference	CLARFELT				Issued on Date	05/09/2025
Assessment Reference	As-Designed	Prop Type Ref				
Property	Rear of Haynes, Partridge Green, Horsham, West Sussex, RH13 8JF					
SAP Rating	84 B	DER	2.89	TER	8.16	
Environmental	97 A	% DER < TER				64.58
CO ₂ Emissions (t/year)	0.52	DFEE	43.10	TFEE	45.30	
Compliance Check	See BREL	% DFEE < TFEE				4.85
% DPER < TPER	24.24	DPER	32.94	TPER	43.48	
Assessor Details	Mr. Alexander Pelling				Assessor ID	T297-0001
Client	SCANDIA-HUS, Project Manager					

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)
Main dwelling			
Ground floor	130.6700 (1b)	x 2.8800 (2b)	= 376.3296 (1b) - (3b)
First floor	90.4600 (1c)	x 2.6800 (2c)	= 242.4328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	221.1300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 618.7624 (5)

2. Ventilation rate

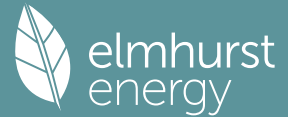
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (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 10.0000 / (5) = 0.0162 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2662 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2662 (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	0.3394	0.3327	0.3260	0.2928	0.2861	0.2529	0.2529	0.2462	0.2662	0.2861	0.2994	0.3127 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5894	0.5827	0.5760	0.5428	0.5361	0.5029	0.5029	0.5000	0.5162	0.5361	0.5494	0.5627 (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
Main dwelling							
Windows			46.8300	0.9615	45.0288		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Rooflights			9.8800	0.9615	9.5000		(27a)
HG Doors			1.8900	1.0000	1.8900		(26a)
Ground Floor			130.6700	0.1100	14.3737	75.0000	9800.2500 (28a)
Plinth	23.7600		23.7600	0.1500	3.5640	9.0000	213.8400 (29a)
Cladding	154.0400	47.0400	107.0000	0.1700	18.1900	9.0000	963.0000 (29a)
Stone	17.2200	3.7800	13.4400	0.1500	2.0160	9.0000	120.9600 (29a)
Ashlar	32.5700		32.5700	0.1300	4.2341	9.0000	293.1300 (29a)
Dormer	1.6700		1.6700	0.1800	0.3006	9.0000	15.0300 (29a)
GF Flat C	23.8700		23.8700	0.1272	3.0358	9.0000	214.8300 (30)
GF Rafters	8.4700		8.4700	0.1400	1.1858	9.0000	76.2300 (30)
Rafters	85.0500	9.8800	75.1700	0.1400	10.5238	9.0000	676.5300 (30)
FF Flat Ceiling	34.5900		34.5900	0.1100	3.8049	9.0000	311.3100 (30)
Total net area of external elements Aum(A, m ²)			511.9100				(31)

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Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	119.7475	(33)
Main dwelling			
GF	195.3200	9.0000	1757.8800 (32c)
FF	178.3000	9.0000	1604.7000 (32c)
Internal Floor 1	90.4600	18.0000	1628.2800 (32d)
Internal Ceiling 1	90.4600	9.0000	814.1400 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	18490.1100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		83.6165	(35)

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	42.5900	0.0020	0.0852	
E11 Eaves (insulation at rafter level)	15.5300	-0.0180	-0.2795	
E13 Gable (insulation at rafter level)	28.1600	0.1200	3.3792	
R6 Flat ceiling	35.7500	0.1200	4.2900	
R4 Ridge (vaulted ceiling)	21.2000	0.1200	2.5440	
R5 Ridge (inverted)	28.7000	0.0460	1.3202	
E2 Other lintels (including other steel lintels)	26.8000	0.0750	2.0100	
E3 Sill	57.6000	0.0470	2.7072	
E4 Jamb	55.0400	0.0200	1.1008	
E5 Ground floor (normal)	46.1400	-0.0020	-0.0923	
E6 Intermediate floor within a dwelling	7.8000	0.2400	1.8720	
R1 Head of roof window	7.8000	0.2400	1.8720	
R2 Sill of roof window	25.3600	0.2400	6.0864	
R3 Jamb of roof window	40.5800	0.0410	1.6638	
E16 Corner (normal)	24.3800	-0.0790	-1.9260	
E17 Corner (inverted - internal area greater than external area)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			26.6329	(36)
Point Thermal Bridges			0.0000	(36a)
Total fabric heat loss			146.3805	(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	120.3415	118.9828	117.6241	110.8306	109.4719	102.6784	102.6784	102.0958	105.3958	109.4719	112.1893	114.9067	(38)
Heat transfer coeff	266.7219	265.3632	264.0045	257.2110	255.8523	249.0589	249.0589	248.4763	251.7763	255.8523	258.5697	261.2871	(39)
Average = Sum(39)m / 12 =												256.9360	
HLP	1.2062	1.2000	1.1939	1.1632	1.1570	1.1263	1.1263	1.1237	1.1386	1.1570	1.1693	1.1816	(40)
HLP (average)												1.1619	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0294 (42)
Hot water usage for mixer showers	93.7662	92.3570	90.3037	86.3749	83.4756	80.2423	78.4045	80.4423	82.6762	86.1477	90.1609	93.4069	(42a)
Hot water usage for baths	32.3812	31.9003	31.2231	29.9744	29.0395	28.0027	27.4427	28.1152	28.8474	29.9567	31.2311	32.2718	(42b)
Hot water usage for other uses	45.6541	43.9939	42.3338	40.6736	39.0135	37.3533	37.3533	39.0135	40.6736	42.3338	43.9939	45.6541	(42c)
Average daily hot water use (litres/day)												157.9755	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	171.8015	168.2513	163.8605	157.0230	151.5285	145.5983	143.2005	147.5710	152.1972	158.4383	165.3859	171.3327	(44)
Energy content (annual)	272.0915	239.5876	251.8476	214.9566	203.9865	179.0301	173.1886	182.7237	187.6743	214.9992	235.6226	268.2656	(45)
Distribution loss (46)m = 0.15 x (45)m	40.8137	35.9381	37.7771	32.2435	30.5980	26.8545	25.9783	27.4086	28.1512	32.2499	35.3434	40.2398	(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	329.0666	291.0489	308.8226	270.0938	260.9616	234.1673	230.1637	239.6988	242.8115	271.9743	290.7597	325.2407	(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	329.0666	291.0489	308.8226	270.0938	260.9616	234.1673	230.1637	239.6988	242.8115	271.9743	290.7597	325.2407	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3294.8093	(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	136.0505	120.8319	129.3194	115.5828	113.4056	103.6372	103.1653	106.3357	106.5114	117.0673	122.4542	134.7784	(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	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	197.0680	218.1824	197.0680	203.6369	197.0680	203.6369	197.0680	197.0680	203.6369	197.0680	203.6369	197.0680	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	390.7093	394.7637	384.5469	362.7965	335.3406	309.5358	292.2967	288.2424	298.4592	320.2096	347.6655	373.4702	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	(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)	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	(71)
Water heating gains (Table 5)	182.8635	179.8094	173.8163	160.5317	152.4268	143.9406	138.6630	142.9243	147.9326	157.3485	170.0753	181.1537	(72)

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Total internal gains
842.0818 864.1965 826.8722 798.4061 756.2764 725.5544 696.4687 696.6756 718.4696 746.0670 792.8187 823.1329 (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					8.3700	10.6334	0.5700	0.7000	0.7700		24.6095 (74)	
East					28.9500	19.6403	0.5700	0.7000	0.7700		157.2179 (76)	
South					1.4400	46.7521	0.5700	0.7000	0.7700		18.6153 (78)	
West					8.0700	19.6403	0.5700	0.7000	0.7700		43.8255 (80)	
North					0.9200	15.5233	0.5700	0.7000	1.0000		5.1285 (82)	
South					2.7600	46.2238	0.5700	0.7000	1.0000		45.8132 (82)	
West					6.2000	26.1244	0.5700	0.7000	1.0000		58.1639 (82)	
Solar gains	353.3737	679.2651	1104.2107	1611.1662	1990.2360	2047.8145	1945.0732	1657.6612	1282.4102	800.8234	438.0866	292.4189 (83)
Total gains	1195.4556	1543.4616	1931.0828	2409.5723	2746.5124	2773.3689	2641.5418	2354.3368	2000.8798	1546.8905	1230.9053	1115.5518 (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 from living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.2565	19.3551	19.4547	19.9686	20.0746	20.6222	20.6222	20.6706	20.3996	20.0746	19.8637	19.6571
alpha	2.2838	2.2903	2.2970	2.3312	2.3383	2.3748	2.3748	2.3780	2.3600	2.3383	2.3242	2.3105
util living area	0.9632	0.9357	0.8850	0.7832	0.6488	0.4972	0.3832	0.4364	0.6514	0.8592	0.9439	0.9682 (86)
MIT	18.3860	18.7379	19.2684	19.9340	20.4123	20.7049	20.8067	20.7821	20.5362	19.8504	19.0163	18.3592 (87)
Th 2	19.9151	19.9200	19.9249	19.9496	19.9545	19.9794	19.9794	19.9816	19.9694	19.9545	19.9446	19.9347 (88)
util rest of house	0.9581	0.9270	0.8696	0.7552	0.6044	0.4346	0.3040	0.3538	0.5907	0.8338	0.9349	0.9637 (89)
MIT 2	16.8345	17.2816	17.9490	18.7801	19.3432	19.6807	19.7759	19.7602	19.5109	18.7035	17.6551	16.8121 (90)
Living area fraction	17.0391	17.4737	18.1231	18.9323	19.4842	19.8158	19.9119	19.8950	19.6462	18.8548	17.8347	17.0162 (92)
MIT	17.0391	17.4737	18.1231	18.9323	19.4842	19.8158	19.9119	19.8950	19.6462	18.8548	17.8347	17.0162 (93)
Temperature adjustment												0.0000
adjusted MIT	17.0391	17.4737	18.1231	18.9323	19.4842	19.8158	19.9119	19.8950	19.6462	18.8548	17.8347	17.0162 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9384	0.9002	0.8366	0.7234	0.5823	0.4238	0.2985	0.3464	0.5693	0.8001	0.9099	0.9460 (94)
Useful gains	1121.7585	1389.3687	1615.4641	1743.0717	1599.2177	1175.4641	788.3837	815.4553	1139.0216	1237.7249	1119.9754	1055.2810 (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	3397.8033	3336.6047	3068.5425	2580.4146	1991.6167	1299.0416	824.8610	868.4293	1396.3971	2112.0155	2775.6599	3348.7086 (97)
Space heating kWh	1693.3773	1308.5425	1081.0903	602.8869	291.9448	0.0000	0.0000	0.0000	0.0000	650.4723	1192.0928	1706.3101 (98a)
Space heating requirement - total per year (kWh/year)												8526.7171
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	1693.3773	1308.5425	1081.0903	602.8869	291.9448	0.0000	0.0000	0.0000	0.0000	650.4723	1192.0928	1706.3101 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8526.7171
Space heating per m2										(98c) / (4) =		38.5597 (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	1693.3773	1308.5425	1081.0903	602.8869	291.9448	0.0000	0.0000	0.0000	0.0000	650.4723	1192.0928	1706.3101 (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)	677.6220	523.6265	432.6092	241.2513	116.8247	0.0000	0.0000	0.0000	0.0000	260.2930	477.0280	682.7972 (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	329.0666	291.0489	308.8226	270.0938	260.9616	234.1673	230.1637	239.6988	242.8115	271.9743	290.7597	325.2407 (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	187.9306	166.2187	176.3693	154.2511	149.0357	133.7335	131.4470	136.8925	138.6702	155.3251	166.0535	185.7457 (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	35.8397	32.3713	35.8397	34.6836	35.8397	34.6836	35.8397	35.8397	34.6836	35.8397	34.6836	35.8397 (231)
Lighting	41.8954	33.6100	30.2621	22.1713	17.1258	13.9919	15.6227	20.3070	26.3767	34.6077	39.0893	43.0598 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-33.8850	-53.0453	-93.2994	-134.3779	-168.0405	-156.4255	-151.1601	-126.9296	-91.5649	-64.5867	-38.5020	-29.0442 (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)												

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(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	-6.1719	-14.3193	-38.2672	-91.2646	-172.1075	-207.8572	-195.3391	-131.1902	-67.1509	-24.5799	-8.7516	-4.8522	(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												3412.0516	(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												1881.6730	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.5590)													
mechanical ventilation fans (SFP = 0.5590)												421.9836	(230a)
Total electricity for the above, kWh/year												421.9836	(231)
Electricity for lighting (calculated in Appendix L)												338.1196	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2102.7128	(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												3951.1149	(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	3412.0516	0.1551	529.0686	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1881.6730	0.1410	265.3060	(264)
Space and water heating			794.3746	(265)
Pumps, fans and electric keep-hot	421.9836	0.1387	58.5343	(267)
Energy for lighting	338.1196	0.1443	48.8011	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1140.8611	0.1314	-149.9514	
PV Unit electricity exported	-961.8516	0.1167	-112.2108	
Total			-262.1621	(269)
Total CO2, kg/year			639.5479	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.8900	(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	3412.0516	1.5741	5370.7481	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1881.6730	1.5214	2862.6875	(278)
Space and water heating			8233.4356	(279)
Pumps, fans and electric keep-hot	421.9836	1.5128	638.3768	(281)
Energy for lighting	338.1196	1.5338	518.6191	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1140.8611	1.4856	-1694.8382	
PV Unit electricity exported	-961.8516	0.4275	-411.2302	
Total			-2106.0685	(283)
Total Primary energy kWh/year			7284.3630	(286)
Dwelling Primary energy Rate (DPER)			32.9400	(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)	
Main dwelling				
Ground floor	130.6700 (1b)	x 2.8800 (2b)	= 376.3296 (1b) - (3b)	
First floor	90.4600 (1c)	x 2.6800 (2c)	= 242.4328 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	221.1300		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	618.7624 (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)

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Number of flues attached to solid fuel boiler
Number of flues attached to other heater
Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6d)
0 * 35 = 0.0000 (6e)
0 * 20 = 0.0000 (6f)
4 * 10 = 40.0000 (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) = 40.0000 / (5) = 0.0646 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3146 (18)
Number of sides sheltered 0 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3146 (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												
	0.4012	0.3933	0.3854	0.3461	0.3382	0.2989	0.2989	0.2910	0.3146	0.3382	0.3540	0.3697
Effective ac	0.5805	0.5773	0.5743	0.5599	0.5572	0.5447	0.5447	0.5424	0.5495	0.5572	0.5626	0.5683

(22)
(22a)
(22b)
(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
Main dwelling							
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Semi-glazed door			1.8900	1.0000	1.8900		(26a)
TER Opening Type			42.3600	1.1450	48.5038		(27)
TER Roof Window			8.9400	1.1450	12.6509		(27a)
Ground Floor			130.6700	0.1300	16.9871		(28a)
Plinth	23.7600		23.7600	0.1800	4.2768		(29a)
Cladding	154.0400	42.7300	111.3100	0.1800	20.0358		(29a)
Stone	17.2200	3.6200	13.6000	0.1800	2.4480		(29a)
Ashlar	32.5700		32.5700	0.1800	5.8626		(29a)
Dormer	1.6700		1.6700	0.1800	0.3006		(29a)
GF Flat C	23.8700		23.8700	0.1100	2.6257		(30)
GF Rafters	8.4700		8.4700	0.1100	0.9317		(30)
Rafters	85.0500	8.9400	76.1100	0.1100	8.3721		(30)
FF Flat Ceiling	34.5900		34.5900	0.1100	3.8049		(30)
Total net area of external elements Aum(A, m2)			511.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	130.7901		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 83.6165 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E11 Eaves (insulation at rafter level)	42.5900	0.0400	1.7036
E13 Gable (insulation at rafter level)	15.5300	0.0800	1.2424
R6 Flat ceiling	28.1600	0.0600	1.6896
R4 Ridge (vaulted ceiling)	35.7500	0.0800	2.8600
R5 Ridge (inverted)	21.2000	0.0400	0.8480
E2 Other lintels (including other steel lintels)	28.7000	0.0500	1.4350
E3 Sill	26.8000	0.0500	1.3400
E4 Jamb	57.6000	0.0500	2.8800
E5 Ground floor (normal)	55.0400	0.1600	8.8064
E6 Intermediate floor within a dwelling	46.1400	0.0000	0.0000
R1 Head of roof window	7.8000	0.0800	0.6240
R2 Sill of roof window	7.8000	0.0600	0.4680
R3 Jamb of roof window	25.3600	0.0800	2.0288
E16 Corner (normal)	40.5800	0.0900	3.6522
E17 Corner (inverted - internal area greater than external area)	24.3800	-0.0900	-2.1942

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 27.3838 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 158.1739 (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
	118.5270	117.8890	117.2636	114.3260	113.7764	111.2179	111.2179	110.7442	112.2034	113.7764	114.8883	116.0507
Heat transfer coeff	276.7009	276.0629	275.4374	272.4999	271.9503	269.3918	269.3918	268.9180	270.3773	271.9503	273.0621	274.2245
Average = Sum(39)m / 12 =												272.4973

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.2513	1.2484	1.2456	1.2323	1.2298	1.2183	1.2183	1.2161	1.2227	1.2298	1.2348	1.2401
HLP (average)												1.2323
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

(40)

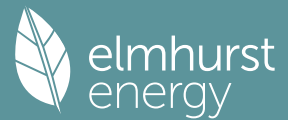
4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0294 (42)
Hot water usage for mixer showers 74.7255 (42a)
Hot water usage for baths 32.2718 (42b)
Hot water usage for other uses 45.6541 (42c)
Average daily hot water use (litres/day) 140.6856 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	153.0482	149.7799	145.7998	139.7480	134.8334	129.5499	127.5196	131.4825	135.6619	141.2087	147.3538	152.6513
Energy conte	242.3910	213.2845	224.0889	191.3080	181.5117	159.2967	154.2239	162.8028	167.2847	191.6189	209.9324	239.0151
Energy content (annual)										Total = Sum(45)m =		2336.7587
Distribution loss (46)m = 0.15 x (45)m												
	36.3586	31.9927	33.6133	28.6962	27.2268	23.8945	23.1336	24.4204	25.0927	28.7428	31.4899	35.8523

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)

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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	297.2978	262.8778	278.9957	244.4436	236.4185	212.4323	209.1307	217.7096	220.4203	246.5257	263.0680	293.9219 (62)
WWHRS	-34.2928	-30.3288	-31.7586	-26.2974	-24.5082	-20.9718	-19.6578	-20.9041	-21.6983	-25.5799	-28.9789	-33.6577 (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	263.0050	232.5490	247.2371	218.1463	211.9103	191.4604	189.4730	196.8056	198.7221	220.9458	234.0891	260.2642 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2664.6077 (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	2665 (64)
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	124.5204	110.5917	118.4350	106.1184	104.2781	95.4746	95.2049	98.0574	98.1307	107.6387	112.3110	123.3980 (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	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	197.0680	218.1824	197.0680	203.6369	197.0680	203.6369	197.0680	197.0680	203.6369	197.0680	203.6369	197.0680 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	390.7093	394.7637	384.5469	362.7965	335.3406	309.5358	292.2967	288.2424	298.4592	320.2096	347.6655	373.4702 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470 (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)	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759 (71)
Water heating gains (Table 5)	167.3662	164.5710	159.1868	147.3867	140.1587	132.6037	127.9636	131.7975	136.2926	144.6757	155.9875	165.8575 (72)
Total internal gains	826.5845	848.9580	812.2426	785.2611	744.0082	714.2174	685.7692	685.5489	706.8297	733.3942	778.7309	807.8366 (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				7.5700	10.6334	0.6300	0.7000	0.7700	24.6002 (74)			
East				26.1900	19.6403	0.6300	0.7000	0.7700	157.2008 (76)			
South				1.3000	46.7521	0.6300	0.7000	0.7700	18.5745 (78)			
West				7.3000	19.6403	0.6300	0.7000	0.7700	43.8169 (80)			
North				0.8300	15.5233	0.6300	0.7000	1.0000	5.1138 (82)			
South				2.4900	46.2238	0.6300	0.7000	1.0000	45.6821 (82)			
West				5.6200	26.1244	0.6300	0.7000	1.0000	58.2725 (82)			
Solar gains	353.2608	679.0852	1103.9881	1610.9148	1989.9657	2047.5482	1944.8157	1657.4195	1282.1789	800.6318	437.9538	292.3205 (83)
Total gains	1179.8453	1528.0432	1916.2307	2396.1759	2733.9739	2761.7656	2630.5850	2342.9684	1989.0086	1534.0260	1216.6847	1100.1572 (84)

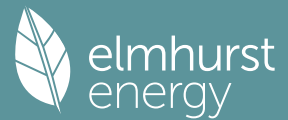
7. Mean internal temperature (heating season)

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	18.5621	18.6050	18.6472	18.8482	18.8863	19.0657	19.0657	19.0993	18.9962	18.8863	18.8094	18.7297
alpha	2.2375	2.2403	2.2431	2.2565	2.2591	2.2710	2.2710	2.2733	2.2664	2.2591	2.2540	2.2486
util living area	0.9645	0.9380	0.8896	0.7943	0.6658	0.5219	0.4069	0.4614	0.6713	0.8670	0.9464	0.9693 (86)
MIT	17.5704	18.0318	18.7412	19.6176	20.2963	20.7182	20.8854	20.8444	20.4723	19.5129	18.3805	17.4992 (87)
Th 2	19.8792	19.8815	19.8837	19.8942	19.8962	19.9054	19.9054	19.9071	19.9019	19.8962	19.8922	19.8880 (88)
util rest of house	0.9594	0.9294	0.8743	0.7660	0.6199	0.4542	0.3188	0.3705	0.6083	0.8417	0.9375	0.9649 (89)
MIT 2	15.8663	16.4495	17.3393	18.4186	19.2164	19.6820	19.8392	19.8111	19.4439	18.3218	16.9035	15.7795 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	16.0911	16.6582	17.5243	18.5767	19.3588	19.8187	19.9772	19.9474	19.5796	18.4789	17.0984	16.0063 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.0911	16.6582	17.5243	18.5767	19.3588	19.8187	19.9772	19.9474	19.5796	18.4789	17.0984	16.0063 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1099.5002	1364.2561	1591.5412	1738.1248	1626.4543	1238.5455	854.6908	876.5367	1167.7657	1225.2943	1099.1168	1034.0478 (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	3262.6033	3246.0126	3036.4958	2636.9106	2082.8243	1405.8676	909.7830	953.9686	1481.5493	2142.6632	2730.1738	3237.5898 (97)
Space heating kWh	1609.3487	1264.5404	1075.0462	647.1258	339.5393	0.0000	0.0000	0.0000	0.0000	682.5224	1174.3610	1639.4352 (98a)
Space heating requirement - total per year (kWh/year)												8431.9191
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	1609.3487	1264.5404	1075.0462	647.1258	339.5393	0.0000	0.0000	0.0000	0.0000	682.5224	1174.3610	1639.4352 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8431.9191
Space heating per m2												(98c) / (4) = 38.1310 (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 %)												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	1609.3487	1264.5404	1075.0462	647.1258	339.5393	0.0000	0.0000	0.0000	0.0000	682.5224	1174.3610	1639.4352	(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)	1743.6064	1370.0329	1164.7305	701.1114	367.8649	0.0000	0.0000	0.0000	0.0000	739.4609	1272.3305	1776.2028	(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	263.0050	232.5490	247.2371	218.1463	211.9103	191.4604	189.4730	196.8056	198.7221	220.9458	234.0891	260.2642	(64)
Efficiency of water heater (217)m	87.4152	87.2711	86.9661	86.3449	85.1113	79.8000	79.8000	79.8000	79.8000	86.4165	87.1661	79.8000	(216)
Fuel for water heating, kWh/month	300.8689	266.4673	284.2914	252.6453	248.9802	239.9254	237.4348	246.6235	249.0252	255.6754	268.5553	297.6190	(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	40.9468	32.8491	29.5769	21.6693	16.7380	13.6751	15.2690	19.8472	25.7796	33.8242	38.2043	42.0849	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-102.0968	-134.7845	-181.4723	-190.5577	-194.5747	-177.5558	-174.9822	-170.0826	-160.5101	-146.9506	-108.7541	-89.3464	(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	-89.2298	-182.8801	-355.1098	-521.8591	-679.5220	-679.2908	-671.6141	-573.6624	-427.0586	-257.9534	-117.8743	-70.9700	(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												9135.3403	(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												3148.1114	(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)												330.4644	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-6458.6921	(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												6241.2240	(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	9135.3403	0.2100	1918.4215
Total CO2 associated with community systems			0.0000
Water heating (other fuel)	3148.1114	0.2100	661.1034
Space and water heating			2579.5249
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293
Energy for lighting	330.4644	0.1443	47.6962
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1831.6677	0.1361	-249.2380
PV Unit electricity exported	-4627.0244	0.1265	-585.5030
Total			-834.7410
Total CO2, kg/year			1804.4093
EPC Target Carbon Dioxide Emission Rate (TER)			8.1600

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	9135.3403	1.1300	10322.9345
Total CO2 associated with community systems			0.0000
Water heating (other fuel)	3148.1114	1.1300	3557.3659
Space and water heating			13880.3004
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008
Energy for lighting	330.4644	1.5338	506.8774
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1831.6677	1.5030	-2752.9580
PV Unit electricity exported	-4627.0244	0.4645	-2149.3265

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Total -4902.2845 (283)
 Total Primary energy kWh/year 9614.9941 (286)
 Target Primary Energy Rate (TPER) 43.4800 (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)
Main dwelling			
Ground floor	130.6700 (1b)	x 2.8800 (2b)	= 376.3296 (1b) - (3b)
First floor	90.4600 (1c)	x 2.6800 (2c)	= 242.4328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	221.1300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 618.7624 (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) = 0.0646 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3146 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3146 (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	0.4012	0.3933	0.3854	0.3461	0.3382	0.2989	0.2989	0.2910	0.3146	0.3382	0.3540	0.3697 (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	0.5805	0.5773	0.5743	0.5599	0.5572	0.5447	0.5447	0.5424	0.5495	0.5572	0.5626	0.5683 (25)

3. Heat losses and heat loss parameter

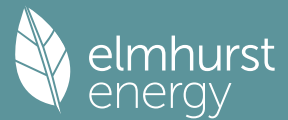
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows			46.8300	0.9615	45.0288		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Rooflights			9.8800	0.9615	9.5000		(27a)
HG Doors			1.8900	1.0000	1.8900		(26a)
Ground Floor			130.6700	0.1100	14.3737	75.0000	9800.2500 (28a)
Plinth	23.7600		23.7600	0.1500	3.5640	9.0000	213.8400 (29a)
Cladding	154.0400	47.0400	107.0000	0.1700	18.1900	9.0000	963.0000 (29a)
Stone	17.2200	3.7800	13.4400	0.1500	2.0160	9.0000	120.9600 (29a)
Ashlar	32.5700		32.5700	0.1300	4.2341	9.0000	293.1300 (29a)
Dormer	1.6700		1.6700	0.1800	0.3006	9.0000	15.0300 (29a)
GF Flat C	23.8700		23.8700	0.1272	3.0358	9.0000	214.8300 (30)
GF Rafters	8.4700		8.4700	0.1400	1.1858	9.0000	76.2300 (30)
Rafters	85.0500	9.8800	75.1700	0.1400	10.5238	9.0000	676.5300 (30)
FF Flat Ceiling	34.5900		34.5900	0.1100	3.8049	9.0000	311.3100 (30)
Total net area of external elements Aum(A, m ²)			511.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	119.7475		(33)
Main dwelling							
GF			195.3200			9.0000	1757.8800 (32c)
FF			178.3000			9.0000	1604.7000 (32c)
Internal Floor 1			90.4600			18.0000	1628.2800 (32d)
Internal Ceiling 1			90.4600			9.0000	814.1400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18490.1100 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 83.6165 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E11 Eaves (insulation at rafter level)	42.5900	0.0020	0.0852
E13 Gable (insulation at rafter level)	15.5300	-0.0180	-0.2795
R6 Flat ceiling	28.1600	0.1200	3.3792
R4 Ridge (vaulted ceiling)	35.7500	0.1200	4.2900
R5 Ridge (inverted)	21.2000	0.1200	2.5440
E2 Other lintels (including other steel lintels)	28.7000	0.0460	1.3202
E3 Sill	26.8000	0.0750	2.0100
E4 Jamb	57.6000	0.0470	2.7072
E5 Ground floor (normal)	55.0400	0.0200	1.1008
E6 Intermediate floor within a dwelling	46.1400	-0.0020	-0.0923
R1 Head of roof window	7.8000	0.2400	1.8720

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R2 Sill of roof window	7.8000	0.2400	1.8720
R3 Jamb of roof window	25.3600	0.2400	6.0864
E16 Corner (normal)	40.5800	0.0410	1.6638
E17 Corner (inverted - internal area greater than external area)	24.3800	-0.0790	-1.9260
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			26.6329 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss			146.3805 (37) (33) + (36) + (36a) =
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)			
(38)m	Jan	Feb	Mar
Heat transfer coeff	118.5270	117.8890	117.2636
Average = Sum(39)m / 12 =	264.9075	264.2695	263.6440
	Apr	May	Jun
	114.3260	113.7764	111.2179
	260.7065	260.1569	257.5984
	Jul	Aug	Sep
	111.2179	110.7442	112.2034
	257.5984	257.1246	258.5839
	Oct	Nov	Dec
	113.7764	114.8883	116.0507 (38)
	260.1569	261.2687	262.4311 (39)
	260.7039		
HLP	Jan	Feb	Mar
HLP (average)	1.1980	1.1951	1.1923
Days in mont	31	28	31
	Apr	May	Jun
	1.1790	1.1765	1.1649
	30	31	30
	Jul	Aug	Sep
	1.1649	1.1628	1.1694
	31	31	30
	Oct	Nov	Dec
	1.1765	1.1815	1.1868 (40)
	31	30	1.1790
			31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0294 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												32.3812 (42b)
Hot water usage for other uses												45.6541 (42c)
Average daily hot water use (litres/day)												71.5262 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	78.0353	75.8942	73.5569	70.6481	68.0529	65.3560	64.7960	67.1287	69.5210	72.2905	75.2251	77.9258 (44)
Energy content (annual)	123.5888	108.0724	113.0542	96.7137	91.6123	80.3629	78.3652	83.1193	85.7264	98.0976	107.1719	122.0130 (45)
Distribution loss (46)m = 0.15 x (45)m												1187.8976
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	105.0505	91.8615	96.0961	82.2066	77.8705	68.3084	66.6104	70.6514	72.8674	83.3829	91.0961	103.7111 (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	105.0505	91.8615	96.0961	82.2066	77.8705	68.3084	66.6104	70.6514	72.8674	83.3829	91.0961	103.7111 (64)
12Total per year (kWh/year)												1009.7129 (64)
Electric shower(s)	60.0728	53.5254	58.4477	55.7759	56.8225	54.2032	56.0100	56.8225	55.7759	58.4477	57.3486	60.0728 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												683.3252 (64a)
Heat gains from water heating, kWh/month	41.2808	36.3467	38.6359	34.4956	33.6733	30.6279	30.6551	31.8685	32.1608	35.4577	37.1112	40.9460 (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	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	197.0680	218.1824	197.0680	203.6369	197.0680	203.6369	197.0680	197.0680	203.6369	197.0680	203.6369	197.0680 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	390.7093	394.7637	384.5469	362.7965	335.3406	309.5358	292.2967	288.2424	298.4592	320.2096	347.6655	373.4702 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470 (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)	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759 (71)
Water heating gains (Table 5)	55.4850	54.0874	51.9300	47.9106	45.2597	42.5388	41.2031	42.8340	44.6678	47.6581	51.5433	55.0349 (72)
Total internal gains	711.7033	735.4745	701.9859	682.7850	646.1093	624.1525	599.0088	596.5853	615.2049	633.3767	671.2867	694.0141 (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						8.3700	10.6334	0.5700	0.7000	0.7700		24.6095 (74)
East						28.9500	19.6403	0.5700	0.7000	0.7700		157.2179 (76)
South						1.4400	46.7521	0.5700	0.7000	0.7700		18.6153 (78)
West						8.0700	19.6403	0.5700	0.7000	0.7700		43.8255 (80)
North						0.9200	15.5233	0.5700	0.7000	1.0000		5.1285 (82)
South						2.7600	46.2238	0.5700	0.7000	1.0000		45.8132 (82)
West						6.2000	26.1244	0.5700	0.7000	1.0000		58.1639 (82)
Solar gains	353.3737	679.2651	1104.2107	1611.1662	1990.2360	2047.8145	1945.0732	1657.6612	1282.4102	800.8234	438.0866	292.4189 (83)
Total gains	1065.0770	1414.7396	1806.1965	2293.9512	2636.3453	2671.9670	2544.0819	2254.2465	1897.6151	1434.2001	1109.3733	986.4330 (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	19.3884	19.4352	19.4813	19.7009	19.7425	19.9386	19.9386	19.9753	19.8626	19.7425	19.6585	19.5714
alpha	2.2926	2.2957	2.2988	2.3134	2.3162	2.3292	2.3292	2.3317	2.3242	2.3162	2.3106	2.3048
util living area	0.9707	0.9453	0.8972	0.7998	0.6679	0.5210	0.4052	0.4619	0.6774	0.8770	0.9543	0.9752 (86)
MIT	17.5947	18.0663	18.7830	19.6646	20.3331	20.7392	20.8957	20.8560	20.4934	19.5338	18.3993	17.5230 (87)
Th 2	19.9216	19.9239	19.9262	19.9369	19.9389	19.9482	19.9482	19.9499	19.9446	19.9389	19.9348	19.9306 (88)
util rest of house	0.9665	0.9377	0.8830	0.7727	0.6235	0.4556	0.3205	0.3741	0.6165	0.8537	0.9467	0.9717 (89)
MIT 2	16.7989	17.2654	17.9684	18.8190	19.4329	19.7851	19.9002	19.8793	19.5978	18.7183	17.6069	16.7332 (90)
Living area fraction	16.9038	17.3711	18.0758	18.9305	19.5516	19.9110	20.0315	20.0081	fLA = Living area / (4) =	17.7115	17.7115	0.1319 (91)
MIT	16.9038	17.3711	18.0758	18.9305	19.5516	19.9110	20.0315	20.0081	19.7159	18.8259	17.7115	16.8373 (92)
Temperature adjustment												0.0000
adjusted MIT	16.9038	17.3711	18.0758	18.9305	19.5516	19.9110	20.0315	20.0081	19.7159	18.8259	17.7115	16.8373 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9492	0.9127	0.8514	0.7425	0.6056	0.4531	0.3275	0.3793	0.6015	0.8224	0.9241	0.9563 (94)
Useful gains	1010.9847	1291.2647	1537.8730	1703.1885	1596.4529	1210.7474	833.2818	855.0798	1141.4475	1179.4199	1025.1415	943.2783 (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	3338.8523	3295.7189	3051.9035	2615.0195	2042.6609	1368.0930	883.9499	927.7303	1452.1889	2140.0230	2772.4417	3316.4333 (97)
Space heating kWh	1731.9335	1346.9932	1126.4387	656.5183	331.9788	0.0000	0.0000	0.0000	0.0000	714.6887	1258.0561	1765.6273 (98a)
Space heating requirement - total per year (kWh/year)												8932.2346
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	1731.9335	1346.9932	1126.4387	656.5183	331.9788	0.0000	0.0000	0.0000	0.0000	714.6887	1258.0561	1765.6273 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8932.2346
Space heating per m2										(98c) / (4) =		40.3936 (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	2421.4250	1906.2282	1954.1470	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7625	0.8180	0.7762	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1846.4554	1559.2959	1516.8537	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2925.1433	2784.8846	2465.5395	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	776.6553	911.8379	705.8222	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	194.1638	227.9595	176.4556	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												598.5789 (107)
Energy for space heating												40.3936 (99)
Energy for space cooling												2.7069 (108)
Total												43.1005 (109)
Fabric Energy Efficiency (DFEE)												43.1 (109)

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

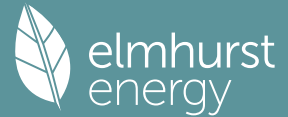
1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	130.6700 (1b)	x 2.8800 (2b)	= 376.3296 (1b) - (3b)
First floor	90.4600 (1c)	x 2.6800 (2c)	= 242.4328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	221.1300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	618.7624 (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		

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0646 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3146 (18)
Number of sides sheltered 0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3146 (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	0.4012	0.3933	0.3854	0.3461	0.3382	0.2989	0.2989	0.2910	0.3146	0.3382	0.3540	0.3697	(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	0.5805	0.5773	0.5743	0.5599	0.5572	0.5447	0.5447	0.5424	0.5495	0.5572	0.5626	0.5683	(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	
Main dwelling								
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Semi-glazed door			1.8900	1.0000	1.8900			(26a)
TER Opening Type			42.3600	1.1450	48.5038			(27)
TER Roof Window			8.9400	1.1450	12.6509			(27a)
Ground Floor			130.6700	0.1300	16.9871			(28a)
Plinth	23.7600		23.7600	0.1800	4.2768			(29a)
Cladding	154.0400	42.7300	111.3100	0.1800	20.0358			(29a)
Stone	17.2200	3.6200	13.6000	0.1800	2.4480			(29a)
Ashlar	32.5700		32.5700	0.1800	5.8626			(29a)
Dormer	1.6700		1.6700	0.1800	0.3006			(29a)
GF Flat C	23.8700		23.8700	0.1100	2.6257			(30)
GF Rafters	8.4700		8.4700	0.1100	0.9317			(30)
Rafters	85.0500	8.9400	76.1100	0.1100	8.3721			(30)
FF Flat Ceiling	34.5900		34.5900	0.1100	3.8049			(30)
Total net area of external elements Aum(A, m2)			511.9100					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 130.7901			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 83.6165 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E11 Eaves (insulation at rafter level)	42.5900	0.0400	1.7036	
E13 Gable (insulation at rafter level)	15.5300	0.0800	1.2424	
R6 Flat ceiling	28.1600	0.0600	1.6896	
R4 Ridge (vaulted ceiling)	35.7500	0.0800	2.8600	
R5 Ridge (inverted)	21.2000	0.0400	0.8480	
E2 Other lintels (including other steel lintels)	28.7000	0.0500	1.4350	
E3 Sill	26.8000	0.0500	1.3400	
E4 Jamb	57.6000	0.0500	2.8800	
E5 Ground floor (normal)	55.0400	0.1600	8.8064	
E6 Intermediate floor within a dwelling	46.1400	0.0000	0.0000	
R1 Head of roof window	7.8000	0.0800	0.6240	
R2 Sill of roof window	7.8000	0.0600	0.4680	
R3 Jamb of roof window	25.3600	0.0800	2.0288	
E16 Corner (normal)	40.5800	0.0900	3.6522	
E17 Corner (inverted - internal area greater than external area)	24.3800	-0.0900	-2.1942	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 27.3838 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 158.1739 (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	118.5270	117.8890	117.2636	114.3260	113.7764	111.2179	111.2179	110.7442	112.2034	113.7764	114.8883	116.0507	(38)
Heat transfer coeff	276.7009	276.0629	275.4374	272.4999	271.9503	269.3918	269.3918	268.9180	270.3773	271.9503	273.0621	274.2245	(39)
Average = Sum(39)m / 12 =												272.4973	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2513	1.2484	1.2456	1.2323	1.2298	1.2183	1.2183	1.2161	1.2227	1.2298	1.2348	1.2401	(40)
HLP (average)												1.2323	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0294 (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	0.0000	
Hot water usage for baths													(42b)
32.3812	31.9003	31.2231	29.9744	29.0395	28.0027	27.4427	28.1152	28.8474	29.9567	31.2311	32.2718		
Hot water usage for other uses													(42c)
45.6541	43.9939	42.3338	40.6736	39.0135	37.3533	37.3533	39.0135	40.6736	42.3338	43.9939	45.6541		
Average daily hot water use (litres/day)												71.5262	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.0353	75.8942	73.5569	70.6481	68.0529	65.3560	64.7960	67.1287	69.5210	72.2905	75.2251	77.9258	(44)
Energy conte	123.5888	108.0724	113.0542	96.7137	91.6123	80.3629	78.3652	83.1193	85.7264	98.0976	107.1719	122.0130	(45)
Energy content (annual)										Total = Sum(45)m =		1187.8976	
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													
105.0505	91.8615	96.0961	82.2066	77.8705	68.3084	66.6104	70.6514	72.8674	83.3829	91.0961	103.7111		(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)

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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	105.0505	91.8615	96.0961	82.2066	77.8705	68.3084	66.6104	70.6514	72.8674	83.3829	91.0961	103.7111	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1009.7129	(64)
Electric shower(s)	60.0728	53.5254	58.4477	55.7759	56.8225	54.2032	56.0100	56.8225	55.7759	58.4477	57.3486	60.0728	(64a)
Heat gains from water heating, kWh/month	41.2808	36.3467	38.6359	34.4956	33.6733	30.6279	30.6551	31.8685	32.1608	35.4577	37.1112	40.9460	(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	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	151.4699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	197.0680	218.1824	197.0680	203.6369	197.0680	203.6369	197.0680	197.0680	203.6369	197.0680	203.6369	197.0680	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	390.7093	394.7637	384.5469	362.7965	335.3406	309.5358	292.2967	288.2424	298.4592	320.2096	347.6655	373.4702	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	38.1470	(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)	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	(71)
Water heating gains (Table 5)	55.4850	54.0874	51.9300	47.9106	45.2597	42.5388	41.2031	42.8340	44.6678	47.6581	51.5433	55.0349	(72)
Total internal gains	711.7033	735.4745	701.9859	682.7850	646.1093	624.1525	599.0088	596.5853	615.2049	633.3767	671.2867	694.0141	(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	7.5700	10.6334	0.6300	0.7000	0.7700	24.6002 (74)
East	26.1900	19.6403	0.6300	0.7000	0.7700	157.2008 (76)
South	1.3000	46.7521	0.6300	0.7000	0.7700	18.5745 (78)
West	7.3000	19.6403	0.6300	0.7000	0.7700	43.8169 (80)
North	0.8300	15.5233	0.6300	0.7000	1.0000	5.1138 (82)
South	2.4900	46.2238	0.6300	0.7000	1.0000	45.6821 (82)
West	5.6200	26.1244	0.6300	0.7000	1.0000	58.2725 (82)

Solar gains	353.2608	679.0852	1103.9881	1610.9148	1989.9657	2047.5482	1944.8157	1657.4195	1282.1789	800.6318	437.9538	292.3205	(83)
Total gains	1064.9641	1414.5596	1805.9739	2293.6998	2636.0750	2671.7007	2543.8245	2254.0049	1897.3838	1434.0085	1109.2405	986.3346	(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	18.5621	18.6050	18.6472	18.8482	18.8863	19.0657	19.0657	19.0993	18.9962	18.8863	18.8094	18.7297	
alpha	2.2375	2.2403	2.2431	2.2565	2.2591	2.2710	2.2710	2.2733	2.2664	2.2591	2.2540	2.2486	
util living area	0.9709	0.9462	0.9000	0.8064	0.6787	0.5341	0.4181	0.4752	0.6880	0.8807	0.9549	0.9753	(86)
MIT	17.4681	17.9383	18.6630	19.5646	20.2655	20.7039	20.8786	20.8344	20.4424	19.4463	18.2892	17.3960	(87)
Th 2	19.8792	19.8815	19.8837	19.8942	19.8962	19.9054	19.9054	19.9071	19.9019	19.8962	19.8922	19.8880	(88)
util rest of house	0.9667	0.9386	0.8858	0.7792	0.6333	0.4659	0.3284	0.3828	0.6257	0.8573	0.9473	0.9717	(89)
MIT 2	16.6482	17.1135	17.8247	18.6956	19.3409	19.7216	19.8505	19.8270	19.5222	18.6072	17.4727	16.5820	(90)
Living area fraction	16.7564	17.2223	17.9353	18.8102	19.4628	19.8512	19.9861	19.9599	19.6436	18.7178	17.5804	16.6894	(91)
MIT	16.7564	17.2223	17.9353	18.8102	19.4628	19.8512	19.9861	19.9599	19.6436	18.7178	17.5804	16.6894	(92)
Temperature adjustment	16.7564	17.2223	17.9353	18.8102	19.4628	19.8512	19.9861	19.9599	19.6436	18.7178	17.5804	16.6894	(93)
adjusted MIT	16.7564	17.2223	17.9353	18.8102	19.4628	19.8512	19.9861	19.9599	19.6436	18.7178	17.5804	16.6894	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1010.5931	1291.6823	1541.0989	1714.0764	1616.8775	1235.1421	853.1490	873.6305	1155.3144	1182.8437	1025.1691	942.8314	(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	3446.6850	3401.7279	3149.6999	2700.5415	2111.1009	1414.6338	912.1859	957.3196	1498.8557	2207.6499	2861.7967	3424.8889	(97)
Space heating kWh	1812.4524	1417.9506	1196.7991	710.2549	367.7022	0.0000	0.0000	0.0000	0.0000	762.4558	1322.3718	1846.6508	(98a)
Space heating requirement - total per year (kWh/year)												9436.6376	
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	1812.4524	1417.9506	1196.7991	710.2549	367.7022	0.0000	0.0000	0.0000	0.0000	762.4558	1322.3718	1846.6508	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9436.6376	
Space heating per m2												42.6746	(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	2532.2830	1993.4994	2043.7769	0.0000	0.0000	0.0000	0.0000	(100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7426	0.8000	0.7566	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1880.4773	1594.7305	1546.3417	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2924.8232	2784.5758	2465.2527	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	751.9291	885.2449	683.6697	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)									fc = cooled area / (4) =			1.0000 (105)
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	187.9823	221.3112	170.9174	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												580.2109 (107)
Energy for space cooling												42.6746 (99)
Total												2.6238 (108)
Fabric Energy Efficiency (TFEE)												45.2985 (109)
												45.3 (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)	
Main dwelling							
Ground floor		130.6700 (1b)	x	2.8800 (2b)	=	376.3296 (1b) - (3b)	
First floor		90.4600 (1c)	x	2.6800 (2c)	=	242.4328 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)		221.1300				(4)	
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	618.7624 (5)	

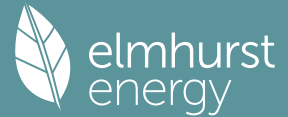
2. Ventilation rate

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												0 * 10 = 0.0000 (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												10.0000 / (5) = 0.0162 (8)
Pressure Test Method												Yes
Measured/design AP50												Blower Door
Infiltration rate												5.0000 (17)
Number of sides sheltered												0.2662 (18)
												0 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.2662 (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)
	0.3394	0.3327	0.3260	0.2928	0.2861	0.2529	0.2529	0.2462	0.2662	0.2861	0.2994	0.3127 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5894	0.5827	0.5760	0.5428	0.5361	0.5029	0.5029	0.5000	0.5162	0.5361	0.5494	0.5627 (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
Main dwelling							
Windows			46.8300	0.9615	45.0288		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Rooflights			9.8800	0.9615	9.5000		(27a)
HG Doors			1.8900	1.0000	1.8900		(26a)
Ground Floor			130.6700	0.1100	14.3737	75.0000	9800.2500 (28a)
Plinth	23.7600		23.7600	0.1500	3.5640	9.0000	213.8400 (29a)
Cladding	154.0400	47.0400	107.0000	0.1700	18.1900	9.0000	963.0000 (29a)
Stone	17.2200	3.7800	13.4400	0.1500	2.0160	9.0000	120.9600 (29a)
Ashlar	32.5700		32.5700	0.1300	4.2341	9.0000	293.1300 (29a)
Dormer	1.6700		1.6700	0.1800	0.3006	9.0000	15.0300 (29a)
GF Flat C	23.8700		23.8700	0.1272	3.0358	9.0000	214.8300 (30)
GF Rafters	8.4700		8.4700	0.1400	1.1858	9.0000	76.2300 (30)
Rafters	85.0500	9.8800	75.1700	0.1400	10.5238	9.0000	676.5300 (30)
FF Flat Ceiling	34.5900		34.5900	0.1100	3.8049	9.0000	311.3100 (30)
Total net area of external elements Aum(A, m2)			511.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	119.7475		(33)
Main dwelling							
GF			195.3200			9.0000	1757.8800 (32c)
FF			178.3000			9.0000	1604.7000 (32c)
Internal Floor 1			90.4600			18.0000	1628.2800 (32d)
Internal Ceiling 1			90.4600			9.0000	814.1400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18490.1100 (34)

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

83.6165 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	42.5900	0.0020	0.0852
E11 Eaves (insulation at rafter level)	15.5300	-0.0180	-0.2795
E13 Gable (insulation at rafter level)	28.1600	0.1200	3.3792
R6 Flat ceiling	35.7500	0.1200	4.2900
R4 Ridge (vaulted ceiling)	21.2000	0.1200	2.5440
R5 Ridge (inverted)	28.7000	0.0460	1.3202
E2 Other lintels (including other steel lintels)	26.8000	0.0750	2.0100
E3 Sill	57.6000	0.0470	2.7072
E4 Jamb	55.0400	0.0200	1.1008
E5 Ground floor (normal)	46.1400	-0.0020	-0.0923
E6 Intermediate floor within a dwelling	7.8000	0.2400	1.8720
R1 Head of roof window	7.8000	0.2400	1.8720
R2 Sill of roof window	25.3600	0.2400	6.0864
R3 Jamb of roof window	40.5800	0.0410	1.6638
E16 Corner (normal)	24.3800	-0.0790	-1.9260
E17 Corner (inverted - internal area greater than external area)			

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

26.6329 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 146.3805 (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	120.3415	118.9828	117.6241	110.8306	109.4719	102.6784	102.6784	102.0958	105.3958	109.4719	112.1893	114.9067
Heat transfer coeff	266.7219	265.3632	264.0045	257.2110	255.8523	249.0589	249.0589	248.4763	251.7763	255.8523	258.5697	261.2871
Average = Sum(39)m / 12 =												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2062	1.2000	1.1939	1.1632	1.1570	1.1263	1.1263	1.1237	1.1386	1.1570	1.1693	1.1816
HLP (average)												
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy

3.0294 (42)

Hot water usage for mixer showers

	93.7662	92.3570	90.3037	86.3749	83.4756	80.2423	78.4045	80.4423	82.6762	86.1477	90.1609	93.4069
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Hot water usage for baths

	32.3812	31.9003	31.2231	29.9744	29.0395	28.0027	27.4427	28.1152	28.8474	29.9567	31.2311	32.2718
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Hot water usage for other uses

	45.6541	43.9939	42.3338	40.6736	39.0135	37.3533	37.3533	39.0135	40.6736	42.3338	43.9939	45.6541
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Average daily hot water use (litres/day)

157.9755 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	171.8015	168.2513	163.8605	157.0230	151.5285	145.5983	143.2005	147.5710	152.1972	158.4383	165.3859	171.3327
Energy conte	272.0915	239.5876	251.8476	214.9566	203.9865	179.0301	173.1886	182.7237	187.6743	214.9992	235.6226	268.2656
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	40.8137	35.9381	37.7771	32.2435	30.5980	26.8545	25.9783	27.4086	28.1512	32.2499	35.3434	40.2398

Water storage loss:

Store volume												
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b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day)												
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Volume factor from Table 2a

Temperature factor from Table 2b												
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Enter (49) or (54) in (55)

Total storage loss												
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If cylinder contains dedicated solar storage												
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Primary loss												
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Combi loss												
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Total heat required for water heating calculated for each month												
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WWHRS												
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PV diverter												
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Solar input												
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FGHRS												
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Output from w/h												
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Electric shower(s)												
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Heat gains from water heating, kWh/month												
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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	8.3700	10.6334	0.5700		0.7000		0.7700	24.6095 (74)
East	28.9500	19.6403	0.5700		0.7000		0.7700	157.2179 (76)
South	1.4400	46.7521	0.5700		0.7000		0.7700	18.6153 (78)
West	8.0700	19.6403	0.5700		0.7000		0.7700	43.8255 (80)
North	0.9200	15.5233	0.5700		0.7000		1.0000	5.1285 (82)
South	2.7600	46.2238	0.5700		0.7000		1.0000	45.8132 (82)
West	6.2000	26.1244	0.5700		0.7000		1.0000	58.1639 (82)

Solar gains	353.3737	679.2651	1104.2107	1611.1662	1990.2360	2047.8145	1945.0732	1657.6612	1282.4102	800.8234	438.0866	292.4189 (83)
Total gains	1287.0436	1610.5805	2006.3449	2459.1534	2782.5306	2787.0609	2654.6422	2370.7919	2023.7372	1595.4288	1293.0065	1199.9792 (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	19.2565	19.3551	19.4547	19.9686	20.0746	20.6222	20.6222	20.6706	20.3996	20.0746	19.8637	19.6571
util living area	2.2838	2.2903	2.2970	2.3312	2.3383	2.3748	2.3748	2.3780	2.3600	2.3383	2.3242	2.3105
util living area	0.9575	0.9305	0.8775	0.7771	0.6440	0.4954	0.3816	0.4340	0.6472	0.8521	0.9385	0.9632 (86)
MIT	18.4467	18.7788	19.3073	19.9521	20.4199	20.7062	20.8073	20.7831	20.5412	19.8737	19.0556	18.4166 (87)
Th 2	19.9151	19.9200	19.9249	19.9496	19.9545	19.9794	19.9794	19.9816	19.9694	19.9545	19.9446	19.9347 (88)
util rest of house	0.9517	0.9212	0.8613	0.7486	0.5995	0.4328	0.3026	0.3517	0.5864	0.8259	0.9287	0.9581 (89)
MIT 2	16.9111	17.3327	17.9964	18.8010	19.3512	19.6819	19.7763	19.7610	19.5157	18.7308	17.7040	16.8847 (90)
Living area fraction	17.1137	17.5234	18.1693	18.9528	19.4922	19.8170	19.9123	19.8958	19.6510	18.8816	17.8823	17.0868 (92)
MIT	17.1137	17.5234	18.1693	18.9528	19.4922	19.8170	19.9123	19.8958	19.6510	18.8816	17.8823	17.0868 (92)
Temperature adjustment	17.1137	17.5234	18.1693	18.9528	19.4922	19.8170	19.9123	19.8958	19.6510	18.8816	17.8823	17.0868 (93)
adjusted MIT	17.1137	17.5234	18.1693	18.9528	19.4922	19.8170	19.9123	19.8958	19.6510	18.8816	17.8823	17.0868 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9302	0.8934	0.8279	0.7172	0.5777	0.4222	0.2972	0.3443	0.5653	0.7922	0.9025	0.9386 (94)
Ext temp.	1197.1596	1438.8703	1661.1126	1763.6195	1607.5840	1176.7580	788.8284	816.3194	1143.9852	1263.8227	1166.9615	1126.3559 (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	3417.6817	3349.7991	3080.7501	2585.6987	1993.6485	1299.3350	824.9616	868.6257	1397.5976	2118.8600	2787.9757	3367.1556 (97)
Space heating	1652.0684	1284.1442	1056.2103	591.8970	287.2320	0.0000	0.0000	0.0000	0.0000	636.1478	1167.1302	1667.1550 (98a)
Space heating requirement - total per year (kWh/year)												8341.9849
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	1652.0684	1284.1442	1056.2103	591.8970	287.2320	0.0000	0.0000	0.0000	0.0000	636.1478	1167.1302	1667.1550 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8341.9849
Space heating per m2										(98c) / (4) =		37.7243 (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)	1652.0684	1284.1442	1056.2103	591.8970	287.2320	0.0000	0.0000	0.0000	0.0000	636.1478	1167.1302	1667.1550 (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)	661.0918	513.8632	422.6532	236.8536	114.9388	0.0000	0.0000	0.0000	0.0000	254.5609	467.0389	667.1288 (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												
Water heating requirement	329.0666	291.0489	308.8226	270.0938	260.9616	234.1673	230.1637	239.6988	242.8115	271.9743	290.7597	325.2407 (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	187.9306	166.2187	176.3693	154.2511	149.0357	133.7335	131.4470	136.8925	138.6702	155.3251	166.0535	185.7457 (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	35.8397	32.3713	35.8397	34.6836	35.8397	34.6836	35.8397	35.8397	34.6836	35.8397	34.6836	35.8397 (231)
Lighting	41.8954	33.6100	30.2621	22.1713	17.1258	13.9919	15.6227	20.3070	26.3767	34.6077	39.0893	43.0598 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-33.8504	-52.9909	-93.1530	-134.1954	-167.8794	-156.4255	-151.1601	-126.9296	-91.5649	-64.5155	-38.4655	-29.0179 (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)	-6.2065	-14.3738	-38.4136	-91.4470	-172.2686	-207.8572	-195.3391	-131.1902	-67.1509	-24.6511	-8.7881	-4.8785 (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												3338.1292	(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												1881.6730	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.5590)													
mechanical ventilation fans (SFP = 0.5590)												421.9836	(230a)
Total electricity for the above, kWh/year												421.9836	(231)
Electricity for lighting (calculated in Appendix L)												338.1196	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2102.7128	(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												3877.1925	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3338.1292	16.4900	550.4575 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1881.6730	16.4900	310.2879 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	421.9836	16.4900	69.5851 (249)
Energy for lighting	338.1196	16.4900	55.7559 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1140.1482	16.4900	-188.0104
PV Unit electricity exported	-962.5646	5.5900	-53.8074
Total			-241.8178 (252)
Total energy cost			744.2686 (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] =	1.0068 (257)
SAP value		83.6800
SAP rating (Section 12)		84 (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	3338.1292	0.1550	517.5692 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1881.6730	0.1410	265.3060 (264)
Space and water heating			782.8752 (265)
Pumps, fans and electric keep-hot	421.9836	0.1387	58.5343 (267)
Energy for lighting	338.1196	0.1443	48.8011 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1140.1482	0.1314	-149.8478
PV Unit electricity exported	-962.5646	0.1167	-112.3234
Total			-262.1711 (269)
Total CO2, kg/year			628.0394 (272)
CO2 emissions per m2			2.8400 (273)
EI value			96.8377
EI rating			97 (274)
EI band			A

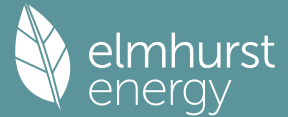
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	130.6700 (1b)	x 2.8800 (2b)	= 376.3296 (1b) - (3b)
First floor	90.4600 (1c)	x 2.6800 (2c)	= 242.4328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	221.1300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	618.7624 (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												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												0 * 10 =	0.0000 (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) =											10.0000 / (5) =	0.0162 (8)		
Pressure test												Yes			
Pressure Test Method												Blower Door			
Measured/design AP50												5.0000 (17)			
Infiltration rate												0.2662 (18)			
Number of sides sheltered												0 (19)			
Shelter factor												(20) = 1 - [0.075 x (19)] =	1.0000 (20)		
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.2662 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Wind speed	4.2000	3.9000	3.9000	3.7000	3.7000	3.3000	3.4000	3.1000	3.2000	3.5000	3.4000	3.8000 (22)			
Wind factor	1.0500	0.9750	0.9750	0.9250	0.9250	0.8250	0.8500	0.7750	0.8000	0.8750	0.8500	0.9500 (22a)			
Adj infilt rate	0.2795	0.2595	0.2595	0.2462	0.2462	0.2196	0.2262	0.2063	0.2129	0.2329	0.2262	0.2529 (22b)			
Mechanical extract ventilation - centralised															
If mechanical ventilation													0.5000 (23a)		
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)		
Effective ac	0.5295	0.5095	0.5095	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5029 (25)			

3. Heat losses and heat loss parameter															

Element	Gross		Openings		NetArea		U-value		A x U		K-value		A x K		
Main dwelling	m2		m2		m2		W/m2K		W/K		kJ/m2K		kJ/K		
Windows					46.8300		0.9615		45.0288						(27)
Solid Doors					2.1000		1.0000		2.1000						(26)
Rooflights					9.8800		0.9615		9.5000						(27a)
HG Doors					1.8900		1.0000		1.8900						(26a)
Ground Floor					130.6700		0.1100		14.3737		75.0000		9800.2500		(28a)
Plinth	23.7600				23.7600		0.1500		3.5640		9.0000		213.8400		(29a)
Cladding	154.0400		47.0400		107.0000		0.1700		18.1900		9.0000		963.0000		(29a)
Stone	17.2200		3.7800		13.4400		0.1500		2.0160		9.0000		120.9600		(29a)
Ashlar	32.5700				32.5700		0.1300		4.2341		9.0000		293.1300		(29a)
Dormer	1.6700				1.6700		0.1800		0.3006		9.0000		15.0300		(29a)
GF Flat C	23.8700				23.8700		0.1272		3.0358		9.0000		214.8300		(30)
GF Rafters	8.4700				8.4700		0.1400		1.1858		9.0000		76.2300		(30)
Rafters	85.0500		9.8800		75.1700		0.1400		10.5238		9.0000		676.5300		(30)
FF Flat Ceiling	34.5900				34.5900		0.1100		3.8049		9.0000		311.3100		(30)
Total net area of external elements Aum(A, m2)					511.9100										(31)
Fabric heat loss, W/K = Sum (A x U)							(26)...(30) + (32) =		119.7475						(33)
Main dwelling															
GF													195.3200	9.0000	1757.8800 (32c)
FF													178.3000	9.0000	1604.7000 (32c)
Internal Floor 1													90.4600	18.0000	1628.2800 (32d)
Internal Ceiling 1													90.4600	9.0000	814.1400 (32e)
Heat capacity Cm = Sum(A x k)													(28)...(30) + (32) + (32a)...(32e) =	18490.1100 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K														83.6165 (35)	
List of Thermal Bridges															
K1 Element							Length		Psi-value		Total				
E11 Eaves (insulation at rafter level)							42.5900		0.0020		0.0852				
E13 Gable (insulation at rafter level)							15.5300		-0.0180		-0.2795				
R6 Flat ceiling							28.1600		0.1200		3.3792				
R4 Ridge (vaulted ceiling)							35.7500		0.1200		4.2900				
R5 Ridge (inverted)							21.2000		0.1200		2.5440				
E2 Other lintels (including other steel lintels)							28.7000		0.0460		1.3202				
E3 Sill							26.8000		0.0750		2.0100				
E4 Jamb							57.6000		0.0470		2.7072				
E5 Ground floor (normal)							55.0400		0.0200		1.1008				
E6 Intermediate floor within a dwelling							46.1400		-0.0020		-0.0923				
R1 Head of roof window							7.8000		0.2400		1.8720				
R2 Sill of roof window							7.8000		0.2400		1.8720				
R3 Jamb of roof window							25.3600		0.2400		6.0864				
E16 Corner (normal)							40.5800		0.0410		1.6638				
E17 Corner (inverted - internal area greater than external area)							24.3800		-0.0790		-1.9260				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)														26.6329 (36)	
Point Thermal Bridges													(36a) =	0.0000	
Total fabric heat loss													(33) + (36) + (36a) =	146.3805 (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	108.1132	104.0371	104.0371	102.0958	102.0958	102.0958	102.0958	102.0958	102.0958	102.0958	102.0958	102.6784 (38)			
Average = Sum(39)m / 12 =	254.4936	250.4176	250.4176	248.4763	248.4763	248.4763	248.4763	248.4763	248.4763	248.4763	248.4763	249.0589 (39)			
													249.3498		
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
HLP (average)	1.1509	1.1324	1.1324	1.1237	1.1237	1.1237	1.1237	1.1237	1.1237	1.1237	1.1237	1.1263 (40)			
Days in month	31	28	31	30	31	30	31	31	30	31	30	31			

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Hot water usage for other uses	45.6541	43.9939	42.3338	40.6736	39.0135	37.3533	37.3533	39.0135	40.6736	42.3338	43.9939	45.6541 (42c)
Average daily hot water use (litres/day)												157.9755 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	171.8015	168.2513	163.8605	157.0230	151.5285	145.5983	143.2005	147.5710	152.1972	158.4383	165.3859	171.3327 (44)
Energy content (annual)	272.0915	239.5876	251.8476	214.9566	203.9865	179.0301	173.1886	182.7237	187.6743	214.9992	235.6226	268.2656 (45)
Distribution loss (46)m = 0.15 x (45)m	40.8137	35.9381	37.7771	32.2435	30.5980	26.8545	25.9783	27.4086	28.1512	32.2499	35.3434	40.2398 (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	329.0666	291.0489	308.8226	270.0938	260.9616	234.1673	230.1637	239.6988	242.8115	271.9743	290.7597	325.2407 (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	329.0666	291.0489	308.8226	270.0938	260.9616	234.1673	230.1637	239.6988	242.8115	271.9743	290.7597	325.2407 (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	136.0505	120.8319	129.3194	115.5828	113.4056	103.6372	103.1653	106.3357	106.5114	117.0673	122.4542	134.7784 (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	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.8643	42.5127	34.5736	26.1745	19.5657	16.5182	17.8485	23.2002	31.1392	39.5384	46.1471	49.1946 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	583.1483	589.1995	573.9505	541.4873	500.5083	461.9938	436.2638	430.2125	445.4615	477.9247	518.9037	557.4182 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058 (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)	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759 (71)
Water heating gains (Table 5)	182.8635	179.8094	173.8163	160.5317	152.4268	143.9406	138.6630	142.9243	147.9326	157.3485	170.0753	181.1537 (72)
Total internal gains	933.6699	931.3154	902.1343	847.9872	792.2946	739.2464	709.5690	713.1307	741.3270	794.6053	854.9199	907.5603 (73)

6. Solar gains

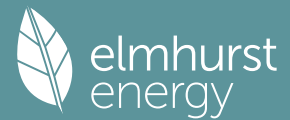
[Jan]					Area	Solar flux		g	FF	Access		Gains
					m2	Table 6a		Specific data	Specific data	factor		W
						W/m2		or Table 6b	or Table 6c	Table 6d		
North					8.3700	12.6907		0.5700	0.7000	0.7700		29.3709 (74)
East					28.9500	23.7106		0.5700	0.7000	0.7700		189.8007 (76)
South					1.4400	53.4173		0.5700	0.7000	0.7700		21.2692 (78)
West					8.0700	23.7106		0.5700	0.7000	0.7700		52.9082 (80)
North					0.9200	18.3080		0.5700	0.7000	1.0000		6.0484 (82)
South					2.7600	54.2973		0.5700	0.7000	1.0000		53.8149 (82)
West					6.2000	31.7758		0.5700	0.7000	1.0000		70.7462 (82)
Solar gains	423.9585	713.4625	1153.4133	1731.0909	2078.2765	2320.6756	2157.1989	1861.4891	1428.5757	891.6145	518.0699	339.0782 (83)
Total gains	1357.6284	1644.7778	2055.5476	2579.0781	2870.5711	3059.9220	2866.7679	2574.6198	2169.9027	1686.2199	1372.9898	1246.6386 (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	20.1818	20.5103	20.5103	20.6706	20.6706	20.6706	20.6706	20.6706	20.6706	20.6706	20.6706	20.6222
alpha	2.3455	2.3674	2.3674	2.3780	2.3780	2.3780	2.3780	2.3780	2.3780	2.3780	2.3780	2.3748
util living area	0.9492	0.9228	0.8615	0.7448	0.5994	0.4318	0.3279	0.3525	0.5949	0.8195	0.9237	0.9567 (86)
MIT	18.6961	18.9872	19.5115	20.1072	20.5296	20.7594	20.8299	20.8240	20.6203	20.0553	19.2931	18.6708 (87)
Th 2	19.9595	19.9744	19.9744	19.9816	19.9816	19.9816	19.9816	19.9816	19.9816	19.9816	19.9816	19.9794 (88)
util rest of house	0.9423	0.9128	0.8438	0.7140	0.5521	0.3687	0.2507	0.2684	0.5303	0.7883	0.9117	0.9507 (89)
MIT 2	17.2546	17.6299	18.2828	19.0085	19.4946	19.7324	19.7947	19.7920	19.6066	18.9686	18.0266	17.2358 (90)
Living area fraction	17.4447	17.8089	18.4449	19.1535	19.6311	19.8679	19.9312	19.9281	19.7403	19.1119	18.1937	17.4251 (91)
MIT	17.4447	17.8089	18.4449	19.1535	19.6311	19.8679	19.9312	19.9281	19.7403	19.1119	18.1937	17.4251 (92)
Temperature adjustment	17.4447	17.8089	18.4449	19.1535	19.6311	19.8679	19.9312	19.9281	19.7403	19.1119	18.1937	17.4251 (93)

8. Space heating requirement

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Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9191	0.8849	0.8113	0.6855	0.5344	0.3613	0.2467	0.2638	0.5134	0.7558	0.8837	0.9298	(94)
Useful gains	1247.8263	1455.4484	1667.5817	1767.8347	1534.0156	1105.4736	707.2477	679.1248	1113.9923	1274.5289	1213.2635	1159.1761	(95)
Ext temp.	4.8000	5.2000	6.9000	9.3000	12.3000	15.1000	17.0000	17.1000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W	3218.0038	3157.4922	2891.0471	2448.3521	1821.6110	1184.7139	728.3456	702.7151	1302.0879	1965.9264	2607.4370	3144.3878	(97)
Space heating kWh	1465.8120	1143.7734	910.2582	489.9725	213.9710	0.0000	0.0000	0.0000	0.0000	514.3997	1003.8049	1476.9975	(98a)
Space heating requirement - total per year (kWh/year)												7218.9893	
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	1465.8120	1143.7734	910.2582	489.9725	213.9710	0.0000	0.0000	0.0000	0.0000	514.3997	1003.8049	1476.9975	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7218.9893	
Space heating per m2										(98c) / (4) =		32.6459	(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	1465.8120	1143.7734	910.2582	489.9725	213.9710	0.0000	0.0000	0.0000	0.0000	514.3997	1003.8049	1476.9975	(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)	586.5594	457.6925	364.2490	196.0674	85.6226	0.0000	0.0000	0.0000	0.0000	205.8422	401.6826	591.0354	(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	329.0666	291.0489	308.8226	270.0938	260.9616	234.1673	230.1637	239.6988	242.8115	271.9743	290.7597	325.2407	(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	187.9306	166.2187	176.3693	154.2511	149.0357	133.7335	131.4470	136.8925	138.6702	155.3251	166.0535	185.7457	(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	35.8397	32.3713	35.8397	34.6836	35.8397	34.6836	35.8397	35.8397	34.6836	35.8397	34.6836	35.8397	(231)	
Lighting	41.8954	33.6100	30.2621	22.1713	17.1258	13.9919	15.6227	20.3070	26.3767	34.6077	39.0893	43.0598	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-39.0956	-55.2598	-98.4174	-144.2583	-174.4556	-171.1854	-163.9008	-140.4068	-101.8873	-70.8721	-43.8947	-32.3569	(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	-8.1023	-15.9229	-44.0093	-109.8399	-196.3970	-258.0695	-236.4604	-163.1912	-82.6835	-30.2677	-11.3491	-6.0144	(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												2888.7512	(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												1881.6730	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.5590)														
mechanical ventilation fans (SFP = 0.5590)													421.9836	(230a)
Total electricity for the above, kWh/year													421.9836	(231)
Electricity for lighting (calculated in Appendix L)													338.1196	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-2398.2980	(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													3132.2293	(238)

10a. Fuel costs - using BEDF prices (577)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2888.7512	28.4300	821.2720	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1881.6730	28.4300	534.9596	(247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000	(247a)
Pumps, fans and electric keep-hot	421.9836	28.4300	119.9699	(249)
Energy for lighting	338.1196	28.4300	96.1274	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1235.9907	28.4300	-351.3921	
PV Unit electricity exported	-1162.3073	5.8100	-67.5301	
Total			-418.9222	(252)

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Total energy cost

1153.4067 (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	2888.7512	0.1554	448.8973 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1881.6730	0.1410	265.3060 (264)
Space and water heating			714.2033 (265)
Pumps, fans and electric keep-hot	421.9836	0.1387	58.5343 (267)
Energy for lighting	338.1196	0.1443	48.8011 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1235.9907	0.1314	-162.3610
PV Unit electricity exported	-1162.3073	0.1162	-135.1172
Total			-297.4783 (269)
Total CO2, kg/year			524.0605 (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	2888.7512	1.5753	4550.6478 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1881.6730	1.5214	2862.6875 (278)
Space and water heating			7413.3353 (279)
Pumps, fans and electric keep-hot	421.9836	1.5128	638.3768 (281)
Energy for lighting	338.1196	1.5338	518.6191 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1235.9907	1.4853	-1835.7970
PV Unit electricity exported	-1162.3073	0.4260	-495.0907
Total			-2330.8876 (283)
Total Primary energy kWh/year			6239.4435 (286)

SAP 10 EPC IMPROVEMENTS

As-Designed

Current energy efficiency rating: B 84
Current environmental impact rating: A 97

N Solar water heating	Recommended
U Solar photovoltaic panels	Already installed
V2 Wind turbine	Not applicable
Recommended measures:	
N Solar water heating	SAP change + 1.1, Cost change -£ 97, CO2 change -46 kg (8.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£97, 0.21 kg/m²	B 85	A 97
Total Savings	£97, 0.21 kg/m²		

Potential energy efficiency rating: B 85
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 577 TEST (01 Aug 2025)
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	£1572	£1466	£106
Space heating	£941	£964	-£23
Water heating	£535	£406	£129
Lighting	£96	£96	£0
Generated (PV)	-£419	-£410	-£9
Total cost of fuels	£1153	£1056	£97
Total cost of uses	£1153	£1056	£97
Delivered energy	14 kWh/m²	12 kWh/m²	2 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	2 kg/m²	2 kg/m²	0 kg/m²
Primary energy	28 kWh/m²	26 kWh/m²	2 kWh/m²

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

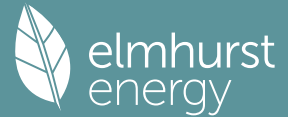
1. Overall dwelling characteristics

Area

Storey height

Volume

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Main dwelling		(m2)		(m)		(m3)	
Ground floor		130.6700 (1b)	x	2.8800 (2b)	=	376.3296 (1b) - (3b)	
First floor		90.4600 (1c)	x	2.6800 (2c)	=	242.4328 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	221.1300					(4)	
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	618.7624 (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	0 * 10 =	0.0000 (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) =	10.0000 / (5) =	0.0162 (8)	
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0000	(17)	
Infiltration rate	0.2662	(18)	
Number of sides sheltered	0	(19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2662 (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	0.3394	0.3327	0.3260	0.2928	0.2861	0.2529	0.2529	0.2462	0.2662	0.2861	0.2994	0.3127	(22b)
Mechanical extract ventilation - centralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5894	0.5827	0.5760	0.5428	0.5361	0.5029	0.5029	0.5000	0.5162	0.5361	0.5494	0.5627	(25)

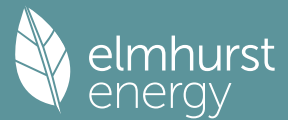
3. Heat losses and heat loss parameter

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
Main dwelling							
Windows			46.8300	0.9615	45.0288		(27)
Solid Doors			2.1000	1.0000	2.1000		(26)
Rooflights			9.8800	0.9615	9.5000		(27a)
HG Doors			1.8900	1.0000	1.8900		(26a)
Ground Floor			130.6700	0.1100	14.3737	75.0000	9800.2500 (28a)
Plinth	23.7600		23.7600	0.1500	3.5640	9.0000	213.8400 (29a)
Cladding	154.0400	47.0400	107.0000	0.1700	18.1900	9.0000	963.0000 (29a)
Stone	17.2200	3.7800	13.4400	0.1500	2.0160	9.0000	120.9600 (29a)
Ashlar	32.5700		32.5700	0.1300	4.2341	9.0000	293.1300 (29a)
Dormer	1.6700		1.6700	0.1800	0.3006	9.0000	15.0300 (29a)
GF Flat C	23.8700		23.8700	0.1272	3.0358	9.0000	214.8300 (30)
GF Rafters	8.4700		8.4700	0.1400	1.1858	9.0000	76.2300 (30)
Rafters	85.0500	9.8800	75.1700	0.1400	10.5238	9.0000	676.5300 (30)
FF Flat Ceiling	34.5900		34.5900	0.1100	3.8049	9.0000	311.3100 (30)
Total net area of external elements Aum(A, m2)			511.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	119.7475		(33)
Main dwelling							
GF			195.3200			9.0000	1757.8800 (32c)
FF			178.3000			9.0000	1604.7000 (32c)
Internal Floor 1			90.4600			18.0000	1628.2800 (32d)
Internal Ceiling 1			90.4600			9.0000	814.1400 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	18490.1100 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		83.6165 (35)	
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E11 Eaves (insulation at rafter level)	42.5900	0.0020	0.0852
E13 Gable (insulation at rafter level)	15.5300	-0.0180	-0.2795
R6 Flat ceiling	28.1600	0.1200	3.3792
R4 Ridge (vaulted ceiling)	35.7500	0.1200	4.2900
R5 Ridge (inverted)	21.2000	0.1200	2.5440
E2 Other lintels (including other steel lintels)	28.7000	0.0460	1.3202
E3 Sill	26.8000	0.0750	2.0100
E4 Jamb	57.6000	0.0470	2.7072
E5 Ground floor (normal)	55.0400	0.0200	1.1008
E6 Intermediate floor within a dwelling	46.1400	-0.0020	-0.0923
R1 Head of roof window	7.8000	0.2400	1.8720
R2 Sill of roof window	7.8000	0.2400	1.8720
R3 Jamb of roof window	25.3600	0.2400	6.0864
E16 Corner (normal)	40.5800	0.0410	1.6638
E17 Corner (inverted - internal area greater than external area)	24.3800	-0.0790	-1.9260
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			26.6329 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) =		146.3805 (37)

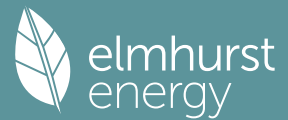
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	120.3415	118.9828	117.6241	110.8306	109.4719	102.6784	102.6784	102.0958	105.3958	109.4719	112.1893	114.9067	(38)
Average = Sum(39)m / 12 =	266.7219	265.3632	264.0045	257.2110	255.8523	249.0589	249.0589	248.4763	251.7763	255.8523	258.5697	261.2871	(39)
												256.9360	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2062	1.2000	1.1939	1.1632	1.1570	1.1263	1.1263	1.1237	1.1386	1.1570	1.1693	1.1816	(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												3.0294 (42)
Hot water usage for mixer showers												93.4069 (42a)
Hot water usage for baths												32.2718 (42b)
Hot water usage for other uses												45.6541 (42c)
Average daily hot water use (litres/day)												157.9755 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	171.8015	168.2513	163.8605	157.0230	151.5285	145.5983	143.2005	147.5710	152.1972	158.4383	165.3859	171.3327 (44)
Energy content (annual)	272.0915	239.5876	251.8476	214.9566	203.9865	179.0301	173.1886	182.7237	187.6743	214.9992	235.6226	268.2656 (45)
Distribution loss (46)m = 0.15 x (45)m												2623.9740
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												
Primary loss												23.2624 (57)
Combi loss												0.0000 (59)
Total heat required for water heating calculated for each month												
WWHRS												325.2407 (62)
PV diverter												0.0000 (63a)
Aperture area of solar collector												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												647.7167 (H24)
Solar input												0.0000 (H29)
Solar input												647.7167
FGHRS												-0.0000 (63c)
Output from w/h												0.0000 (63d)
Electric shower(s)												
Heat gains from water heating, kWh/month												
	136.0505	120.8319	128.2028	110.1799	103.1701	93.5519	92.7437	96.6585	102.1891	115.9507	122.4542	134.7784 (65)
5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m												
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
Pumps, fans												
Losses e.g. evaporation (negative values) (Table 5)												
Water heating gains (Table 5)												
Total internal gains												
	933.6699	931.3154	900.6335	840.4832	778.5373	725.2389	695.5615	700.1238	735.3238	793.1045	854.9199	907.5603 (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	8.3700											24.6095 (74)
East	28.9500											157.2179 (76)
South	1.4400											18.6153 (78)
West	8.0700											43.8255 (80)
North	0.9200											5.1285 (82)
South	2.7600											45.8132 (82)
West	6.2000											58.1639 (82)
Solar gains	353.3737	679.2651	1104.2107	1611.1662	1990.2360	2047.8145	1945.0732	1657.6612	1282.4102	800.8234	438.0866	292.4189 (83)
Total gains	1287.0436	1610.5805	2004.8441	2451.6494	2768.7733	2773.0534	2640.6347	2357.7850	2017.7340	1593.9280	1293.0065	1199.9792 (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	19.2565	19.3551	19.4547	19.9686	20.0746	20.6222	20.6222	20.6706	20.3996	20.0746	19.8637	19.6571
alpha	2.2838	2.2903	2.2970	2.3312	2.3383	2.3748	2.3748	2.3780	2.3600	2.3383	2.3242	2.3105
util living area	0.9575	0.9305	0.8777	0.7780	0.6458	0.4972	0.3833	0.4359	0.6483	0.8523	0.9385	0.9632 (86)
MIT	18.4467	18.7788	19.3065	19.9494	20.4170	20.7048	20.8066	20.7823	20.5399	19.8730	19.0556	18.4166 (87)
Th 2	19.9151	19.9200	19.9249	19.9496	19.9545	19.9794	19.9794	19.9816	19.9694	19.9545	19.9446	19.9347 (88)
util rest of house	0.9517	0.9212	0.8615	0.7496	0.6013	0.4346	0.3041	0.3534	0.5875	0.8261	0.9287	0.9581 (89)
MIT 2	16.9111	17.3327	17.9954	18.7978	19.3482	19.6807	19.7759	19.7604	19.5144	18.7300	17.7040	16.8847 (90)
Living area fraction									fLA = Living area / (4) =			0.1319 (91)
MIT	17.1137	17.5234	18.1684	18.9498	19.4892	19.8158	19.9119	19.8952	19.6497	18.8808	17.8823	17.0868 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1137	17.5234	18.1684	18.9498	19.4892	19.8158	19.9119	19.8952	19.6497	18.8808	17.8823	17.0868 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9302	0.8934	0.8281	0.7181	0.5795	0.4239	0.2985	0.3459	0.5663	0.7924	0.9025	0.9386	(94)
Useful gains	1197.1596	1438.8703	1660.2143	1760.5394	1604.4094	1175.4341	788.3527	815.6377	1142.6908	1263.0259	1166.9615	1126.3559	(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	3417.6817	3349.7991	3080.5100	2584.9074	1992.8780	1299.0348	824.8540	868.4707	1397.2847	2118.6512	2787.9757	3367.1556	(97)
Space heating requirement - total per year (kWh/year)	1652.0684	1284.1442	1056.7000	593.5449	289.0206	0.0000	0.0000	0.0000	0.0000	636.5852	1167.1302	1667.1550	(98a)
Solar heating kWh												8346.3486	
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)	1652.0684	1284.1442	1056.7000	593.5449	289.0206	0.0000	0.0000	0.0000	0.0000	636.5852	1167.1302	1667.1550	(98c)
Space heating per m2												8346.3486	
										(98c) / (4) =		37.7441	(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	1652.0684	1284.1442	1056.7000	593.5449	289.0206	0.0000	0.0000	0.0000	0.0000	636.5852	1167.1302	1667.1550 (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)	661.0918	513.8632	422.8491	237.5130	115.6545	0.0000	0.0000	0.0000	0.0000	254.7360	467.0389	667.1288 (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	329.0666	274.8773	247.7966	180.2596	138.0798	119.8225	116.0115	140.0411	177.9494	241.7154	290.7597	325.2407 (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	187.9306	156.9830	141.5172	102.9467	78.8577	68.4309	66.2544	79.9778	101.6273	138.0442	166.0535	185.7457 (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	42.6342	38.5083	42.6342	41.2589	42.6342	41.2589	42.6342	42.6342	41.2589	42.6342	41.2589	42.6342 (231)	
Lighting	41.8954	33.6100	30.2621	22.1713	17.1258	13.9919	15.6227	20.3070	26.3767	34.6077	39.0893	43.0598 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-33.8647	-52.9735	-92.7339	-132.3001	-162.2295	-148.5105	-143.5908	-122.3424	-90.0568	-64.3858	-38.4896	-29.0294 (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	-6.1922	-14.3912	-38.8328	-93.3424	-177.9184	-215.7722	-202.9084	-135.7774	-68.6590	-24.7809	-8.7640	-4.8670 (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													3339.8754 (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													1474.3691 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(MEV)Centralised, Database: in-use factor = 1.3000, SFP = 0.5590)													
mechanical ventilation fans (SFP = 0.5590)													421.9836 (230a)
pump for solar water heating													80.0000 (230g)
Total electricity for the above, kWh/year													501.9836 (231)
Electricity for lighting (calculated in Appendix L)													338.1196 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													

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PV generation	-2102.7128 (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	3551.6348 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3339.8754	16.4900	550.7455 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1474.3691	16.4900	243.1235 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	421.9836	16.4900	69.5851 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	338.1196	16.4900	55.7559 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1110.5069	16.4900	-183.1226
PV Unit electricity exported	-992.2059	5.5900	-55.4643
Total			-238.5869 (252)
Total energy cost			693.8150 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9385 (257)
SAP value		84.7863
SAP rating (Section 12)		85 (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	3339.8754	0.1550	517.8117 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1474.3691	0.1449	213.5793 (264)
Space and water heating			731.3911 (265)
Pumps, fans and electric keep-hot	501.9836	0.1387	69.6313 (267)
Energy for lighting	338.1196	0.1443	48.8011 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1110.5069	0.1317	-146.2665
PV Unit electricity exported	-992.2059	0.1165	-115.5555
Total			-261.8220 (269)
Total CO2, kg/year			588.0015 (272)
CO2 emissions per m2			2.6600 (273)
EI value			97.0393
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)
Main dwelling			
Ground floor	130.6700 (1b)	x 2.8800 (2b)	= 376.3296 (1b) - (3b)
First floor	90.4600 (1c)	x 2.6800 (2c)	= 242.4328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	221.1300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	618.7624 (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	0 * 10 = 0.0000 (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	10.0000 / (5) = 0.0162 (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)
0.2662 (18)
0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2662 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	3.9000	3.7000	3.7000	3.3000	3.4000	3.1000	3.2000	3.5000	3.4000	3.8000	(22)
Wind factor	1.0500	0.9750	0.9750	0.9250	0.9250	0.8250	0.8500	0.7750	0.8000	0.8750	0.8500	0.9500	(22a)
Adj infilt rate	0.2795	0.2595	0.2595	0.2462	0.2462	0.2196	0.2262	0.2063	0.2129	0.2329	0.2262	0.2529	(22b)
Mechanical extract ventilation - centralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5295	0.5095	0.5095	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5029	(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	
Main dwelling								
Windows			46.8300	0.9615	45.0288			(27)
Solid Doors			2.1000	1.0000	2.1000			(26)
Rooflights			9.8800	0.9615	9.5000			(27a)
HG Doors			1.8900	1.0000	1.8900			(26a)
Ground Floor			130.6700	0.1100	14.3737	75.0000	9800.2500	(28a)
Plinth	23.7600		23.7600	0.1500	3.5640	9.0000	213.8400	(29a)
Cladding	154.0400	47.0400	107.0000	0.1700	18.1900	9.0000	963.0000	(29a)
Stone	17.2200	3.7800	13.4400	0.1500	2.0160	9.0000	120.9600	(29a)
Ashlar	32.5700		32.5700	0.1300	4.2341	9.0000	293.1300	(29a)
Dormer	1.6700		1.6700	0.1800	0.3006	9.0000	15.0300	(29a)
GF Flat C	23.8700		23.8700	0.1272	3.0358	9.0000	214.8300	(30)
GF Rafters	8.4700		8.4700	0.1400	1.1858	9.0000	76.2300	(30)
Rafters	85.0500	9.8800	75.1700	0.1400	10.5238	9.0000	676.5300	(30)
FF Flat Ceiling	34.5900		34.5900	0.1100	3.8049	9.0000	311.3100	(30)
Total net area of external elements Aum(A, m2)			511.9100					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	119.7475		(33)
Main dwelling								
GF			195.3200			9.0000	1757.8800	(32c)
FF			178.3000			9.0000	1604.7000	(32c)
Internal Floor 1			90.4600			18.0000	1628.2800	(32d)
Internal Ceiling 1			90.4600			9.0000	814.1400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18490.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 83.6165 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E11 Eaves (insulation at rafter level)	42.5900	0.0020	0.0852
E13 Gable (insulation at rafter level)	15.5300	-0.0180	-0.2795
R6 Flat ceiling	28.1600	0.1200	3.3792
R4 Ridge (vaulted ceiling)	35.7500	0.1200	4.2900
R5 Ridge (inverted)	21.2000	0.1200	2.5440
E2 Other lintels (including other steel lintels)	28.7000	0.0460	1.3202
E3 Sill	26.8000	0.0750	2.0100
E4 Jamb	57.6000	0.0470	2.7072
E5 Ground floor (normal)	55.0400	0.0200	1.1008
E6 Intermediate floor within a dwelling	46.1400	-0.0020	-0.0923
R1 Head of roof window	7.8000	0.2400	1.8720
R2 Sill of roof window	7.8000	0.2400	1.8720
R3 Jamb of roof window	25.3600	0.2400	6.0864
E16 Corner (normal)	40.5800	0.0410	1.6638
E17 Corner (inverted - internal area greater than external area)	24.3800	-0.0790	-1.9260

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 26.6329 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 146.3805 (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	108.1132	104.0371	104.0371	102.0958	102.0958	102.0958	102.0958	102.0958	102.0958	102.0958	102.0958	102.6784	(38)
Heat transfer coeff	254.4936	250.4176	250.4176	248.4763	248.4763	248.4763	248.4763	248.4763	248.4763	248.4763	248.4763	249.0589	(39)
Average = Sum(39)m / 12 =												249.3498	
HLP	1.1509	1.1324	1.1324	1.1237	1.1237	1.1237	1.1237	1.1237	1.1237	1.1237	1.1237	1.1263	(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												3.0294 (42)
Hot water usage for mixer showers												
93.7662	92.3570	90.3037	86.3749	83.4756	80.2423	78.4045	80.4423	82.6762	86.1477	90.1609	93.4069	(42a)
Hot water usage for baths												
32.3812	31.9003	31.2231	29.9744	29.0395	28.0027	27.4427	28.1152	28.8474	29.9567	31.2311	32.2718	(42b)
Hot water usage for other uses												
45.6541	43.9939	42.3338	40.6736	39.0135	37.3533	37.3533	39.0135	40.6736	42.3338	43.9939	45.6541	(42c)
Average daily hot water use (litres/day)												157.9755 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	171.8015	168.2513	163.8605	157.0230	151.5285	145.5983	143.2005	147.5710	152.1972	158.4383	165.3859	171.3327 (44)
Energy conte	272.0915	239.5876	251.8476	214.9566	203.9865	179.0301	173.1886	182.7237	187.6743	214.9992	235.6226	268.2656 (45)
Energy content (annual)	Total = Sum(45)m =										2623.9740	
Distribution loss (46)m = 0.15 x (45)m												
	40.8137	35.9381	37.7771	32.2435	30.5980	26.8545	25.9783	27.4086	28.1512	32.2499	35.3434	40.2398 (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)

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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	329.0666	291.0489	307.4269	263.3402	248.1673	221.5606	217.1367	227.6023	237.4086	270.5785	290.7597	325.2407 (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												731.3829 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												731.3829
Solar input	-0.0000	-18.6293	-63.3048	-90.8436	-115.5755	-117.1664	-113.6063	-101.1208	-69.6253	-37.0904	-4.4205	-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	329.0666	272.4197	244.1220	172.4965	132.5918	104.3942	103.5304	126.4815	167.7833	233.4882	286.3392	325.2407 (64)
											Total per year (kWh/year) = Sum(64)m =	2497.9541 (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	136.0505	120.8319	128.2028	110.1799	103.1701	93.5519	92.7437	96.6585	102.1891	115.9507	122.4542	134.7784 (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	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639	181.7639 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.8643	42.5127	34.5736	26.1745	19.5657	16.5182	17.8485	23.2002	31.1392	39.5384	46.1471	49.1946 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	583.1483	589.1995	573.9505	541.4873	500.5083	461.9938	436.2638	430.2125	445.4615	477.9247	518.9037	557.4182 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058	56.2058 (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)	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759	-121.1759 (71)
Water heating gains (Table 5)	182.8635	179.8094	172.3155	153.0277	138.6695	129.9331	124.6555	129.9174	141.9294	155.8477	170.0753	181.1537 (72)
Total internal gains	933.6699	931.3154	900.6335	840.4832	778.5373	725.2389	695.5615	700.1238	735.3238	793.1045	854.9199	907.5603 (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	8.3700	12.6907	0.5700	0.7000	0.7700	29.3709 (74)
East	28.9500	23.7106	0.5700	0.7000	0.7700	189.8007 (76)
South	1.4400	53.4173	0.5700	0.7000	0.7700	21.2692 (78)
West	8.0700	23.7106	0.5700	0.7000	0.7700	52.9082 (80)
North	0.9200	18.3080	0.5700	0.7000	1.0000	6.0484 (82)
South	2.7600	54.2973	0.5700	0.7000	1.0000	53.8149 (82)
West	6.2000	31.7758	0.5700	0.7000	1.0000	70.7462 (82)

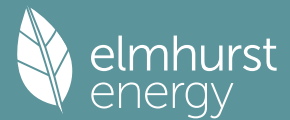
Solar gains	423.9585	713.4625	1153.4133	1731.0909	2078.2765	2320.6756	2157.1989	1861.4891	1428.5757	891.6145	518.0699	339.0782 (83)
Total gains	1357.6284	1644.7778	2054.0468	2571.5741	2856.8138	3045.9145	2852.7604	2561.6129	2163.8995	1684.7191	1372.9898	1246.6386 (84)

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	20.1818	20.5103	20.5103	20.6706	20.6706	20.6706	20.6706	20.6706	20.6706	20.6706	20.6706	20.6222
alpha	2.3455	2.3674	2.3674	2.3780	2.3780	2.3780	2.3780	2.3780	2.3780	2.3780	2.3780	2.3748
util living area	0.9492	0.9228	0.8617	0.7458	0.6012	0.4334	0.3294	0.3541	0.5960	0.8197	0.9237	0.9567 (86)
MIT	18.6961	18.9872	19.5108	20.1048	20.5273	20.7585	20.8295	20.8235	20.6193	20.0546	19.2931	18.6708 (87)
Th 2	19.9595	19.9744	19.9744	19.9816	19.9816	19.9816	19.9816	19.9816	19.9816	19.9816	19.9816	19.9794 (88)
util rest of house	0.9423	0.9128	0.8440	0.7150	0.5539	0.3701	0.2518	0.2697	0.5313	0.7885	0.9117	0.9507 (89)
MIT 2	17.2546	17.6299	18.2819	19.0058	19.4922	19.7317	19.7945	19.7917	19.6056	18.9678	18.0266	17.2358 (90)
Living area fraction												FLA = Living area / (4) =
MIT	17.4447	17.8089	18.4440	19.1508	19.6288	19.8672	19.9310	19.9278	19.7394	19.1112	18.1937	17.4251 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4447	17.8089	18.4440	19.1508	19.6288	19.8672	19.9310	19.9278	19.7394	19.1112	18.1937	17.4251 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9191	0.8849	0.8114	0.6864	0.5361	0.3627	0.2478	0.2650	0.5144	0.7561	0.8837	0.9298	(94)
Useful gains	1247.8263	1455.4484	1666.7375	1765.1324	1531.4948	1104.6337	706.9767	678.8159	1113.0083	1273.8290	1213.2635	1159.1761	(95)
Ext temp.	4.8000	5.2000	6.9000	9.3000	12.3000	15.1000	17.0000	17.1000	14.5000	11.2000	7.7000	4.8000	(96)
Heat loss rate W	3218.0038	3157.4922	2890.8290	2447.6811	1821.0212	1184.5268	728.2841	702.6444	1301.8567	1965.7477	2607.4370	3144.3878	(97)
Space heating kWh	1465.8120	1143.7734	910.7241	491.4351	215.4076	0.0000	0.0000	0.0000	0.0000	514.7875	1003.8049	1476.9975	(98a)
Space heating requirement - total per year (kWh/year)												7222.7421	
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	1465.8120	1143.7734	910.7241	491.4351	215.4076	0.0000	0.0000	0.0000	0.0000	514.7875	1003.8049	1476.9975	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7222.7421	
Space heating per m2										(98c) / (4) =		32.6629	(99)

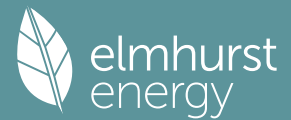
9a. Energy requirements - Individual heating systems, including micro-CHP

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	1465.8120	1143.7734	910.7241	491.4351	215.4076	0.0000	0.0000	0.0000	0.0000	514.7875	1003.8049	1476.9975	(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)	586.5594	457.6925	364.4354	196.6527	86.1975	0.0000	0.0000	0.0000	0.0000	205.9974	401.6826	591.0354	(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	329.0666	272.4197	244.1220	172.4965	132.5918	104.3942	103.5304	126.4815	167.7833	233.4882	286.3392	325.2407	(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	187.9306	155.5795	139.4186	98.5132	75.7235	59.6197	59.1265	72.2338	95.8214	133.3456	163.5290	185.7457	(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	42.6342	38.5083	42.6342	41.2589	42.6342	41.2589	42.6342	42.6342	41.2589	42.6342	41.2589	42.6342	(231)	
Lighting	41.8954	33.6100	30.2621	22.1713	17.1258	13.9919	15.6227	20.3070	26.3767	34.6077	39.0893	43.0598	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-39.1151	-55.2306	-97.8780	-141.6775	-167.5446	-160.2751	-153.9281	-133.9960	-99.7158	-70.6290	-43.9149	-32.3717	(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	-8.0828	-15.9522	-44.5487	-112.4206	-203.3080	-268.9797	-246.4331	-169.6020	-84.8550	-30.5109	-11.3289	-5.9996	(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												2890.2530	(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												1426.5871	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.5590)														
mechanical ventilation fans (SFP = 0.5590)												421.9836	(230a)	
pump for solar water heating												80.0000	(230g)	
Total electricity for the above, kWh/year												501.9836	(231)	
Electricity for lighting (calculated in Appendix L)												338.1196	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation												-2398.2980	(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												2758.6452	(238)	

10a. Fuel costs - using BEDF prices (577)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2890.2530	28.4300	821.6989	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1426.5871	28.4300	405.5787	(247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000	(247a)
Pumps, fans and electric keep-hot	421.9836	28.4300	119.9699	(249)
Pump for solar water heating	80.0000	28.4300	22.7440	(249)
Energy for lighting	338.1196	28.4300	96.1274	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1196.2765	28.4300	-340.1014	

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PV Unit electricity exported	-1202.0215	5.8100	-69.8375
Total			-409.9389 (252)
Total energy cost			1056.1801 (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	2890.2530	0.1554	449.1065 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1426.5871	0.1455	207.5416 (264)
Space and water heating			656.6481 (265)
Pumps, fans and electric keep-hot	501.9836	0.1387	69.6313 (267)
Energy for lighting	338.1196	0.1443	48.8011 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1196.2765	0.1317	-157.5690
PV Unit electricity exported	-1202.0215	0.1160	-139.4360
Total			-297.0050 (269)
Total CO2, kg/year			478.0755 (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	2890.2530	1.5753	4552.9238 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1426.5871	1.5381	2194.2954 (278)
Space and water heating			6747.2192 (279)
Pumps, fans and electric keep-hot	501.9836	1.5128	759.4008 (281)
Energy for lighting	338.1196	1.5338	518.6191 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1196.2765	1.4866	-1778.4122
PV Unit electricity exported	-1202.0215	0.4250	-510.8818
Total			-2289.2940 (283)
Total Primary energy kWh/year			5735.9450 (286)