

**KG Designs**

Longacre
Bentons Lane
Dial Post
Horsham
RH13 8NW

Therm Energy Limited

45 Graham Road
Worthing
West Sussex
BN11 1TL

TEL : 01903 884357

info@thermenergy.co.uk
www.thermenergy.co.uk

Our Ref : DJ-10

Sent By : E-Mail

11 December 2025

Dear Dave

ENERGY STATEMENT (PLANNING)

Report By :

Joe Solti Accredited Assessor

Further to receipt of drawings, we are pleased to present our report as follows.

Development Details

Site Location :

Land East of Spring Gardens, Washington, West Sussex RH20 3BP

Development :

1 New Detached 4 Bedroom Dwelling

Local Authority :

Horsham District Council

Planning Policy (36) :

Appropriate Energy Use (Energy Hierarchy)

Planning Policy (37) :

(1) Maximise Energy Efficiency and Integrate Decentralised,
Renewable and Low Carbon Energy

(2) Limit Water Use to 110 Litres/Person/Day

DJ-10

Site Location :

Land East of Spring Gardens, Washington, West Sussex RH20 3BP

POLICY 36

Strategic Policy : Appropriate Energy Use

Energy Hierarchy

All development will be required to contribute to clean, efficient energy in Horsham based on the following hierarchy :

- (1) Lean - use less energy - eg through demand reduction
- (2) Clean - supply energy efficiently - eg through heat networks
- (3) Green - use renewable energy sources

District Heating & Cooling

Commercial and residential developments in Heat Priority Areas or the strategic development locations will be expected to connect to district heating networks where they exist using the following hierarchy, or incorporate the necessary infrastructure for connection to future network.

Development should demonstrate that the heating and cooling systems have been selected in accordance with the following heating and cooling hierarchy :

- (1) Connection to existing (C)CHP distribution networks (not available)
- (2) Site wide renewable (C)CHP (not suitable - single dwelling)
- (3) Site wide gas-fired (C)CHP (not suitable -single dwelling)
- (4) Site wide renewable community heating/cooling (not suitable - single dwelling)
- (5) Site wide gas-fired community heating/cooling (not suitable - single dwelling)
- (6) Individual building renewable heating = most suitable**
- (7) Individual building heating, with the exception of electric heating

All (C)CHP must be of a scale and operated to maximise the potential for carbon reduction. Where site-wide (C)CHP is proposed, consideration must be given to extending the network to adjacent sites.

Energy Statements

All applications for residential or commercial development must include an Energy Statement demonstrating and quantifying how the development will comply with the Energy Hierarchy.

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Site Location :	Land East of Spring Gardens, Washington, West Sussex RH20 3BP
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BASELINE CO2

Calculations (SAP) :	Part L1A Compliant
Total Emissions :	3.79 kg CO2 per m2
Total Emissions :	1,004.35 kg CO2 per year

BE LEAN CO2

Calculations (SAP) :	Energy Efficiency Measures
Total Emissions :	3.63 kg CO2 per m2
Total Emissions :	961.95 kg CO2 per year
CO2 Saving :	42.40 kg CO2 per year = 4.22 %

BE CLEAN CO2

Calculations (SAP) :	Heat Networks (Not Available)
Total Emissions :	3.63 kg CO2 per m2
Total Emissions :	961.95 kg CO2 per year
CO2 Saving :	0.00 kg CO2 per year = 0.00 %

BE GREEN CO2

Calculations (SAP) :	Renewables (Solar PV - min 2kW with export capable meter + battery)
Total Emissions :	2.85 kg CO2 per m2
Total Emissions :	755.25 kg CO2 per year
CO2 Saving :	206.70 kg CO2 per year = 21.49 %

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Site Location :

Land East of Spring Gardens, Washington, West Sussex RH20 3BP

POLICY 37

Sustainable Construction

Proposals must seek to improve the sustainability of development. To deliver sustainable design, development should incorporate the following measures where appropriate according to the type of development and location :

(1) Maximise energy efficiency and integrate the use of decentralised, renewable and low carbon energy.

(2) Limit water use to 110 litres/person/day

(3)-(8) By others

All new development will be required to provide satisfactory arrangements for the storage of refuse and recyclable materials as an integral part of the design.

New homes and workplaces should include the provision of high-speed broadband access and enable provision of future technologies where available.

1. Maximise Energy Efficiency & Integrate Decentralised, Renewables and Low Carbon Energy

The building is to be designed with a "fabric first approach" to minimise energy requirements, incorporating excellent fabric insulation and air-tightness, advanced detailing, and low energy use ventilation and lighting (ie LEDs and/or CFLs).

Heating is to be by air source heat pump (preferably Products Characteristic Database listed), with advanced heating controls. Installer MCS certified.

Solar PV (min 2kW) with battery storage is then added to further reduce energy use and carbon emissions.

See SAP Calculations attached to this report.

2. Limit Water Use to 110 Litres/Person/Day

Water use is to be reduced and suitably minimised by the fitting of low water use sanitary fittings (taps/showers), dual flush WCs, and low water use (and energy efficient) dishwashers and washing machines.

See Water Efficiency Calculation attached to this report.

Construction and Insulation

<u>Element</u>	<u>U-Value</u> (W/m ² K)
<u>Exposed Wall</u> (brick) 102.5mm facing brick outer leaf + 50mm residual (clear) cavity + 60mm PIR insulation + 100mm lightweight aircrete 2.9N block inner leaf + plaster or plasterboard on dabs internal finish.	0.22
<u>Exposed Wall</u> (clad) Cladding + timber battens + 9mm external grade plywood + timber frame (100mm PIR insulation between) + 50mm PIR insulation to inside face of frame + 12.5mm plasterboard.	0.16
<u>Ground Floor</u> 75mm screed + 140mm PIR insulation + suspended concrete beam and block floor or concrete slab.	0.13
<u>Exposed Floor</u> (over garage) 140mm PIR insulation (between timber floor joists).	0.18
<u>Roof</u> (loft/void) 400mm mineral wool insulation quilt (100mm between joists + 300mm cross-laid over, or 200mm + 200mm).	0.11
<u>Roof</u> (skeilings) 120mm PIR insulation (between rafters/joists) + 50mm PIR insulation (under rafters/joists) + battens + plasterboard.	0.14
<u>Windows & Doors</u> Double-glazed + 16mm cavity (argon gas fill) + soft coat low-E glass + warm edge spacer, or similar to achieve U-value of 1.20W/m ² K (or better).	1.20

Heating, Ventilation & RenewablesMain Heating System

Electric air source heat pump (ground floor = underfloor heating, first floor = radiators). MCS installer.
Wood-burner (optional).

Water Heating

From electric air source heat pump. Hot water cylinder (factory PIR insulation, heat loss TBC kWh/day) + thermostat.

Heating Controls

Time and temperature zoned heating controls.

Ventilation

Background ventilators + intermittent extract fans (Approved Document F1, 2010).

Solar PV

Solar PV panels = 2.00 kW/peak, on south-west facing roof (export capable meter) + battery storage.

OtherDetailing

Construction details (limiting thermal bridging and air leakage) fully adopted in accordance with Recognised Construction Details (RCD) and ROI timber frame details.

Lighting

Low energy lighting with minimum luminous efficacy of 75 light source lumens/circuit-watt (per light fitting).

Air Tightness

Design air permeability is 5m³/h/m² at 50 Pa - to be achieved by air pressure test.

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Thu 11 Dec 2025 10:06:41

Project Information			
Assessed By	Joe Solti	Building Type	House, Detached
OCDEA Registration	EES/003578	Assessment Date	2025-12-11

Dwelling Details			
Assessment Type	As designed	Total Floor Area	265 m ²
Site Reference	DJ-10	Plot Reference	DJ1001 (Baseline)
Address	Land East of Spring Gardens, Washington, RH20 3BP		

Client Details	
Name	.
Company	KG Designs
Address	Longacre, Bentons Lane, Dial Post, Horsham, RH13 8NW

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	7.45 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	3.79 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	39.51 kWh _{PE} /m ²		
Dwelling primary energy	39.16 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	39.1 kWh/m ²		
Dwelling fabric energy efficiency	39.1 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.19	Walls (1) (0.22)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.13	Exposed Floor (0.18)	OK
Roofs	0.16	0.11	Roof (2) (0.14)	OK
Windows, doors, and roof windows	1.6	1.2	Doors (NE) (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	112	0.22
Exposed wall: Walls (2)	108.5	0.16
Ground floor: Ground Floor, Ground Floor	133	0.13
Upper floor: Exposed Floor, Exposed Floor	9.5	0.18
Exposed roof: Roof (1)	136	0.11
Exposed roof: Roof (2)	9	0.14

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Doors (NE), Doors (part glazed)	2	North East	N/A	1.2
Doors (NE), Doors (solid)	2	North East	N/A	1.2
Doors (NW), Doors (part glazed)	2	North West	N/A	1.2
Windows (NE), Windows	7	North East	0.7	1.2
Windows (NE), Windows	4	North East	0.7	1.2
Windows (NW), Windows	0.5	North West	0.7	1.2
Windows (SE), Windows	1.5	South East	0.7	1.2
Windows (SE), Windows	1.5	South East	0.7	1.2
Windows (SW), Windows	18	South West	0.7	1.2
Windows (SW), Windows	12	South West	0.7	1.2
Roof Windows, Roof Windows	1.5	South West	0.7	1.2

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.194	
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.144	
External wall	E3: Sill	Calculated by person with suitable expertise	0.021 (!)	
External wall	E3: Sill	Calculated by person with suitable expertise	0.048	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.016 (!)	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.064	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.054	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.004 (!)	
External wall	E20: Exposed floor (normal)	Calculated by person with suitable expertise	0.046	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.082	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.082	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.075	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.054	
3 Air permeability (better than typically expected values are flagged with a subsequent (!))				
Maximum permitted air permeability at 50Pa		8 m ³ /hm ²		
Dwelling air permeability at 50Pa		5.15 m ³ /hm ² , Design value		OK
Air permeability test certificate reference				
4 Space heating				
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity				
Efficiency	219.3%			
Emitter type	Both radiators and underfloor			
Flow temperature				
System type	Air source heat pump			
Manufacturer				
Model				
Commissioning				
Secondary heating system: Closed room heater				
Fuel	Dual fuel appliance (mineral and wood)			
Efficiency	65.0%			
Commissioning				
5 Hot water				
Cylinder/store - type: Cylinder				
Capacity	300 litres			
Declared heat loss	2 kWh/day			
Primary pipework insulated	Yes			
Manufacturer				
Model				
Commissioning				
Waste water heat recovery system 1 - type: N/A				
Efficiency				
Manufacturer				
Model				

6 Controls		
Main heating 1 - type: Programmer and at least two room thermostats		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Plot Reference	DJ-10				Issued on Date	11/12/2025
Assessment Reference	DJ1001 (Baseline)	Plot Type Ref	New Dwelling			
Plot Address	Land East of Spring Gardens, Washington, West Sussex, RH20 3BP				SAP Version	10.2
SAP Rating	80 C	DER	3.79	TER	7.45	
Environmental	96 A	% DER < TER				49.13
CO ₂ Emissions (t/year)	0.87	DFEE	39.11	TFEE	39.11	
Compliance Check	See BREL	% DFEE < TFEE				0.00
% DPER < TPER	0.87	DPER	39.16	TPER	39.51	
Assessor Details	Mr. Joe Solti				Assessor ID	5122-0001
Client	KG Designs, .					

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	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 70.0000 / (5) = 0.1067 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.1500 (17)
Infiltration rate	0.3642 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3096 (21)

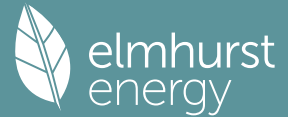
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3947	0.3870	0.3793	0.3406	0.3328	0.2941	0.2941	0.2864	0.3096	0.3328	0.3483	0.3638 (22b)
Effective ac	0.5779	0.5749	0.5719	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662 (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							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(31)
Total net area of external elements Aum(A, m ²)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.0918		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				26.0000	0.1940	5.0440	
E2 Other lintels (including other steel lintels)				13.0000	0.1440	1.8720	
E3 Sill				11.5000	0.0210	0.2415	

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Full SAP Calculation Printout



Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1332.7552	1680.0722	1959.7419	2255.5205	2438.2250	2423.1087	2322.0587	2147.9816	1960.0222	1643.9499	1369.5931	1247.5452 (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	39.0952	39.1860	39.2755	39.7012	39.7818	40.1617	40.1617	40.2329	40.0145	39.7818	39.6190	39.4501
alpha	3.6063	3.6124	3.6184	3.6467	3.6521	3.6774	3.6774	3.6822	3.6676	3.6521	3.6413	3.6300
util living area	0.9925	0.9824	0.9620	0.9092	0.8068	0.6472	0.4971	0.5504	0.7742	0.9406	0.9852	0.9940 (86)
MIT	19.3742	19.6039	19.9190	20.3162	20.6355	20.8286	20.8909	20.8796	20.7393	20.3042	19.7651	19.3397 (87)
Th 2	20.0289	20.0309	20.0329	20.0423	20.0440	20.0522	20.0522	20.0537	20.0491	20.0440	20.0405	20.0368 (88)
util rest of house	0.9909	0.9787	0.9539	0.8892	0.7644	0.5735	0.3996	0.4513	0.7114	0.9234	0.9815	0.9928 (89)
MIT 2	18.5265	18.7560	19.0682	19.4594	19.7534	19.9184	19.9587	19.9548	19.8520	19.4564	18.9251	18.4984 (90)
Living area fraction									fLA =	Living area / (4) =		0.1057 (91)
MIT	18.6161	18.8456	19.1581	19.5499	19.8466	20.0146	20.0572	20.0525	19.9458	19.5460	19.0139	18.5873 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6161	18.8456	19.1581	19.5499	19.8466	20.0146	20.0572	20.0525	19.9458	19.5460	19.0139	18.5873 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9877	0.9729	0.9446	0.8770	0.7545	0.5703	0.4001	0.4512	0.7036	0.9122	0.9762	0.9901 (94)
Useful gains	1316.3309	1634.4945	1851.1458	1978.1556	1839.6739	1382.0157	929.1310	969.1614	1379.0755	1499.5331	1337.0553	1235.2538 (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	4043.3046	3929.5368	3558.6244	2961.9471	2261.1304	1488.6266	950.4816	1002.4044	1613.0906	2483.0054	3320.3604	4026.8454 (97)
Space heating kWh	2028.8685	1542.2684	1270.3641	708.3299	313.5636	0.0000	0.0000	0.0000	0.0000	731.7034	1427.9797	2076.9441 (98a)
Space heating requirement - total per year (kWh/year)												10100.0217
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	2028.8685	1542.2684	1270.3641	708.3299	313.5636	0.0000	0.0000	0.0000	0.0000	731.7034	1427.9797	2076.9441 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10100.0217
Space heating per m2										(98c) / (4) =		38.1133 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (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	2028.8685	1542.2684	1270.3641	708.3299	313.5636	0.0000	0.0000	0.0000	0.0000	731.7034	1427.9797	2076.9441 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	925.1566	703.2688	579.2814	322.9958	142.9839	0.0000	0.0000	0.0000	0.0000	333.6541	651.1535	947.0789 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												4605.5731 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												1670.2146 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

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Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	381.2835 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	6657.0711 (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	4605.5731	0.1553	715.0909 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			950.5513 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Total CO2, kg/year			1005.5822 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.7900 (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	4605.5731	1.5748	7252.9495 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	1.5213	2540.8682 (278)
Space and water heating			9793.8177 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	381.2835	1.5338	584.8253 (282)
Total Primary energy kWh/year			10378.6430 (286)
Dwelling Primary energy Rate (DPER)			39.1600 (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	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

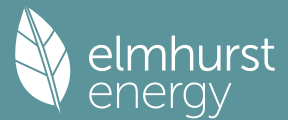
2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0610 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3110 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2643 (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	0.3370	0.3304	0.3238	0.2908	0.2842	0.2511	0.2511	0.2445	0.2643	0.2842	0.2974	0.3106 (22b)
Effective ac	0.5568	0.5546	0.5524	0.5423	0.5404	0.5315	0.5315	0.5299	0.5349	0.5404	0.5442	0.5482 (25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Main dwelling													
TER Opaque door			2.0000	1.0000	2.0000			(26)					
TER Semi-glazed door			4.0000	1.0000	4.0000			(26a)					
TER Opening Type			44.5000	1.1450	50.9542			(27)					
TER Roof Window			1.5000	1.1450	2.1226			(27a)					
Ground Floor			133.0000	0.1300	17.2900			(28a)					
Exposed Floor			9.5000	0.1300	1.2350			(28b)					
Wall (cavity)	145.0000	33.0000	112.0000	0.1800	20.1600			(29a)					
Wall (clad)	126.0000	17.5000	108.5000	0.1800	19.5300			(29a)					
Roof (loft)	136.0000		136.0000	0.1100	14.9600			(30)					
Roof (skeilings)	10.5000	1.5000	9.0000	0.1100	0.9900			(30)					
Total net area of external elements Aum(A, m2)			560.0000					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	133.2418			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							150.0000	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E2 Other lintels (including other steel lintels)				26.0000	0.0500		1.3000						
E2 Other lintels (including other steel lintels)				13.0000	0.0500		0.6500						
E3 Sill				11.5000	0.0500		0.5750						
E3 Sill				4.5000	0.0500		0.2250						
E4 Jamb				49.0000	0.0500		2.4500						
E4 Jamb				22.5000	0.0500		1.1250						
E5 Ground floor (normal)				54.0000	0.1600		8.6400						
E6 Intermediate floor within a dwelling				57.0000	0.0000		0.0000						
E20 Exposed floor (normal)				6.5000	0.3200		2.0800						
E10 Eaves (insulation at ceiling level)				44.5000	0.0600		2.6700						
E12 Gable (insulation at ceiling level)				3.5000	0.0600		0.2100						
E11 Eaves (insulation at rafter level)				9.0000	0.0400		0.3600						
Ei6 Corner (normal)				48.5000	0.0900		4.3650						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.6500	(36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss							(33) + (36) + (36a) =	157.8918 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 120.4989	Feb 120.0216	Mar 119.5537	Apr 117.3562	May 116.9451	Jun 115.0311	Jul 115.0311	Aug 114.6767	Sep 115.7683	Oct 116.9451	Nov 117.7768	Dec 118.6464	(38)
Heat transfer coeff	278.3907	277.9134	277.4456	275.2480	274.8369	272.9229	272.9229	272.5685	273.6602	274.8369	275.6686	276.5382	(39)
Average = Sum(39)m / 12 =												275.2461	
HLP	Jan 1.0505	Feb 1.0487	Mar 1.0470	Apr 1.0387	May 1.0371	Jun 1.0299	Jul 1.0299	Aug 1.0286	Sep 1.0327	Oct 1.0371	Nov 1.0403	Dec 1.0435	(40)
HLP (average)												1.0387	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

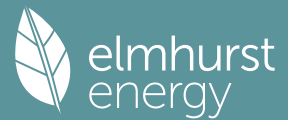
4. Water heating energy requirements (kWh/year)													

Assumed occupancy													3.0864 (42)
Hot water usage for mixer showers													
75.9692	74.8275	73.1639	69.9808	67.6318	65.0122	63.5232	65.1742	66.9841	69.7967	73.0482	75.6781	75.6781	(42a)
Hot water usage for baths													
32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	32.6816	(42b)
Hot water usage for other uses													
46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	46.2381	(42c)
Average daily hot water use (litres/day)												142.4795	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	154.9998	151.6897	147.6588	141.5299	136.5526	131.2017	129.1456	133.1590	137.3918	143.0093	149.2327	154.5978	(44)
Energy conte	245.4817	216.0041	226.9461	193.7473	183.8260	161.3278	156.1904	164.8787	169.4178	194.0622	212.6093	242.0628	(45)
Energy content (annual)										Total = Sum(45)m =		2366.5543	
Distribution loss (46)m = 0.15 x (45)m													
36.8223	32.4006	34.0419	29.0621	27.5739	24.1992	23.4286	24.7318	25.4127	29.1093	31.8914	36.3094	(46)	
Water storage loss (or HIU loss):													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1409	(55)
Total storage loss													
35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	(56)
If cylinder contains dedicated solar storage													
35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
304.1105	268.9591	285.5750	250.4849	242.4549	218.0653	214.8192	223.5075	226.1554	252.6911	269.3469	300.6916	(62)	
WWHRS	-34.7299	-30.7154	-32.1634	-26.6326	-24.8206	-21.2392	-19.9083	-21.1705	-21.9749	-25.9060	-29.3483	-34.0868	(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	269.3806	238.2437	253.4115	223.8523	217.6342	196.8262	194.9109	202.3370	204.1805	226.7851	239.9985	266.6049	(64)
Total per year (kWh/year)												2734.1653	(64)
Electric shower(s)												2734	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
128.5257	114.1854	122.3626	109.8110	108.0252	99.0315	98.8364	101.7252	101.7215	111.4287	116.0826	127.3889	(65)	

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

Metabolic gains (Table 5), Watts													
(66)m	Jan 154.3215	Feb 154.3215	Mar 154.3215	Apr 154.3215	May 154.3215	Jun 154.3215	Jul 154.3215	Aug 154.3215	Sep 154.3215	Oct 154.3215	Nov 154.3215	Dec 154.3215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
222.2254	246.0353	222.2254	229.6330	222.2254	229.6330	222.2254	229.6330	222.2254	229.6330	222.2254	229.6330	222.2254	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	(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)													

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Water heating gains (Table 5)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Total internal gains	172.7496	169.9188	164.4659	152.5153	145.1952	137.5438	132.8446	136.7274	141.2798	149.7698	161.2259	(72)
	896.5344	921.9678	881.4801	853.0405	808.1476	776.5527	745.5058	744.9343	768.1191	796.0982	845.1270	(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	
Northeast					11.0000	11.2829	0.6300	0.7000				0.7700	37.9303 (75)	
Southeast					3.0000	36.7938	0.6300	0.7000				0.7700	33.7340 (77)	
Southwest					30.0000	36.7938	0.6300	0.7000				0.7700	337.3402 (79)	
Northwest					0.5000	11.2829	0.6300	0.7000				0.7700	1.7241 (81)	
Southwest					1.5000	39.9751	0.6300	0.7000				1.0000	23.7992 (82)	
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)		
Total gains	1331.0623	1678.5104	1958.4885	2255.0188	2438.1672	2420.5225	2319.7953	2145.5018	1957.2826	1643.6873	1368.6140	1245.9541 (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	39.6625	39.7306	39.7976	40.1153	40.1753	40.4571	40.4571	40.5097	40.3481	40.1753	40.0541	39.9282		
alpha	3.6442	3.6487	3.6532	3.6744	3.6784	3.6971	3.6971	3.7006	3.6899	3.6784	3.6703	3.6619		
util living area	0.9925	0.9824	0.9617	0.9081	0.8044	0.6449	0.4947	0.5482	0.7724	0.9400	0.9852	0.9941	(86)	
MIT	18.9776	19.2821	19.6985	20.2180	20.6373	20.8865	20.9675	20.9526	20.7701	20.1990	19.4866	18.9255	(87)	
Th 2	20.0414	20.0429	20.0444	20.0512	20.0525	20.0585	20.0585	20.0596	20.0562	20.0525	20.0499	20.0472	(88)	
util rest of house	0.9909	0.9787	0.9535	0.8880	0.7619	0.5716	0.3981	0.4499	0.7097	0.9227	0.9815	0.9928	(89)	
MIT 2	17.6527	18.0413	18.5688	19.2167	19.7099	19.9753	20.0425	20.0343	19.8675	19.2063	18.3088	17.5898	(90)	
Living area fraction	17.7927	18.1724	18.6882	19.3225	19.8078	20.0716	20.1402	20.1313	19.9628	19.3112	18.4332	17.7310	(91)	
MIT	17.7927	18.1724	18.6882	19.3225	19.8078	20.0716	20.1402	20.1313	19.9628	19.3112	18.4332	17.7310	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.7927	18.1724	18.6882	19.3225	19.8078	20.0716	20.1402	20.1313	19.9628	19.3112	18.4332	17.7310	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	1311.3011	1625.4248	1836.8307	1960.0771	1827.5144	1386.3321	943.7138	982.2266	1375.3504	1487.6451	1330.6289	1231.0475	(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	3756.2501	3688.5760	3381.5535	2868.7607	2228.3356	1493.3243	966.2011	1017.0428	1604.4241	2394.1553	3124.2209	3741.8300	(97)	
Space heating kWh	1819.0421	1386.4376	1149.2738	654.2522	298.2110	0.0000	0.0000	0.0000	0.0000	674.4436	1291.3862	1868.0222	(98a)	
Space heating requirement - total per year (kWh/year)												9141.0686		
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	1819.0421	1386.4376	1149.2738	654.2522	298.2110	0.0000	0.0000	0.0000	0.0000	674.4436	1291.3862	1868.0222	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												9141.0686		
Space heating per m2												(98c) / (4) =	34.4946	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													92.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1819.0421	1386.4376	1149.2738	654.2522	298.2110	0.0000	0.0000	0.0000	0.0000	0.0000	674.4436	1291.3862	1868.0222	(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)	1970.7931	1502.0993	1245.1504	708.8323	323.0888	0.0000	0.0000	0.0000	0.0000	730.7082	1399.1183	2023.8593	(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	269.3806	238.2437	253.4115	223.8523	217.6342	196.8262	194.9109	202.3370	204.1805	226.7851	239.9985	266.6049	(64)	
Efficiency of water heater (217)m	87.5267	87.3553	87.0268	86.3183	84.7666	79.8000	79.8000	79.8000	79.8000	86.3494	87.2577	87.5665	(216)	
Fuel for water heating, kWh/month	307.7696	272.7296	291.1879	259.3336	256.7453	246.6493	244.2492	253.5551	255.8653	262.6367	275.0457	304.4597	(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	7.3041	7.3041	7.0685	7.3041	(231)	
Lighting	46.1741	37.0425	33.3527	24.4356	18.8748	15.4209	17.2182	22.3809	29.0705	38.1421	43.0814	47.4574	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-106.3719	-141.6157	-192.2308	-203.5227	-209.1064	-191.2324	-188.4550	-182.5596	-171.2612	-155.2418	-113.7421	-92.9368	(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)	

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Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-88.3663	-181.7133	-353.9191	-521.5973	-680.5765	-680.8927	-673.2372	-574.4473	-426.7846	-256.8822	-116.9273	-70.2382 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1												9903.6497 (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												3230.2270 (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)												372.6511 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-6573.8582 (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												7018.6695 (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	9903.6497	0.2100	2079.7664	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3230.2270	0.2100	678.3477	(264)
Space and water heating			2758.1141	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	372.6511	0.1443	53.7851	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1948.2762	0.1359	-264.7578	
PV Unit electricity exported	-4625.5820	0.1265	-584.9097	
Total			-849.6674	(269)
Total CO2, kg/year			1974.1610	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.4500	(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	9903.6497	1.1300	11191.1241	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3230.2270	1.1300	3650.1565	(278)
Space and water heating			14841.2806	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	372.6511	1.5338	571.5847	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1948.2762	1.5023	-2926.9163	
PV Unit electricity exported	-4625.5820	0.4642	-2147.1300	
Total			-5074.0463	(283)
Total Primary energy kWh/year			10468.9197	(286)
Target Primary Energy Rate (TPER)			39.5100	(287)

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

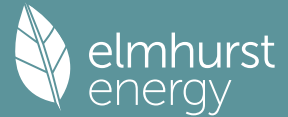
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)	
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (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)

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Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0610 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		5.1500 (17)
Infiltration rate		0.3185 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2707 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)	
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)	
Adj infilt rate	0.3452 0.3384 0.3316 0.2978 0.2910 0.2572 0.2572 0.2504 0.2707 0.2910 0.3046 0.3181 (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	0.5596 0.5573 0.5550 0.5443 0.5423 0.5331 0.5331 0.5314 0.5366 0.5423 0.5464 0.5506 (25)	

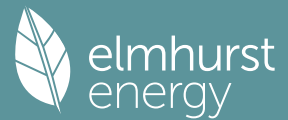
3. Heat losses and heat loss parameter

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							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.0918		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							150.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				26.0000	0.1940	5.0440	
E2 Other lintels (including other steel lintels)				13.0000	0.1440	1.8720	
E3 Sill				11.5000	0.0210	0.2415	
E3 Sill				4.5000	0.0480	0.2160	
E4 Jamb				49.0000	0.0160	0.7840	
E4 Jamb				22.5000	0.0640	1.4400	
E5 Ground floor (normal)				54.0000	0.0540	2.9160	
E6 Intermediate floor within a dwelling				57.0000	0.0040	0.2280	
E20 Exposed floor (normal)				6.5000	0.0460	0.2990	
E10 Eaves (insulation at ceiling level)				44.5000	0.0820	3.6490	
E12 Gable (insulation at ceiling level)				3.5000	0.0820	0.2870	
E11 Eaves (insulation at rafter level)				9.0000	0.0750	0.6750	
E16 Corner (normal)				48.5000	0.0540	2.6190	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						20.2705 (36)	
Point Thermal Bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	157.3623 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	Jan 121.0989 Feb 120.5983 Mar 120.1076 Apr 117.8028 May 117.3716 Jun 115.3642 Jul 115.3642 Aug 114.9925 Sep 116.1374 Oct 117.3716 Nov 118.2439 Dec 119.1559 (38)						
Heat transfer coeff	278.4611 277.9605 277.4698 275.1651 274.7338 272.7265 272.7265 272.3547 273.4997 274.7338 275.6062 276.5182 (39)						
Average = Sum(39)m / 12 =							275.1630
HLP	Jan 1.0508 Feb 1.0489 Mar 1.0471 Apr 1.0384 May 1.0367 Jun 1.0292 Jul 1.0292 Aug 1.0278 Sep 1.0321 Oct 1.0367 Nov 1.0400 Dec 1.0435 (40)						
HLP (average)							1.0384
Days in mont	31 28 31 30 31 30 31 31 30 31 30 31						

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0864 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816 (42b)
Hot water usage for other uses	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381 (42c)
Average daily hot water use (litres/day)												72.4384 (43)
Daily hot water use	Jan 79.0306 Feb 76.8622 Mar 74.4950 Apr 71.5491 May 68.9208 Jun 66.1895 Jul 65.6224 Aug 67.9848 Sep 70.4077 Oct 73.2125 Nov 76.1845 Dec 78.9197 (44)											
Energy conte	125.1651	109.4507	114.4960	97.9471	92.7807	81.3877	79.3646	84.1794	86.8197	99.3487	108.5388	123.5692 (45)
Energy content (annual)										Total = Sum(45)m =		1203.0477
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss (or HIU loss):												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338 (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)

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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	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1022.5906	(64)
Electric shower(s)	60.8386	54.2077	59.1928	56.4869	57.5469	54.8941	56.7240	57.5469	56.4869	59.1928	58.0797	60.8386	(64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											692.0360	(64a)
Heat gains from water heating, kWh/month	41.8072	36.8102	39.1286	34.9355	34.1026	31.0184	31.0460	32.2748	32.5709	35.9098	37.5844	41.4681	(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	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	229.6330	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	(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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Water heating gains (Table 5)	56.1925	54.7771	52.5922	48.5215	45.8368	43.0812	41.7284	43.3802	45.2374	48.2659	52.2006	55.7367	(72)
Total internal gains	776.9773	803.8262	766.6064	746.0466	705.7893	682.0901	654.3897	651.5870	672.0767	691.5942	733.1016	757.5813	(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	

Northeast													11.0000	11.2829	0.6300	0.7000	0.7700	37.9303 (75)
Southeast													3.0000	36.7938	0.6300	0.7000	0.7700	33.7340 (77)
Southwest													30.0000	36.7938	0.6300	0.7000	0.7700	337.3402 (79)
Northwest													0.5000	11.2829	0.6300	0.7000	0.7700	1.7241 (81)
Southwest													1.5000	39.9751	0.6300	0.7000	1.0000	23.7992 (82)

Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879	(83)					
Total gains	1211.5052	1560.3688	1843.6148	2148.0250	2335.8089	2326.0598	2228.6792	2052.1545	1861.2402	1539.1833	1256.5887	1127.4691	(84)					

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.6524	39.7239	39.7941	40.1274	40.1904	40.4862	40.4862	40.5415	40.3718	40.1904	40.0632	39.9311	
alpha	3.6435	3.6483	3.6529	3.6752	3.6794	3.6991	3.6991	3.7028	3.6915	3.6794	3.6709	3.6621	
util living area	0.9945	0.9859	0.9678	0.9186	0.8201	0.6630	0.5118	0.5681	0.7923	0.9499	0.9887	0.9958	(86)
MIT	18.9064	19.2146	19.6381	20.1731	20.6099	20.8757	20.9637	20.9468	20.7480	20.1489	19.4225	18.8551	(87)
Th 2	20.0412	20.0428	20.0443	20.0515	20.0528	20.0591	20.0591	20.0603	20.0567	20.0528	20.0501	20.0473	(88)
util rest of house	0.9933	0.9830	0.9608	0.9003	0.7793	0.5897	0.4130	0.4679	0.7316	0.9349	0.9859	0.9948	(89)
MIT 2	18.1090	18.4163	18.8358	19.3597	19.7634	19.9874	20.0450	20.0379	19.8934	19.3465	18.6299	18.0621	(90)
Living area fraction	fLA = Living area / (4) =											0.1057	(91)
MIT	18.1932	18.5007	18.9206	19.4456	19.8528	20.0813	20.1421	20.1339	19.9837	19.4313	18.7137	18.1459	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1932	18.5007	18.9206	19.4456	19.8528	20.0813	20.1421	20.1339	19.9837	19.4313	18.7137	18.1459	(93)

8. Space heating requirement

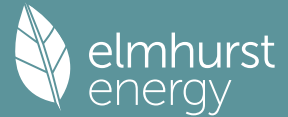
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9763	0.9500	0.8861	0.7695	0.5915	0.4221	0.4763	0.7263	0.9222	0.9801	0.9921	(94)
Useful gains	1199.3444	1523.4600	1751.3534	1903.3260	1797.4140	1375.8965	940.6811	977.3775	1351.7657	1419.4890	1231.6079	1118.6072	(95)
Ext temp.	4.3000	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	3868.7208	3780.4488	3446.3350	2901.7882	2239.8518	1494.8885	966.0248	1016.9502	1609.1810	2426.2486	3200.7984	3856.2978	(97)
Space heating kWh	1986.0161	1516.6965	1261.0664	718.8928	329.1737	0.0000	0.0000	0.0000	0.0000	749.0292	1417.8172	2036.8418	(98a)
Space heating requirement - total per year (kWh/year)												10015.5336	
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	1986.0161	1516.6965	1261.0664	718.8928	329.1737	0.0000	0.0000	0.0000	0.0000	749.0292	1417.8172	2036.8418	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10015.5336	
Space heating per m ²												37.7945	(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	2563.6287	2018.1758	2069.8959	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7914	0.8602	0.8241	0.0000	0.0000	0.0000	0.0000	(101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2028.8760	1736.1292	1705.8919	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2591.3686	2482.6836	2283.0948	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	404.9947	555.4364	429.4390	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	101.2487	138.8591	107.3597	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												347.4675	(107)
Energy for space heating												37.7945	(99)
Energy for space cooling												1.3112	(108)
Total												39.1057	(109)
Fabric Energy Efficiency (DFEE)												39.1	(109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

2. Ventilation rate

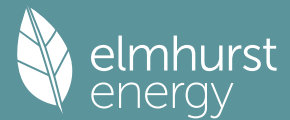
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0610 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3110 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2643 (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	0.3370	0.3304	0.3238	0.2908	0.2842	0.2511	0.2511	0.2445	0.2643	0.2842	0.2974	0.3106 (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	0.5568	0.5546	0.5524	0.5423	0.5404	0.5315	0.5315	0.5299	0.5349	0.5404	0.5442	0.5482 (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			2.0000	1.0000	2.0000		(26)
TER Semi-glazed door			4.0000	1.0000	4.0000		(26a)
TER Opening Type			44.5000	1.1450	50.9542		(27)
TER Roof Window			1.5000	1.1450	2.1226		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1300	1.2350		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.1800	20.1600		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1800	19.5300		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1100	0.9900		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	133.2418		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							150.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				26.0000	0.0500		1.3000
E2 Other lintels (including other steel lintels)				13.0000	0.0500		0.6500
E3 Sill				11.5000	0.0500		0.5750
E3 Sill				4.5000	0.0500		0.2250
E4 Jamb				49.0000	0.0500		2.4500
E4 Jamb				22.5000	0.0500		1.1250
E5 Ground floor (normal)				54.0000	0.1600		8.6400
E6 Intermediate floor within a dwelling				57.0000	0.0000		0.0000
E20 Exposed floor (normal)				6.5000	0.3200		2.0800
E10 Eaves (insulation at ceiling level)				44.5000	0.0600		2.6700

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E12 Gable (insulation at ceiling level)	3.5000	0.0600	0.2100
E11 Eaves (insulation at rafter level)	9.0000	0.0400	0.3600
E16 Corner (normal)	48.5000	0.0900	4.3650
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			24.6500 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	157.8918 (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	120.4989	120.0216	119.5537	117.3562	116.9451	115.0311	115.0311	114.6767	115.7683	116.9451	117.7768	118.6464 (38)
Heat transfer coeff	278.3907	277.9134	277.4456	275.2480	274.8369	272.9229	272.9229	272.5685	273.6602	274.8369	275.6686	276.5382 (39)
Average = Sum(39)m / 12 =												275.2461
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0505	1.0487	1.0470	1.0387	1.0371	1.0299	1.0299	1.0286	1.0327	1.0371	1.0403	1.0435 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0864 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	(42b)
Hot water usage for other uses	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	(42c)
Average daily hot water use (litres/day)													72.4384 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	79.0306	76.8622	74.4950	71.5491	68.9208	66.1895	65.6224	67.9848	70.4077	73.2125	76.1845	78.9197	(44)
Energy content (annual)	125.1651	109.4507	114.4960	97.9471	92.7807	81.3877	79.3646	84.1794	86.8197	99.3487	108.5388	123.5692	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1203.0477	
Water storage loss (or HIU loss):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
WWHRS	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338	(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	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 1022.5906 (64)
Electric shower(s)	60.8386	54.2077	59.1928	56.4869	57.5469	54.8941	56.7240	57.5469	56.4869	59.1928	58.0797	60.8386	(64a)
													Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 692.0360 (64a)
Heat gains from water heating, kWh/month													
	41.8072	36.8102	39.1286	34.9355	34.1026	31.0184	31.0460	32.2748	32.5709	35.9098	37.5844	41.4681	(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	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	229.6330	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	(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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Water heating gains (Table 5)	56.1925	54.7771	52.5922	48.5215	45.8368	43.0812	41.7284	43.3802	45.2374	48.2659	52.2006	55.7367	(72)
Total internal gains	776.9773	803.8262	766.6064	746.0466	705.7893	682.0901	654.3897	651.5870	672.0767	691.5942	733.1016	757.5813	(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			
Northeast				11.0000	11.2829	0.6300	0.7000	0.7700	37.9303 (75)			
Southeast				3.0000	36.7938	0.6300	0.7000	0.7700	33.7340 (77)			
Southwest				30.0000	36.7938	0.6300	0.7000	0.7700	337.3402 (79)			
Northwest				0.5000	11.2829	0.6300	0.7000	0.7700	1.7241 (81)			
Southwest				1.5000	39.9751	0.6300	0.7000	1.0000	23.7992 (82)			
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1211.5052	1560.3688	1843.6148	2148.0250	2335.8089	2326.0598	2228.6792	2052.1545	1861.2402	1539.1833	1256.5887	1127.4691 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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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	39.6625	39.7306	39.7976	40.1153	40.1753	40.4571	40.4571	40.5097	40.3481	40.1753	40.0541	39.9282
alpha	3.6442	3.6487	3.6532	3.6744	3.6784	3.6971	3.6971	3.7006	3.6899	3.6784	3.6703	3.6619
util living area	0.9945	0.9859	0.9678	0.9187	0.8202	0.6632	0.5121	0.5684	0.7924	0.9499	0.9887	0.9958 (86)
MIT	18.9069	19.2150	19.6383	20.1726	20.6095	20.8753	20.9636	20.9466	20.7476	20.1484	19.4220	18.8549 (87)
Th 2	20.0414	20.0429	20.0444	20.0512	20.0525	20.0585	20.0585	20.0596	20.0562	20.0525	20.0499	20.0472 (88)
util rest of house	0.9933	0.9830	0.9608	0.9003	0.7794	0.5899	0.4132	0.4682	0.7318	0.9350	0.9859	0.9948 (89)
MIT 2	18.1097	18.4168	18.8360	19.3590	19.7627	19.9866	20.0444	20.0371	19.8926	19.3457	18.6294	18.0619 (90)
Living area fraction									FLA = Living area /	(4) =		0.1057 (91)
MIT	18.1939	18.5011	18.9208	19.4450	19.8522	20.0805	20.1415	20.1332	19.9829	19.4305	18.7131	18.1457 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1939	18.5011	18.9208	19.4450	19.8522	20.0805	20.1415	20.1332	19.9829	19.4305	18.7131	18.1457 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9900	0.9763	0.9500	0.8861	0.7696	0.5917	0.4223	0.4765	0.7264	0.9223	0.9801	0.9921 (94)
Useful gains	1199.3459	1523.4598	1751.3498	1903.3844	1797.5945	1376.3979	941.1123	977.8328	1352.0167	1419.5165	1231.6074	1118.6067 (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	3867.9370	3779.9371	3446.0956	2902.4817	2240.5236	1495.7531	966.5541	1017.5593	1609.9160	2426.9546	3201.3725	3856.5216 (97)
Space heating kWh	1985.4318	1516.3527	1260.8909	719.3501	329.5392	0.0000	0.0000	0.0000	0.0000	749.5339	1418.2308	2037.0087 (98a)
Space heating requirement - total per year (kWh/year)												10016.3380
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	1985.4318	1516.3527	1260.8909	719.3501	329.5392	0.0000	0.0000	0.0000	0.0000	749.5339	1418.2308	2037.0087 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10016.3380
Space heating per m2										(98c) / (4) =		37.7975 (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	2565.4756	2019.6297	2071.5206	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7910	0.8599	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2029.3904	1736.7483	1706.4473	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2591.3686	2482.6836	2283.0948	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	404.6244	554.9759	429.0257	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	101.1561	138.7440	107.2564	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												347.1565 (107)
Energy for space heating												37.7975 (99)
Energy for space cooling												1.3100 (108)
Total												39.1075 (109)
Fabric Energy Efficiency (TFEE)												39.1 (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	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1067 (8)
Pressure test	Yes
Pressure Test Method	Blower Door

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3096 (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	0.3947	0.3870	0.3793	0.3406	0.3328	0.2941	0.2941	0.2864	0.3096	0.3328	0.3483	0.3638 (22b)
Effective ac	0.5779	0.5749	0.5719	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662 (25)

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.0918		(33)

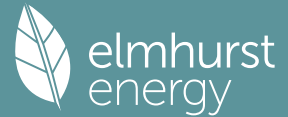
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			150.0000 (35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	26.0000	0.1940	5.0440
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E3 Sill	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160
E6 Intermediate floor within a dwelling	57.0000	0.0040	0.2280
E20 Exposed floor (normal)	6.5000	0.0460	0.2990
E10 Eaves (insulation at ceiling level)	44.5000	0.0820	3.6490
E12 Gable (insulation at ceiling level)	3.5000	0.0820	0.2870
E11 Eaves (insulation at rafter level)	9.0000	0.0750	0.6750
E16 Corner (normal)	48.5000	0.0540	2.6190

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	125.0682	124.4135	123.7717	120.7573	120.1933	117.5679	117.5679	117.0817	118.5791	120.1933	121.3342	122.5270
Heat transfer coeff												
	282.4305	281.7757	281.1339	278.1195	277.5556	274.9301	274.9301	274.4439	275.9414	277.5556	278.6965	279.8893
Average = Sum(39)/ 12 =						274.9301	274.9301	274.4439	275.9414	277.5556	278.6965	278.1168

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0658	1.0633	1.0609	1.0495	1.0474	1.0375	1.0375	1.0356	1.0413	1.0474	1.0517	1.0562 (40)
HLP (average)												1.0495
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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Heat gains from water heating, kWh/month
132.0172 117.2509 125.5272 112.3323 110.3002 100.8936 100.5203 103.5702 103.6940 113.8561 118.9476 130.8047 (65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	(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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Water heating gains (Table 5)	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128	(72)
Total internal gains	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430	(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	
Northeast					11.0000	11.2829	0.6300	0.7000	0.7700		37.9303 (75)	
Southeast					3.0000	36.7938	0.6300	0.7000	0.7700		33.7340 (77)	
Southwest					30.0000	36.7938	0.6300	0.7000	0.7700		337.3402 (79)	
Northwest					0.5000	11.2829	0.6300	0.7000	0.7700		1.7241 (81)	
Southwest					1.5000	39.9751	0.6300	0.7000	1.0000		23.7992 (82)	
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1424.9695	1744.6358	2033.6341	2300.7638	2468.5659	2428.6416	2327.1705	2156.9343	1976.0487	1688.6253	1429.1708	1331.9309 (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	39.0952	39.1860	39.2755	39.7012	39.7818	40.1617	40.1617	40.2329	40.0145	39.7818	39.6190	39.4501	
alpha	3.6063	3.6124	3.6184	3.6467	3.6521	3.6774	3.6774	3.6822	3.6676	3.6521	3.6413	3.6300	
util living area	0.9906	0.9803	0.9578	0.9047	0.8022	0.6461	0.4962	0.5485	0.7709	0.9362	0.9831	0.9926	(86)
MIT	19.4145	19.6310	19.9474	20.3302	20.6415	20.8291	20.8910	20.8800	20.7420	20.3200	19.7905	19.3770	(87)
Th 2	20.0289	20.0309	20.0329	20.0423	20.0440	20.0522	20.0522	20.0537	20.0491	20.0440	20.0405	20.0368	(88)
util rest of house	0.9887	0.9762	0.9489	0.8840	0.7593	0.5725	0.3988	0.4496	0.7078	0.9180	0.9790	0.9911	(89)
MIT 2	18.5666	18.7827	19.0957	19.4722	19.7582	19.9187	19.9587	19.9550	19.8540	19.4710	18.9501	18.5355	(90)
Living area fraction	18.6562	18.8723	19.1857	19.5629	19.8516	20.0149	20.0573	20.0527	19.9478	19.5607	19.0389	18.6244	(91)
MIT	18.6562	18.8723	19.1857	19.5629	19.8516	20.0149	20.0573	20.0527	19.9478	19.5607	19.0389	18.6244	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6562	18.8723	19.1857	19.5629	19.8516	20.0149	20.0573	20.0527	19.9478	19.5607	19.0389	18.6244	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9849	0.9699	0.9392	0.8717	0.7496	0.5693	0.3993	0.4495	0.7001	0.9065	0.9732	0.9880	(94)
Useful gains	1403.5171	1692.0481	1909.8915	2005.6392	1850.4298	1382.7151	929.2928	969.6161	1383.4874	1530.7494	1390.8338	1315.8999	(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	4054.6305	3937.0661	3566.3692	2965.5497	2262.5096	1488.7133	950.5021	1002.4617	1613.6519	2487.1022	3327.3308	4037.2330	(97)
Space heating kWh	1972.4284	1508.6521	1232.4194	691.1356	306.5874	0.0000	0.0000	0.0000	0.0000	711.5265	1394.2778	2024.6718	(98a)
Space heating requirement - total per year (kWh/year)												9841.6989	
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	1972.4284	1508.6521	1232.4194	691.1356	306.5874	0.0000	0.0000	0.0000	0.0000	711.5265	1394.2778	2024.6718	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9841.6989	
Space heating per m ²										(98c) / (4) =		37.1385	(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 %)													219.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement	1972.4284	1508.6521	1232.4194	691.1356	306.5874	0.0000	0.0000	0.0000	0.0000	711.5265	1394.2778	2024.6718	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	899.4201	687.9398	561.9788	315.1553	139.8027	0.0000	0.0000	0.0000	0.0000	324.4535	635.7856	923.2430	(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)

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
Efficiency of water heater	(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148	(217)
Space cooling fuel requirement	(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4487.7788	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1670.2146	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												381.2835	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												6539.2769	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4487.7788	16.4900	740.0347 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	16.4900	275.4184 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	381.2835	16.4900	62.8736 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1078.3268 (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] = 1.2523 (257)
SAP value	79.7010
SAP rating (Section 12)	80 (258)
SAP band	C

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4487.7788	0.1553	696.7977 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			932.2581 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Total CO2, kg/year			987.2891 (272)
CO2 emissions per m2			3.7300 (273)
EI value			95.7324
EI rating			96 (274)
EI band			A

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1067 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.1500 (17)
Infiltration rate	0.3642 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3096 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.9000	3.5000	3.5000	3.4000	3.4000	3.1000	3.2000	3.0000	2.9000	3.1000	3.0000	3.3000 (22)
Wind factor	0.9750	0.8750	0.8750	0.8500	0.8500	0.7750	0.8000	0.7500	0.7250	0.7750	0.7500	0.8250 (22a)
Adj infilt rate	0.3019	0.2709	0.2709	0.2632	0.2632	0.2399	0.2477	0.2322	0.2245	0.2399	0.2322	0.2554 (22b)
Effective ac	0.5456	0.5367	0.5367	0.5346	0.5346	0.5288	0.5307	0.5270	0.5252	0.5288	0.5270	0.5326 (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							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000		112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m ²)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	137.0918	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 150.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	26.0000	0.1940	5.0440
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E3 Sill	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160
E6 Intermediate floor within a dwelling	57.0000	0.0040	0.2280
E20 Exposed floor (normal)	6.5000	0.0460	0.2990
E10 Eaves (insulation at ceiling level)	44.5000	0.0820	3.6490
E12 Gable (insulation at ceiling level)	3.5000	0.0820	0.2870
E11 Eaves (insulation at rafter level)	9.0000	0.0750	0.6750
E16 Corner (normal)	48.5000	0.0540	2.6190

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 20.2705 (36)

Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 157.3623 (37)

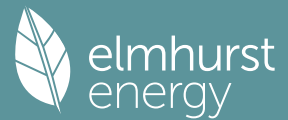
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	118.0670	116.1482	116.1482	115.7009	115.7009	114.4368	114.8452	114.0413	113.6589	114.4368	114.0413	115.2665 (38)
Heat transfer coeff	275.4293	273.5104	273.5104	273.0631	273.0631	271.7990	272.2074	271.4036	271.0211	271.7990	271.4036	272.6288 (39)
Average = Sum(39)m / 12 =												272.5699

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0394	1.0321	1.0321	1.0304	1.0304	1.0257	1.0272	1.0242	1.0227	1.0257	1.0242	1.0288 (40)
HLP (average)												1.0286
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy											3.0864 (42)
Hot water usage for mixer showers											
85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379 (42a)

Full SAP Calculation Printout



Hot water usage for baths	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816 (42b)
Hot water usage for other uses	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381 (42c)
Average daily hot water use (litres/day)												151.2346 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576 (44)
Distribution loss (46)m = 0.15 x (45)m	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745 (45)
Water storage loss (or HIU loss):	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312 (46)
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047 (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	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050 (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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Water heating gains (Table 5)	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128 (72)
Total internal gains	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430 (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
Northeast	11.0000	14.6130	0.6300	0.7000	0.7700	49.1253 (75)
Southeast	3.0000	45.0642	0.6300	0.7000	0.7700	41.3166 (77)
Southwest	30.0000	45.0642	0.6300	0.7000	0.7700	413.1660 (79)
Northwest	0.5000	14.6130	0.6300	0.7000	0.7700	2.2330 (81)
Southwest	1.5000	50.1759	0.6300	0.7000	1.0000	29.8722 (82)

Solar gains	535.7130	795.0814	1135.4145	1529.9207	1730.0072	1893.4468	1783.8811	1589.2775	1340.1542	962.3448	628.5378	448.1700 (83)
Total gains	1526.1547	1783.1746	2092.0403	2428.7062	2568.5535	2678.1187	2536.7621	2345.6442	2127.0393	1803.3810	1534.2216	1410.2131 (84)

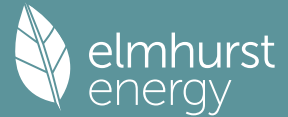
7. Mean internal temperature (heating season)

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	40.0889	40.3702	40.3702	40.4363	40.4363	40.6244	40.5634	40.6836	40.7410	40.6244	40.6836	40.5007
alpha	3.6726	3.6913	3.6913	3.6958	3.6958	3.7083	3.7042	3.7122	3.7161	3.7083	3.7122	3.7000
util living area	0.9863	0.9764	0.9461	0.8724	0.7404	0.5359	0.3891	0.4174	0.6870	0.9023	0.9738	0.9894 (86)
MIT	19.6022	19.7595	20.0942	20.4610	20.7370	20.8770	20.9075	20.9054	20.8164	20.4787	19.9831	19.5689 (87)
Th 2	20.0507	20.0567	20.0567	20.0581	20.0581	20.0620	20.0607	20.0632	20.0644	20.0620	20.0632	20.0594 (88)
util rest of house	0.9834	0.9715	0.9347	0.8457	0.6879	0.4571	0.2939	0.3166	0.6117	0.8749	0.9672	0.9871 (89)
MIT 2	18.7703	18.9303	19.2581	19.6072	19.8511	19.9592	19.9748	19.9768	19.9238	19.6350	19.1584	18.7444 (90)
Living area fraction												0.1057 (91)
MIT	18.8582	19.0179	19.3464	19.6974	19.9447	20.0562	20.0734	20.0749	20.0181	19.7241	19.2455	18.8315 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8582	19.0179	19.3464	19.6974	19.9447	20.0562	20.0734	20.0749	20.0181	19.7241	19.2455	18.8315 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9785	0.9645	0.9242	0.8339	0.6810	0.4566	0.2952	0.3178	0.6076	0.8630	0.9597	0.9830 (94)

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Useful gains	1493.3885	1719.8837	1933.4211	2025.2989	1749.1636	1222.8668	748.9563	745.5445	1292.4548	1556.3116	1472.4225	1386.2479	(95)
Ext temp.	5.1000	5.4000	7.2000	9.6000	12.6000	15.4000	17.3000	17.3000	14.8000	11.5000	8.0000	5.1000	(96)
Heat loss rate W	3789.4131	3724.6502	3322.1787	2757.2280	2005.5688	1265.5377	754.9286	753.1150	1414.2126	2235.3111	3052.0761	3743.6013	(97)
Space heating kWh	1708.2423	1347.2031	1033.2356	526.9890	190.7655	0.0000	0.0000	0.0000	0.0000	505.1756	1137.3506	1753.8710	(98a)
Space heating requirement - total per year (kWh/year)												8202.8326	
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	1708.2423	1347.2031	1033.2356	526.9890	190.7655	0.0000	0.0000	0.0000	0.0000	505.1756	1137.3506	1753.8710	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8202.8326	
Space heating per m2											(98c) / (4) =	30.9541	(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 %)													219.3000	(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	1708.2423	1347.2031	1033.2356	526.9890	190.7655	0.0000	0.0000	0.0000	0.0000	505.1756	1137.3506	1753.8710	(98)	
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)	
Space heating fuel (main heating system)	778.9523	614.3197	471.1517	240.3051	86.9884	0.0000	0.0000	0.0000	0.0000	230.3582	518.6277	799.7588	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)	
Efficiency of water heater													190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)	
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148	(219)	
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)	
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1												3740.4618	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												190.4000		
Water heating fuel used												1670.2146	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
Total electricity for the above, kWh/year												0.0000	(231)	
Electricity for lighting (calculated in Appendix L)												381.2835	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation												0.0000	(233)	
Wind generation												0.0000	(234)	
Hydro-electric generation (Appendix N)												0.0000	(235a)	
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)	
Appendix Q - special features														
Energy saved or generated												-0.0000	(236)	
Energy used												0.0000	(237)	
Total delivered energy for all uses												5791.9598	(238)	

10a. Fuel costs - using BEDF prices (587)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3740.4618	28.4300	1063.4133	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1670.2146	28.4300	474.8420	(247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	381.2835	28.4300	108.3989	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1646.6542	(255)

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

Energy	Emission factor	Emissions
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Space heating - main system 1	kWh/year	kg CO2/kWh	kg CO2/year
Total CO2 associated with community systems	3740.4618	0.1559	583.1948 (261)
Water heating (other fuel)	1670.2146	0.1410	0.0000 (373)
Space and water heating			235.4604 (264)
Pumps, fans and electric keep-hot	0.0000	0.0000	818.6552 (265)
Energy for lighting	381.2835	0.1443	0.0000 (267)
Total CO2, kg/year			55.0310 (268)
			873.6862 (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	3740.4618	1.5772	5899.5709 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	1.5213	2540.8682 (278)
Space and water heating			8440.4391 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	381.2835	1.5338	584.8253 (282)
Total Primary energy kWh/year			9025.2644 (286)

SAP 10 EPC IMPROVEMENTS

DJ1001 (Baseline)

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

N Solar water heating			SAP increase too small
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Recommended
Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 3.3	-£ 324	-153 kg (17.5%)
V2 Wind turbine	+ 7.8	-£ 712	-347 kg (48.2%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 101	-44 kg (5.1%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar photovoltaic panels	£324	0.58 kg/m²	B 83 A 96
Wind turbine	£712	1.31 kg/m²	B 91 A 98
Total Savings	£1036	1.89 kg/m²	

Potential energy efficiency rating: B 91
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 587 TEST (28 Nov 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £1647	Potential £1647	£0 Saving
Electricity			
Space heating	£1063	£1063	£0
Water heating	£475	£475	£0
Lighting	£108	£108	£0
Generated (PV)	-£0	-£324	£324
Generated (wind)	-£0	-£712	£712
Total cost of fuels	£1647	£611	£1036
Total cost of uses	£1646	£610	£1036
Delivered energy	22 kWh/m²	8 kWh/m²	14 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.4 tonnes	0.5 tonnes
CO2 emissions per m²	3 kg/m²	1 kg/m²	2 kg/m²
Primary energy	34 kWh/m²	13 kWh/m²	21 kWh/m²

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

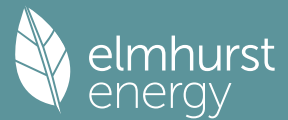
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (5)

2. Ventilation rate

m3 per hour

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Number of open chimneys 0 * 80 = 0.0000 (6a)
Number of open flues 0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire 1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler 0 * 20 = 0.0000 (6d)
Number of flues attached to other heater 0 * 35 = 0.0000 (6e)
Number of blocked chimneys 0 * 20 = 0.0000 (6f)
Number of intermittent extract fans 6 * 10 = 60.0000 (7a)
Number of passive vents 0 * 10 = 0.0000 (7b)
Number of flueless gas fires 0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 70.0000 / (5) = 0.1067 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.1500 (17)
Infiltration rate 0.3642 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3096 (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												
	0.3947	0.3870	0.3793	0.3406	0.3328	0.2941	0.2941	0.2864	0.3096	0.3328	0.3483	0.3638 (22b)
Effective ac	0.5779	0.5749	0.5719	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662 (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							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 137.0918		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 150.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	26.0000	0.1940	5.0440
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E3 Sill	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160
E6 Intermediate floor within a dwelling	57.0000	0.0040	0.2280
E20 Exposed floor (normal)	6.5000	0.0460	0.2990
E10 Eaves (insulation at ceiling level)	44.5000	0.0820	3.6490
E12 Gable (insulation at ceiling level)	3.5000	0.0820	0.2870
E11 Eaves (insulation at rafter level)	9.0000	0.0750	0.6750
E16 Corner (normal)	48.5000	0.0540	2.6190

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 20.2705 (36)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 157.3623 (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	125.0682	124.4135	123.7717	120.7573	120.1933	117.5679	117.5679	117.0817	118.5791	120.1933	121.3342	122.5270 (38)
Heat transfer coeff	282.4305	281.7757	281.1339	278.1195	277.5556	274.9301	274.9301	274.4439	275.9414	277.5556	278.6965	279.8893 (39)
Average = Sum(39)m / 12 =												278.1168

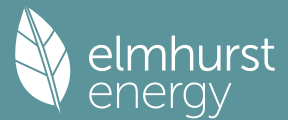
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0658	1.0633	1.0609	1.0495	1.0474	1.0375	1.0375	1.0356	1.0413	1.0474	1.0517	1.0562 (40)
HLP (average)												1.0495
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0864 (42)
Hot water usage for mixer showers 85.4653 84.1809 82.3093 78.7284 76.0857 73.1387 71.4636 73.3210 75.3571 78.5213 82.1792 85.1379 (42a)
Hot water usage for baths 32.7924 32.3054 31.6196 30.3551 29.4082 28.3583 27.7912 28.4722 29.2137 30.3372 31.6277 32.6816 (42b)
Hot water usage for other uses 46.2381 44.5567 42.8754 41.1940 39.5126 37.8312 37.8312 39.5126 41.1940 42.8754 44.5567 46.2381 (42c)
Average daily hot water use (litres/day) 151.2346 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576 (44)
Energy conte	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745 (45)
Energy content (annual)										Total = Sum(45)m =		2511.9926
Distribution loss (46)m = 0.15 x (45)m	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss												
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)

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If cylinder contains dedicated solar storage												
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Total per year (kWh/year) = Sum(64)m =												3180.0886 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047 (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	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050 (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)												
	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Water heating gains (Table 5)												
	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128 (72)
Total internal gains	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430 (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	
Northeast					11.0000	11.2829	0.6300	0.7000	0.7700		37.9303 (75)	
Southeast					3.0000	36.7938	0.6300	0.7000	0.7700		33.7340 (77)	
Southwest					30.0000	36.7938	0.6300	0.7000	0.7700		337.3402 (79)	
Northwest					0.5000	11.2829	0.6300	0.7000	0.7700		1.7241 (81)	
Southwest					1.5000	39.9751	0.6300	0.7000	1.0000		23.7992 (82)	
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1424.9695	1744.6358	2033.6341	2300.7638	2468.5659	2428.6416	2327.1705	2156.9343	1976.0487	1688.6253	1429.1708	1331.9309 (84)

7. Mean internal temperature (heating season)

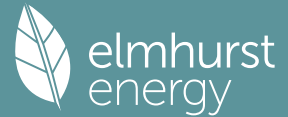
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.0952	39.1860	39.2755	39.7012	39.7818	40.1617	40.1617	40.2329	40.0145	39.7818	39.6190	39.4501
alpha	3.6063	3.6124	3.6184	3.6467	3.6521	3.6774	3.6774	3.6822	3.6676	3.6521	3.6413	3.6300
util living area	0.9906	0.9803	0.9578	0.9047	0.8022	0.6461	0.4962	0.5485	0.7709	0.9362	0.9831	0.9926 (86)
MIT	19.4145	19.6310	19.9474	20.3302	20.6415	20.8291	20.8910	20.8800	20.7420	20.3200	19.7905	19.3770 (87)
Th 2	20.0289	20.0309	20.0329	20.0423	20.0440	20.0522	20.0522	20.0537	20.0491	20.0440	20.0405	20.0368 (88)
util rest of house	0.9887	0.9762	0.9489	0.8840	0.7593	0.5725	0.3988	0.4496	0.7078	0.9180	0.9790	0.9911 (89)
MIT 2	18.5666	18.7827	19.0957	19.4722	19.7582	19.9187	19.9587	19.9550	19.8540	19.4710	18.9501	18.5355 (90)
Living area fraction	18.6562	18.8723	19.1857	19.5629	19.8516	20.0149	20.0573	20.0527	19.9478	19.5607	19.0389	18.6244 (92)
MIT	18.6562	18.8723	19.1857	19.5629	19.8516	20.0149	20.0573	20.0527	19.9478	19.5607	19.0389	18.6244 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6562	18.8723	19.1857	19.5629	19.8516	20.0149	20.0573	20.0527	19.9478	19.5607	19.0389	18.6244 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9849	0.9699	0.9392	0.8717	0.7496	0.5693	0.3993	0.4495	0.7001	0.9065	0.9732	0.9880 (94)
Useful gains	1403.5171	1692.0481	1909.8915	2005.6392	1850.4298	1382.7151	929.2928	969.6161	1383.4874	1530.7494	1390.8338	1315.8999 (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	4054.6305	3937.0661	3566.3692	2965.5497	2262.5096	1488.7133	950.5021	1002.4617	1613.6519	2487.1022	3327.3308	4037.2330 (97)
Space heating kWh	1972.4284	1508.6521	1232.4194	691.1356	306.5874	0.0000	0.0000	0.0000	0.0000	711.5265	1394.2778	2024.6718 (98a)
Space heating requirement - total per year (kWh/year)												9841.6989
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	1972.4284	1508.6521	1232.4194	691.1356	306.5874	0.0000	0.0000	0.0000	0.0000	711.5265	1394.2778	2024.6718 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9841.6989
Space heating per m ²												37.1385 (99)

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

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Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													219.3000 (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	1972.4284	1508.6521	1232.4194	691.1356	306.5874	0.0000	0.0000	0.0000	0.0000	711.5265	1394.2778	2024.6718	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	899.4201	687.9398	561.9788	315.1553	139.8027	0.0000	0.0000	0.0000	0.0000	324.4535	635.7856	923.2430	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.0689	-65.0780	-101.3443	-120.5822	-131.8704	-117.3179	-115.6504	-106.0870	-89.9128	-75.7800	-47.8678	-35.7469	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													4487.7788 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													190.4000
Water heating fuel used													1670.2146 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													381.2835 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1049.3068 (233)
Wind generation													-3575.5408 (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													2987.0916 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4487.7788	16.4900	740.0347	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1670.2146	16.4900	275.4184	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	381.2835	16.4900	62.8736	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1049.3068	16.4900	-173.0307	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-173.0307	(252)
Wind Turbine electricity used in dwelling	-2502.8785	16.4900	-412.7247	
Wind Turbine electricity exported	0.0000	5.5900	0.0000	
Total			-412.7247	(252)
Total energy cost			492.5714	(255)

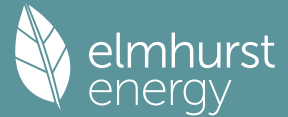
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.5720 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	90.7276
SAP rating (Section 12)		91 (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
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Space heating - main system 1	4487.7788	0.1553	696.7977 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			932.2581 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1049.3068	0.1339	-140.5529
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-140.5529 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-347.1801 (269)
Total CO2, kg/year			499.5561 (272)
CO2 emissions per m2			1.8900 (273)
EI value			97.8406
EI rating			98 (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	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1067 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.1500 (17)
Infiltration rate	0.3642 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3096 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.9000	3.5000	3.5000	3.4000	3.4000	3.1000	3.2000	3.0000	2.9000	3.1000	3.0000	3.3000 (22)
Wind factor	0.9750	0.8750	0.8750	0.8500	0.8500	0.7750	0.8000	0.7500	0.7250	0.7750	0.7500	0.8250 (22a)
Adj infilt rate	0.3019	0.2709	0.2709	0.2632	0.2632	0.2399	0.2477	0.2322	0.2245	0.2399	0.2322	0.2554 (22b)
Effective ac	0.5456	0.5367	0.5367	0.5346	0.5346	0.5288	0.5307	0.5270	0.5252	0.5288	0.5270	0.5326 (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							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.0918		(33)

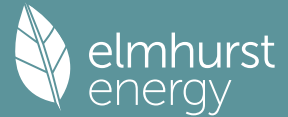
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

List of Thermal Bridges

150.0000 (35)

	Length	Psi-value	Total
K1 Element	26.0000	0.1940	5.0440
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E2 Other lintels (including other steel lintels)	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160

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E6 Intermediate floor within a dwelling						57.0000	0.0040	0.2280				
E20 Exposed floor (normal)						6.5000	0.0460	0.2990				
E10 Eaves (insulation at ceiling level)						44.5000	0.0820	3.6490				
E12 Gable (insulation at ceiling level)						3.5000	0.0820	0.2870				
E11 Eaves (insulation at rafter level)						9.0000	0.0750	0.6750				
E16 Corner (normal)						48.5000	0.0540	2.6190				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												20.2705 (36)
Point Thermal bridges												0.0000
Total fabric heat loss												(33) + (36) + (36a) = 157.3623 (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	118.0670	116.1482	116.1482	115.7009	115.7009	114.4368	114.8452	114.0413	113.6589	114.4368	114.0413	115.2665 (38)
Average = Sum(39)m / 12 =	275.4293	273.5104	273.5104	273.0631	273.0631	271.7990	272.2074	271.4036	271.0211	271.7990	271.4036	272.6288 (39)
												272.5699
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0394	1.0321	1.0321	1.0304	1.0304	1.0257	1.0272	1.0242	1.0227	1.0257	1.0242	1.0286 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												3.0864 (42)
Hot water usage for mixer showers												
	85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379 (42a)
Hot water usage for baths												
	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816 (42b)
Hot water usage for other uses												
	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381 (42c)
Average daily hot water use (litres/day)												151.2346 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576 (44)
Energy conte	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745 (45)
Energy content (annual)												
Distribution loss	(46)m = 0.15 x (45)m											
	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss												
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage												
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
												Total per year (kWh/year) = Sum(64)m = 3180.0886 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month												
	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047 (65)

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

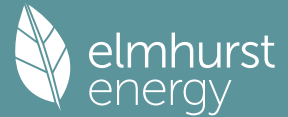
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219 (68)
Pumps, fans	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Total internal gains	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128 (72)
	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430 (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					
Northeast			11.0000	14.6130	0.6300	0.7000	0.7700	49.1253 (75)				
Southeast			3.0000	45.0642	0.6300	0.7000	0.7700	41.3166 (77)				
Southwest			30.0000	45.0642	0.6300	0.7000	0.7700	413.1660 (79)				
Northwest			0.5000	14.6130	0.6300	0.7000	0.7700	2.2330 (81)				
Southwest			1.5000	50.1759	0.6300	0.7000	1.0000	29.8722 (82)				

Solar gains	535.7130	795.0814	1135.4145	1529.9207	1730.0072	1893.4468	1783.8811	1589.2775	1340.1542	962.3448	628.5378	448.1700 (83)
Total gains	1526.1547	1783.1746	2092.0403	2428.7062	2568.5535	2678.1187	2536.7621	2345.6442	2127.0393	1803.3810	1534.2216	1410.2131 (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	40.0889	40.3702	40.3702	40.4363	40.4363	40.6244	40.5634	40.6836	40.7410	40.6244	40.6836	40.5007
alpha	3.6726	3.6913	3.6913	3.6958	3.6958	3.7083	3.7042	3.7122	3.7161	3.7083	3.7122	3.7000
util living area	0.9863	0.9764	0.9461	0.8724	0.7404	0.5359	0.3891	0.4174	0.6870	0.9023	0.9738	0.9894 (86)
MIT	19.6022	19.7595	20.0942	20.4610	20.7370	20.8770	20.9075	20.9054	20.8164	20.4787	19.9831	19.5689 (87)
Th 2	20.0507	20.0567	20.0567	20.0581	20.0581	20.0620	20.0607	20.0632	20.0644	20.0620	20.0632	20.0594 (88)
util rest of house	0.9834	0.9715	0.9347	0.8457	0.6879	0.4571	0.2939	0.3166	0.6117	0.8749	0.9672	0.9871 (89)
MIT 2	18.7703	18.9303	19.2581	19.6072	19.8511	19.9592	19.9748	19.9768	19.9238	19.6350	19.1584	18.7444 (90)
Living area fraction	fLA = Living area / (4) = 0.1057 (91)											
MIT	18.8582	19.0179	19.3464	19.6974	19.9447	20.0562	20.0734	20.0749	20.0181	19.7241	19.2455	18.8315 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.8582	19.0179	19.3464	19.6974	19.9447	20.0562	20.0734	20.0749	20.0181	19.7241	19.2455	18.8315 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9785	0.9645	0.9242	0.8339	0.6810	0.4566	0.2952	0.3178	0.6076	0.8630	0.9597	0.9830	(94)
Useful gains	1493.3885	1719.8837	1933.4211	2025.2989	1749.1636	1222.8668	748.9563	745.5445	1292.4548	1556.3116	1472.4225	1386.2479	(95)
Ext temp.	5.1000	5.4000	7.2000	9.6000	12.6000	15.4000	17.3000	17.3000	14.8000	11.5000	8.0000	5.1000	(96)
Heat loss rate W	3789.4131	3724.6502	3322.1787	2757.2280	2005.5688	1265.5377	754.9286	753.1150	1414.2126	2235.3111	3052.0761	3743.6013	(97)
Space heating kWh	1708.2423	1347.2031	1033.2356	526.9890	190.7655	0.0000	0.0000	0.0000	0.0000	505.1756	1137.3506	1753.8710	(98a)
Space heating requirement - total per year (kWh/year)												8202.8326	
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	1708.2423	1347.2031	1033.2356	526.9890	190.7655	0.0000	0.0000	0.0000	0.0000	505.1756	1137.3506	1753.8710	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8202.8326	
Space heating per m2											(98c) / (4) =	30.9541	(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 %)													219.3000 (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	1708.2423	1347.2031	1033.2356	526.9890	190.7655	0.0000	0.0000	0.0000	0.0000	505.1756	1137.3506	1753.8710	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	778.9523	614.3197	471.1517	240.3051	86.9884	0.0000	0.0000	0.0000	0.0000	230.3582	518.6277	799.7588	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-51.3444	-68.5708	-105.7776	-127.0968	-134.6838	-128.6340	-125.5742	-115.9811	-98.8059	-83.5612	-56.5470	-43.0444	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													3740.4618 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													190.4000
Water heating fuel used													1670.2146 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													381.2835 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1139.6213 (233)

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Wind generation	-3575.5408 (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	2149.4600 (238)

10a. Fuel costs - using BEDF prices (587)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3740.4618	28.4300	1063.4133 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	28.4300	474.8420 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	381.2835	28.4300	108.3989 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1139.6213	28.4300	-323.9943
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-323.9943 (252)
Wind Turbine electricity used in dwelling	-2502.8785	28.4300	-711.5684
Wind Turbine electricity exported	0.0000	5.8100	0.0000
Total			-711.5684 (252)
Total energy cost			611.0915 (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	3740.4618	0.1559	583.1948 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			818.6552 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1139.6213	0.1341	-152.8157
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-152.8157 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-347.1801 (269)
Total CO2, kg/year			373.6904 (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	3740.4618	1.5772	5899.5709 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	1.5213	2540.8682 (278)
Space and water heating			8440.4391 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	381.2835	1.5338	584.8253 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1139.6213	1.4956	-1704.3711
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1704.3711 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.5128	-3786.3546
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-3786.3546 (283)
Total Primary energy kWh/year			3534.5387 (286)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Thu 11 Dec 2025 10:07:19

Project Information			
Assessed By	Joe Solti	Building Type	House, Detached
OCDEA Registration	EES/003578	Assessment Date	2025-12-11

Dwelling Details			
Assessment Type	As designed	Total Floor Area	265 m ²
Site Reference	DJ-10	Plot Reference	DJ1002 (Be Lean)
Address	Land East of Spring Gardens, Washington, RH20 3BP		

Client Details	
Name	.
Company	KG Designs
Address	Longacre, Bentons Lane, Dial Post, Horsham, RH13 8NW

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	7.45 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	3.63 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	39.51 kWh _{PE} /m ²		
Dwelling primary energy	37.54 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	39.1 kWh/m ²		
Dwelling fabric energy efficiency	38.3 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.19	Walls (1) (0.22)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.13	Exposed Floor (0.18)	OK
Roofs	0.16	0.11	Roof (2) (0.14)	OK
Windows, doors, and roof windows	1.6	1.2	Doors (NE) (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

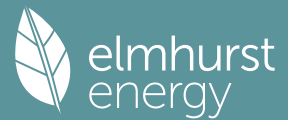
2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	112	0.22
Exposed wall: Walls (2)	108.5	0.16
Ground floor: Ground Floor, Ground Floor	133	0.13
Upper floor: Exposed Floor, Exposed Floor	9.5	0.18
Exposed roof: Roof (1)	136	0.11
Exposed roof: Roof (2)	9	0.14

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Doors (NE), Doors (part glazed)	2	North East	N/A	1.2
Doors (NE), Doors (solid)	2	North East	N/A	1.2
Doors (NW), Doors (part glazed)	2	North West	N/A	1.2
Windows (NE), Windows	7	North East	0.7	1.2
Windows (NE), Windows	4	North East	0.7	1.2
Windows (NW), Windows	0.5	North West	0.7	1.2
Windows (SE), Windows	1.5	South East	0.7	1.2
Windows (SE), Windows	1.5	South East	0.7	1.2
Windows (SW), Windows	18	South West	0.7	1.2
Windows (SW), Windows	12	South West	0.7	1.2
Roof Windows, Roof Windows	1.5	South West	0.7	1.2

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.144	
External wall	E3: Sill	Calculated by person with suitable expertise	0.021 (!)	
External wall	E3: Sill	Calculated by person with suitable expertise	0.048	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.016 (!)	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.064	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.054	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.004 (!)	
External wall	E20: Exposed floor (normal)	Calculated by person with suitable expertise	0.046	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.082	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.082	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.075	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.054	
3 Air permeability (better than typically expected values are flagged with a subsequent (!))				
Maximum permitted air permeability at 50Pa		8 m ³ /hm ²		
Dwelling air permeability at 50Pa		5 m ³ /hm ² , Design value		OK
Air permeability test certificate reference				
4 Space heating				
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity				
Efficiency	219.3%			
Emitter type	Both radiators and underfloor			
Flow temperature				
System type	Air source heat pump			
Manufacturer				
Model				
Commissioning				
Secondary heating system: Closed room heater				
Fuel	Dual fuel appliance (mineral and wood)			
Efficiency	65.0%			
Commissioning				
5 Hot water				
Cylinder/store - type: Cylinder				
Capacity	300 litres			
Declared heat loss	2 kWh/day			
Primary pipework insulated	Yes			
Manufacturer				
Model				
Commissioning				
Waste water heat recovery system 1 - type: N/A				
Efficiency				
Manufacturer				
Model				

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

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Plot Reference	DJ-10				Issued on Date	11/12/2025	
Assessment Reference	DJ1002 (Be Lean)			Plot Type Ref	New Dwelling		
Plot Address	Land East of Spring Gardens, Washington, West Sussex, RH20 3BP				SAP Version	10.2	
SAP Rating	81 B	DER	3.63	TER	7.45		
Environmental	96 A	% DER < TER				51.28	
CO ₂ Emissions (t/year)	0.84	DFEE	38.30	TFEE	39.11		
Compliance Check	See BREL	% DFEE < TFEE				2.07	
% DPER < TPER	4.99	DPER	37.54	TPER	39.51		
Assessor Details	Mr. Joe Solti				Assessor ID	5122-0001	
Client	KG Designs, .						

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	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (5)

2. Ventilation rate

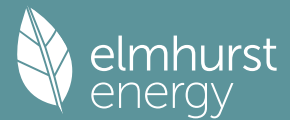
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1067 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3567 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3032 (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	0.3866	0.3790	0.3715	0.3336	0.3260	0.2881	0.2881	0.2805	0.3032	0.3260	0.3411	0.3563 (22b)
Effective ac	0.5747	0.5718	0.5690	0.5556	0.5531	0.5415	0.5415	0.5393	0.5460	0.5531	0.5582	0.5635 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m ²)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.0918		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				26.0000	0.0500	1.3000	
E2 Other lintels (including other steel lintels)				13.0000	0.1440	1.8720	
E3 Sill				11.5000	0.0210	0.2415	

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E3 Sill								4.5000	0.0480	0.2160		
E4 Jamb								49.0000	0.0160	0.7840		
E4 Jamb								22.5000	0.0640	1.4400		
E5 Ground floor (normal)								54.0000	0.0540	2.9160		
E6 Intermediate floor within a dwelling								57.0000	0.0040	0.2280		
E20 Exposed floor (normal)								6.5000	0.0460	0.2990		
E10 Eaves (insulation at ceiling level)								44.5000	0.0820	3.6490		
E12 Gable (insulation at ceiling level)								3.5000	0.0820	0.2870		
E11 Eaves (insulation at rafter level)								9.0000	0.0750	0.6750		
E16 Corner (normal)								48.5000	0.0540	2.6190		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											16.5265	(36)
Point Thermal bridges											0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	153.6183 (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	124.3810	123.7529	123.1373	120.2458	119.7048	117.1863	117.1863	116.7199	118.1564	119.7048	120.7992	121.9434 (38)
Average = Sum(39)m / 12 =	277.9992	277.3712	276.7556	273.8640	273.3230	270.8046	270.8046	270.3382	271.7746	273.3230	274.4175	275.5616 (39)
												273.8614
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0491	1.0467	1.0444	1.0334	1.0314	1.0219	1.0219	1.0201	1.0256	1.0314	1.0355	1.0399 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												3.0864 (42)
Hot water usage for mixer showers												
	85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379 (42a)
Hot water usage for baths												
	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816 (42b)
Hot water usage for other uses												
	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381 (42c)
Average daily hot water use (litres/day)												151.2346 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576 (44)
Energy conte	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2511.9926
	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss												
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage												
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
12Total per year (kWh/year)												3180.0886 (64)
Electric shower(s)												3180 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												
Heat gains from water heating, kWh/month												
	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254	229.6330	222.2254 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227 (68)
Pumps, fans	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Total internal gains	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128 (72)
	898.2273	923.5296	882.7336	853.5422	808.2053	779.1389	747.7691	747.4140	770.8587	796.3608	846.1061	877.6573 (73)

6. Solar gains												

[Jan]												
	Area											
	m2											
	Solar flux											
	Table 6a											
	W/m2											
	Specific data											
	or Table 6b											
	g											
	Specific data											
	or Table 6c											
	FF											
	Access											
	factor											
	Table 6d											
	Gains											
	W											
Northeast	11.0000											37.9303 (75)
Southeast	3.0000											33.7340 (77)
Southwest	30.0000											337.3402 (79)
Northwest	0.5000											1.7241 (81)
Southwest	1.5000											23.7992 (82)

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Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1332.7552	1680.0722	1959.7419	2255.5205	2438.2250	2423.1087	2322.0587	2147.9816	1960.0222	1643.9499	1369.5931	1247.5452 (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	39.7183	39.8083	39.8968	40.3181	40.3979	40.7736	40.7736	40.8439	40.6280	40.3979	40.2368	40.0697
alpha	3.6479	3.6539	3.6598	3.6879	3.6932	3.7182	3.7182	3.7229	3.7085	3.6932	3.6825	3.6713
util living area	0.9925	0.9823	0.9615	0.9075	0.8030	0.6415	0.4913	0.5445	0.7699	0.9396	0.9851	0.9941 (86)
MIT	19.4018	19.6311	19.9440	20.3363	20.6489	20.8350	20.8938	20.8831	20.7488	20.3218	19.7881	19.3668 (87)
Th 2	20.0427	20.0446	20.0465	20.0556	20.0572	20.0651	20.0651	20.0666	20.0621	20.0572	20.0538	20.0503 (88)
util rest of house	0.9909	0.9786	0.9533	0.8874	0.7605	0.5686	0.3957	0.4471	0.7072	0.9223	0.9814	0.9928 (89)
MIT 2	18.1463	18.4396	18.8366	19.3292	19.6974	19.8985	19.9472	19.9421	19.8175	19.3218	18.6483	18.1071 (90)
Living area fraction									fLA =	Living area / (4) =		0.1057 (91)
MIT	18.2790	18.5655	18.9536	19.4356	19.7979	19.9975	20.0472	20.0416	19.9159	19.4275	18.7687	18.2402 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2790	18.5655	18.9536	19.4356	19.7979	19.9975	20.0472	20.0416	19.9159	19.4275	18.7687	18.2402 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9867	0.9709	0.9411	0.8715	0.7473	0.5630	0.3938	0.4444	0.6961	0.9075	0.9744	0.9893 (94)
Useful gains	1314.9750	1631.1148	1844.3467	1965.5782	1822.1276	1364.1380	914.4110	954.4952	1364.2808	1491.8146	1334.5844	1234.2217 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.1000	14.0000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	3886.1493	3790.4243	3446.6022	2885.3185	2213.3527	1461.6611	933.5207	984.4540	1580.6026	2412.7553	3202.0929	3868.9422 (97)
Space heating kWh	1912.9537	1451.0560	1192.0781	662.2130	291.0714	0.0000	0.0000	0.0000	0.0000	685.1799	1344.6061	1960.2320 (98a)
Space heating requirement - total per year (kWh/year)												9499.3903
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	1912.9537	1451.0560	1192.0781	662.2130	291.0714	0.0000	0.0000	0.0000	0.0000	685.1799	1344.6061	1960.2320 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9499.3903
Space heating per m2										(98c) / (4) =		35.8468 (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 %)												219.3000 (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	1912.9537	1451.0560	1192.0781	662.2130	291.0714	0.0000	0.0000	0.0000	0.0000	685.1799	1344.6061	1960.2320 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	872.2999	661.6762	543.5833	301.9667	132.7275	0.0000	0.0000	0.0000	0.0000	312.4395	613.1355	893.8586 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (232)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567 (231)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												4331.6873 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												1670.2146 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

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Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	381.2835 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	6383.1854 (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	4331.6873	0.1553	672.6968 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			908.1572 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Total CO2, kg/year			963.1882 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6300 (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	4331.6873	1.5749	6822.1116 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	1.5213	2540.8682 (278)
Space and water heating			9362.9798 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	381.2835	1.5338	584.8253 (282)
Total Primary energy kWh/year			9947.8051 (286)
Dwelling Primary energy Rate (DPER)			37.5400 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
Ground floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
First floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 655.8000 (5)
Dwelling volume			

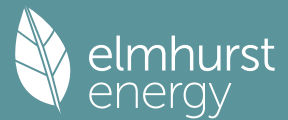
2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0610 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3110 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2643 (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	0.3370	0.3304	0.3238	0.2908	0.2842	0.2511	0.2511	0.2445	0.2643	0.2842	0.2974	0.3106 (22b)
Effective ac	0.5568	0.5546	0.5524	0.5423	0.5404	0.5315	0.5315	0.5299	0.5349	0.5404	0.5442	0.5482 (25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.0000	1.0000	2.0000			(26)
TER Semi-glazed door			4.0000	1.0000	4.0000			(26a)
TER Opening Type			44.5000	1.1450	50.9542			(27)
TER Roof Window			1.5000	1.1450	2.1226			(27a)
Ground Floor			133.0000	0.1300	17.2900			(28a)
Exposed Floor			9.5000	0.1300	1.2350			(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.1800	20.1600			(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1800	19.5300			(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600			(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1100	0.9900			(30)
Total net area of external elements Aum(A, m2)			560.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	133.2418			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 150.0000 (35)

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	26.0000	0.0500	1.3000	
E2 Other lintels (including other steel lintels)	13.0000	0.0500	0.6500	
E2 Other lintels (including other steel lintels)	11.5000	0.0500	0.5750	
E3 Sill	4.5000	0.0500	0.2250	
E3 Sill	49.0000	0.0500	2.4500	
E4 Jamb	22.5000	0.0500	1.1250	
E4 Jamb	54.0000	0.1600	8.6400	
E5 Ground floor (normal)	57.0000	0.0000	0.0000	
E6 Intermediate floor within a dwelling	6.5000	0.3200	2.0800	
E20 Exposed floor (normal)	44.5000	0.0600	2.6700	
E10 Eaves (insulation at ceiling level)	3.5000	0.0600	0.2100	
E12 Gable (insulation at ceiling level)	9.0000	0.0400	0.3600	
E11 Eaves (insulation at rafter level)	48.5000	0.0900	4.3650	
E16 Corner (normal)				

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 24.6500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 157.8918 (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	120.4989	120.0216	119.5537	117.3562	116.9451	115.0311	115.0311	114.6767	115.7683	116.9451	117.7768	118.6464	(38)	
Average = Sum(39)m / 12 =	278.3907	277.9134	277.4456	275.2480	274.8369	272.9229	272.9229	272.5685	273.6602	274.8369	275.6686	276.5382	(39)	
												275.2461		
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
HLP (average)	1.0505	1.0487	1.0470	1.0387	1.0371	1.0299	1.0299	1.0286	1.0327	1.0371	1.0403	1.0435	(40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31		

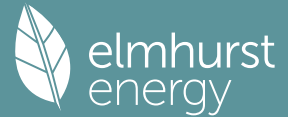
4. Water heating energy requirements (kWh/year)

Assumed occupancy														3.0864 (42)
Hot water usage for mixer showers	75.9692	74.8275	73.1639	69.9808	67.6318	65.0122	63.5232	65.1742	66.9841	69.7967	73.0482	75.6781	(42a)	
Hot water usage for baths	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	(42b)	
Hot water usage for other uses	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	(42c)	
Average daily hot water use (litres/day)												142.4795	(43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	154.9998	151.6897	147.6588	141.5299	136.5526	131.2017	129.1456	133.1590	137.3918	143.0093	149.2327	154.5978	(44)	
Energy content (annual)	245.4817	216.0041	226.9461	193.7473	183.8260	161.3278	156.1904	164.8787	169.4178	194.0622	212.6093	242.0628	(45)	
Distribution loss (46)m = 0.15 x (45)m	36.8223	32.4006	34.0419	29.0621	27.5739	24.1992	23.4286	24.7318	25.4127	29.1093	31.8914	36.3094	(46)	
Water storage loss (or HIU loss):														
Store volume														300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):														2.1127 (48)
Temperature factor from Table 2b														0.5400 (49)
Enter (49) or (54) in (55)														1.1409 (55)
Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)	
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	304.1105	268.9591	285.5750	250.4849	242.4549	218.0653	214.8192	223.5075	226.1554	252.6911	269.3469	300.6916	(62)	
WWHRS	-34.7299	-30.7154	-32.1634	-26.6326	-24.8206	-21.2392	-19.9083	-21.1705	-21.9749	-25.9060	-29.3483	-34.0868	(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	269.3806	238.2437	253.4115	223.8523	217.6342	196.8262	194.9109	202.3370	204.1805	226.7851	239.9985	266.6049	(64)	
12Total per year (kWh/year)														2734.1653 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =														0.0000 (64a)
Heat gains from water heating, kWh/month	128.5257	114.1854	122.3626	109.8110	108.0252	99.0315	98.8364	101.7252	101.7215	111.4287	116.0826	127.3889	(65)	

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

Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	(66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	222.2254	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254	(67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227	(68)	
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)														

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Water heating gains (Table 5)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Total internal gains	172.7496	169.9188	164.4659	152.5153	145.1952	137.5438	132.8446	136.7274	141.2798	149.7698	161.2259	(72)
	896.5344	921.9678	881.4801	853.0405	808.1476	776.5527	745.5058	744.9343	768.1191	796.0982	845.1270	(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
Northeast				11.0000	11.2829		0.6300	0.7000		0.7700		37.9303 (75)
Southeast				3.0000	36.7938		0.6300	0.7000		0.7700		33.7340 (77)
Southwest				30.0000	36.7938		0.6300	0.7000		0.7700		337.3402 (79)
Northwest				0.5000	11.2829		0.6300	0.7000		0.7700		1.7241 (81)
Southwest				1.5000	39.9751		0.6300	0.7000		1.0000		23.7992 (82)
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1331.0623	1678.5104	1958.4885	2255.0188	2438.1672	2420.5225	2319.7953	2145.5018	1957.2826	1643.6873	1368.6140	1245.9541 (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	39.6625	39.7306	39.7976	40.1153	40.1753	40.4571	40.4571	40.5097	40.3481	40.1753	40.0541	39.9282		
alpha	3.6442	3.6487	3.6532	3.6744	3.6784	3.6971	3.6971	3.7006	3.6899	3.6784	3.6703	3.6619		
util living area	0.9925	0.9824	0.9617	0.9081	0.8044	0.6449	0.4947	0.5482	0.7724	0.9400	0.9852	0.9941	(86)	
MIT	18.9776	19.2821	19.6985	20.2180	20.6373	20.8865	20.9675	20.9526	20.7701	20.1990	19.4866	18.9255	(87)	
Th 2	20.0414	20.0429	20.0444	20.0512	20.0525	20.0585	20.0585	20.0596	20.0562	20.0525	20.0499	20.0472	(88)	
util rest of house	0.9909	0.9787	0.9535	0.8880	0.7619	0.5716	0.3981	0.4499	0.7097	0.9227	0.9815	0.9928	(89)	
MIT 2	17.6527	18.0413	18.5688	19.2167	19.7099	19.9753	20.0425	20.0343	19.8675	19.2063	18.3088	17.5898	(90)	
Living area fraction	17.7927	18.1724	18.6882	19.3225	19.8078	20.0716	20.1402	20.1313	19.9628	19.3112	18.4332	17.7310	(91)	
MIT	17.7927	18.1724	18.6882	19.3225	19.8078	20.0716	20.1402	20.1313	19.9628	19.3112	18.4332	17.7310	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.7927	18.1724	18.6882	19.3225	19.8078	20.0716	20.1402	20.1313	19.9628	19.3112	18.4332	17.7310	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	1311.3011	1625.4248	1836.8307	1960.0771	1827.5144	1386.3321	943.7138	982.2266	1375.3504	1487.6451	1330.6289	1231.0475	(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	3756.2501	3688.5760	3381.5535	2868.7607	2228.3356	1493.3243	966.2011	1017.0428	1604.4241	2394.1553	3124.2209	3741.8300	(97)	
Space heating kWh	1819.0421	1386.4376	1149.2738	654.2522	298.2110	0.0000	0.0000	0.0000	0.0000	674.4436	1291.3862	1868.0222	(98a)	
Space heating requirement - total per year (kWh/year)												9141.0686		
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	1819.0421	1386.4376	1149.2738	654.2522	298.2110	0.0000	0.0000	0.0000	0.0000	674.4436	1291.3862	1868.0222	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												9141.0686		
Space heating per m2										(98c) / (4) =		34.4946	(99)	

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													92.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	1819.0421	1386.4376	1149.2738	654.2522	298.2110	0.0000	0.0000	0.0000	0.0000	674.4436	1291.3862	1868.0222	(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)	1970.7931	1502.0993	1245.1504	708.8323	323.0888	0.0000	0.0000	0.0000	0.0000	730.7082	1399.1183	2023.8593	(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	269.3806	238.2437	253.4115	223.8523	217.6342	196.8262	194.9109	202.3370	204.1805	226.7851	239.9985	266.6049	(64)	
Efficiency of water heater (217)m	87.5267	87.3553	87.0268	86.3183	84.7666	79.8000	79.8000	79.8000	79.8000	86.3494	87.2577	87.5665	(216)	
Fuel for water heating, kWh/month	307.7696	272.7296	291.1879	259.3336	256.7453	246.6493	244.2492	253.5551	255.8653	262.6367	275.0457	304.4597	(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	7.3041	7.3041	7.0685	7.3041	(231)	
Lighting	46.1741	37.0425	33.3527	24.4356	18.8748	15.4209	17.2182	22.3809	29.0705	38.1421	43.0814	47.4574	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-106.3719	-141.6157	-192.2308	-203.5227	-209.1064	-191.2324	-188.4550	-182.5596	-171.2612	-155.2418	-113.7421	-92.9368	(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)	

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Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-88.3663	-181.7133	-353.9191	-521.5973	-680.5765	-680.8927	-673.2372	-574.4473	-426.7846	-256.8822	-116.9273	-70.2382 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1												9903.6497 (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												3230.2270 (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)												372.6511 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-6573.8582 (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												7018.6695 (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	9903.6497	0.2100	2079.7664	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3230.2270	0.2100	678.3477	(264)
Space and water heating			2758.1141	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	372.6511	0.1443	53.7851	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1948.2762	0.1359	-264.7578	
PV Unit electricity exported	-4625.5820	0.1265	-584.9097	
Total			-849.6674	(269)
Total CO2, kg/year			1974.1610	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.4500	(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	9903.6497	1.1300	11191.1241	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3230.2270	1.1300	3650.1565	(278)
Space and water heating			14841.2806	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	372.6511	1.5338	571.5847	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1948.2762	1.5023	-2926.9163	
PV Unit electricity exported	-4625.5820	0.4642	-2147.1300	
Total			-5074.0463	(283)
Total Primary energy kWh/year			10468.9197	(286)
Target Primary Energy Rate (TPER)			39.5100	(287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)	
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (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)

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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 * 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) = 0.0610 (8)
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered
Blower Door
Yes
5.0000 (17)
0.3110 (18)
2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2643 (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	0.3370	0.3304	0.3238	0.2908	0.2842	0.2511	0.2511	0.2445	0.2643	0.2842	0.2974	0.3106 (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	0.5568	0.5546	0.5524	0.5423	0.5404	0.5315	0.5315	0.5299	0.5349	0.5404	0.5442	0.5482 (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							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 137.0918		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 150.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E3 Sill	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160
E6 Intermediate floor within a dwelling	57.0000	0.0040	0.2280
E20 Exposed floor (normal)	6.5000	0.0460	0.2990
E10 Eaves (insulation at ceiling level)	44.5000	0.0820	3.6490
E12 Gable (insulation at ceiling level)	3.5000	0.0820	0.2870
E11 Eaves (insulation at rafter level)	9.0000	0.0750	0.6750
E16 Corner (normal)	48.5000	0.0540	2.6190

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal Bridges
Total fabric heat loss
(36a) = 16.5265 (36)
(33) + (36) + (36a) = 153.6183 (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	120.4989	120.0216	119.5537	117.3562	116.9451	115.0311	115.0311	114.6767	115.7683	116.9451	117.7768	118.6464 (38)
Heat transfer coeff	274.1171	273.6398	273.1720	270.9745	270.5633	268.6493	268.6493	268.2949	269.3866	270.5633	271.3951	272.2646 (39)
Average = Sum(39)m / 12 =												270.9725

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0344	1.0326	1.0308	1.0225	1.0210	1.0138	1.0138	1.0124	1.0166	1.0210	1.0241	1.0274 (40)
HLP (average)												1.0225
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0864 (42)

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

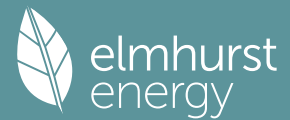
Hot water usage for baths 32.7924 32.3054 31.6196 30.3551 29.4082 28.3583 27.7912 28.4722 29.2137 30.3372 31.6277 32.6816 (42b)

Hot water usage for other uses 46.2381 44.5567 42.8754 41.1940 39.5126 37.8312 37.8312 39.5126 41.1940 42.8754 44.5567 46.2381 (42c)

Average daily hot water use (litres/day) 72.4384 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	79.0306	76.8622	74.4950	71.5491	68.9208	66.1895	65.6224	67.9848	70.4077	73.2125	76.1845	78.9197 (44)
Energy conte	125.1651	109.4507	114.4960	97.9471	92.7807	81.3877	79.3646	84.1794	86.8197	99.3487	108.5388	123.5692 (45)
Energy content (annual)										Total = Sum(45)m =		1203.0477
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss (or HIU loss):												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338 (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)

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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	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1022.5906	(64)
Electric shower(s)	60.8386	54.2077	59.1928	56.4869	57.5469	54.8941	56.7240	57.5469	56.4869	59.1928	58.0797	60.8386	(64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											692.0360	(64a)
Heat gains from water heating, kWh/month	41.8072	36.8102	39.1286	34.9355	34.1026	31.0184	31.0460	32.2748	32.5709	35.9098	37.5844	41.4681	(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	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	229.6330	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	(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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Water heating gains (Table 5)	56.1925	54.7771	52.5922	48.5215	45.8368	43.0812	41.7284	43.3802	45.2374	48.2659	52.2006	55.7367	(72)
Total internal gains	776.9773	803.8262	766.6064	746.0466	705.7893	682.0901	654.3897	651.5870	672.0767	691.5942	733.1016	757.5813	(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	
Northeast				11.0000			11.2829		0.6300		0.7000		0.7700	37.9303 (75)
Southeast				3.0000			36.7938		0.6300		0.7000		0.7700	33.7340 (77)
Southwest				30.0000			36.7938		0.6300		0.7000		0.7700	337.3402 (79)
Northwest				0.5000			11.2829		0.6300		0.7000		0.7700	1.7241 (81)
Southwest				1.5000			39.9751		0.6300		0.7000		1.0000	23.7992 (82)
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879	(83)	
Total gains	1211.5052	1560.3688	1843.6148	2148.0250	2335.8089	2326.0598	2228.6792	2052.1545	1861.2402	1539.1833	1256.5887	1127.4691	(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	40.2808	40.3511	40.4202	40.7480	40.8099	41.1007	41.1007	41.1550	40.9882	40.8099	40.6848	40.5549	
alpha	3.6854	3.6901	3.6947	3.7165	3.7207	3.7400	3.7400	3.7437	3.7325	3.7207	3.7123	3.7037	
util living area	0.9945	0.9859	0.9674	0.9171	0.8165	0.6574	0.5059	0.5622	0.7882	0.9490	0.9887	0.9958	(86)
MIT	18.9412	19.2490	19.6696	20.1985	20.6268	20.8832	20.9665	20.9505	20.7597	20.1710	19.4513	18.8893	(87)
Th 2	20.0548	20.0563	20.0577	20.0646	20.0659	20.0719	20.0719	20.0730	20.0696	20.0659	20.0633	20.0606	(88)
util rest of house	0.9933	0.9829	0.9603	0.8986	0.7756	0.5848	0.4090	0.4637	0.7276	0.9340	0.9858	0.9949	(89)
MIT 2	18.1533	18.4601	18.8766	19.3940	19.7891	20.0045	20.0589	20.0522	19.9139	19.3776	18.6680	18.1057	(90)
Living area fraction	18.2365	18.5435	18.9604	19.4790	19.8776	20.0974	20.1548	20.1471	20.0032	19.4614	18.7508	18.1885	(91)
MIT	18.2365	18.5435	18.9604	19.4790	19.8776	20.0974	20.1548	20.1471	20.0032	19.4614	18.7508	18.1885	(92)
Temperature adjustment	18.2365	18.5435	18.9604	19.4790	19.8776	20.0974	20.1548	20.1471	20.0032	19.4614	18.7508	18.1885	(93)

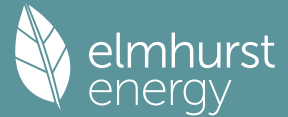
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9900	0.9763	0.9496	0.8847	0.7663	0.5870	0.4180	0.4720	0.7227	0.9215	0.9801	0.9922	(94)
Ext temp.	1199.4404	1523.4351	1750.6917	1900.2864	1789.9220	1365.3106	931.6295	968.6148	1345.1804	1418.3331	1231.6370	1118.6969	(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	3820.2469	3733.4016	3403.8393	2866.6446	2212.5515	1476.8678	954.9844	1005.3229	1590.2553	2397.5770	3161.9693	3808.5658	(97)
Space heating requirement - total per year (kWh/year)	1949.8801	1485.0975	1229.9419	695.7779	314.4363	0.0000	0.0000	0.0000	0.0000	728.5575	1389.8392	2001.2624	(98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating contribution - total per year (kWh/year)	1949.8801	1485.0975	1229.9419	695.7779	314.4363	0.0000	0.0000	0.0000	0.0000	728.5575	1389.8392	2001.2624	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1949.8801	1485.0975	1229.9419	695.7779	314.4363	0.0000	0.0000	0.0000	0.0000	728.5575	1389.8392	2001.2624	(99)
Space heating per m ²	(98c) / (4) =											36.9615	(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	2525.3039	1988.0052	2039.0413	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7991	0.8667	0.8313	0.0000	0.0000	0.0000	0.0000	(101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2017.9642	1723.0508	1695.1284	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2591.3686	2482.6836	2283.0948	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	412.8512	565.1668	437.4470	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	103.2128	141.2917	109.3617	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												353.8662	(107)
Energy for space heating												36.9615	(99)
Energy for space cooling												1.3353	(108)
Total												38.2968	(109)
Fabric Energy Efficiency (DFEE)												38.3	(109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

2. Ventilation rate

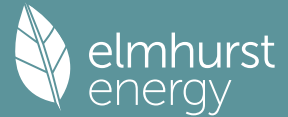
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0610 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3110	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2643 (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	0.3370	0.3304	0.3238	0.2908	0.2842	0.2511	0.2511	0.2445	0.2643	0.2842	0.2974	0.3106 (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	0.5568	0.5546	0.5524	0.5423	0.5404	0.5315	0.5315	0.5299	0.5349	0.5404	0.5442	0.5482 (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							
TER Opaque door			2.0000	1.0000	2.0000		(26)
TER Semi-glazed door			4.0000	1.0000	4.0000		(26a)
TER Opening Type			44.5000	1.1450	50.9542		(27)
TER Roof Window			1.5000	1.1450	2.1226		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1300	1.2350		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.1800	20.1600		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1800	19.5300		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1100	0.9900		(30)
Total net area of external elements Aum(A, m ²)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	133.2418		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				26.0000	0.0500	1.3000	
E2 Other lintels (including other steel lintels)				13.0000	0.0500	0.6500	
E3 Sill				11.5000	0.0500	0.5750	
E3 Sill				4.5000	0.0500	0.2250	
E4 Jamb				49.0000	0.0500	2.4500	
E4 Jamb				22.5000	0.0500	1.1250	
E5 Ground floor (normal)				54.0000	0.1600	8.6400	
E6 Intermediate floor within a dwelling				57.0000	0.0000	0.0000	
E20 Exposed floor (normal)				6.5000	0.3200	2.0800	
E10 Eaves (insulation at ceiling level)				44.5000	0.0600	2.6700	

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E12 Gable (insulation at ceiling level)	3.5000	0.0600	0.2100
E11 Eaves (insulation at rafter level)	9.0000	0.0400	0.3600
E16 Corner (normal)	48.5000	0.0900	4.3650
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			24.6500 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	157.8918 (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	120.4989	120.0216	119.5537	117.3562	116.9451	115.0311	115.0311	114.6767	115.7683	116.9451	117.7768	118.6464 (38)
Heat transfer coeff	278.3907	277.9134	277.4456	275.2480	274.8369	272.9229	272.9229	272.5685	273.6602	274.8369	275.6686	276.5382 (39)
Average = Sum(39)m / 12 =												275.2461
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0505	1.0487	1.0470	1.0387	1.0371	1.0299	1.0299	1.0286	1.0327	1.0371	1.0403	1.0435 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0864 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												32.3054 (42b)
Hot water usage for other uses												46.2381 (42c)
Average daily hot water use (litres/day)												72.4384 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	79.0306	76.8622	74.4950	71.5491	68.9208	66.1895	65.6224	67.9848	70.4077	73.2125	76.1845	78.9197 (44)
Energy content (annual)	125.1651	109.4507	114.4960	97.9471	92.7807	81.3877	79.3646	84.1794	86.8197	99.3487	108.5388	123.5692 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1203.0477
Water storage loss (or HIU 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	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338 (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	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 1022.5906 (64)
Electric shower(s)												1023 (64)
Heat gains from water heating, kWh/month												
	60.8386	54.2077	59.1928	56.4869	57.5469	54.8941	56.7240	57.5469	56.4869	59.1928	58.0797	60.8386 (64a)
	41.8072	36.8102	39.1286	34.9355	34.1026	31.0184	31.0460	32.2748	32.5709	35.9098	37.5844	41.4681 (65)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 692.0360 (64a)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	229.6330	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227 (68)
Pumps, fans	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Total internal gains	56.1925	54.7771	52.5922	48.5215	45.8368	43.0812	41.7284	43.3802	45.2374	48.2659	52.2006	55.7367 (72)
	776.9773	803.8262	766.6064	746.0466	705.7893	682.0901	654.3897	651.5870	672.0767	691.5942	733.1016	757.5813 (73)

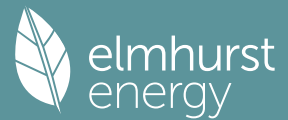
6. Solar gains

[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			
Northeast				11.0000	11.2829	0.6300	0.7000	0.7700	37.9303 (75)			
Southeast				3.0000	36.7938	0.6300	0.7000	0.7700	33.7340 (77)			
Southwest				30.0000	36.7938	0.6300	0.7000	0.7700	337.3402 (79)			
Northwest				0.5000	11.2829	0.6300	0.7000	0.7700	1.7241 (81)			
Southwest				1.5000	39.9751	0.6300	0.7000	1.0000	23.7992 (82)			
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1211.5052	1560.3688	1843.6148	2148.0250	2335.8089	2326.0598	2228.6792	2052.1545	1861.2402	1539.1833	1256.5887	1127.4691 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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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	39.6625	39.7306	39.7976	40.1153	40.1753	40.4571	40.4571	40.5097	40.3481	40.1753	40.0541	39.9282
alpha	3.6442	3.6487	3.6532	3.6744	3.6784	3.6971	3.6971	3.7006	3.6899	3.6784	3.6703	3.6619
util living area	0.9945	0.9859	0.9678	0.9187	0.8202	0.6632	0.5121	0.5684	0.7924	0.9499	0.9887	0.9958 (86)
MIT	18.9069	19.2150	19.6383	20.1726	20.6095	20.8753	20.9636	20.9466	20.7476	20.1484	19.4220	18.8549 (87)
Th 2	20.0414	20.0429	20.0444	20.0512	20.0525	20.0585	20.0585	20.0596	20.0562	20.0525	20.0499	20.0472 (88)
util rest of house	0.9933	0.9830	0.9608	0.9003	0.7794	0.5899	0.4132	0.4682	0.7318	0.9350	0.9859	0.9948 (89)
MIT 2	18.1097	18.4168	18.8360	19.3590	19.7627	19.9866	20.0444	20.0371	19.8926	19.3457	18.6294	18.0619 (90)
Living area fraction									FLA = Living area /	(4) =		0.1057 (91)
MIT	18.1939	18.5011	18.9208	19.4450	19.8522	20.0805	20.1415	20.1332	19.9829	19.4305	18.7131	18.1457 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1939	18.5011	18.9208	19.4450	19.8522	20.0805	20.1415	20.1332	19.9829	19.4305	18.7131	18.1457 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9900	0.9763	0.9500	0.8861	0.7696	0.5917	0.4223	0.4765	0.7264	0.9223	0.9801	0.9921 (94)
Useful gains	1199.3459	1523.4598	1751.3498	1903.3844	1797.5945	1376.3979	941.1123	977.8328	1352.0167	1419.5165	1231.6074	1118.6067 (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	3867.9370	3779.9371	3446.0956	2902.4817	2240.5236	1495.7531	966.5541	1017.5593	1609.9160	2426.9546	3201.3725	3856.5216 (97)
Space heating kWh	1985.4318	1516.3527	1260.8909	719.3501	329.5392	0.0000	0.0000	0.0000	0.0000	749.5339	1418.2308	2037.0087 (98a)
Space heating requirement - total per year (kWh/year)												10016.3380
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	1985.4318	1516.3527	1260.8909	719.3501	329.5392	0.0000	0.0000	0.0000	0.0000	749.5339	1418.2308	2037.0087 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10016.3380
Space heating per m2										(98c) / (4) =		37.7975 (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	2565.4756	2019.6297	2071.5206	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7910	0.8599	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2029.3904	1736.7483	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2591.3686	2482.6836	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	404.6244	554.9759	429.0257	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	101.1561	138.7440	107.2564	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												347.1565 (107)
Energy for space heating												37.7975 (99)
Energy for space cooling												1.3100 (108)
Total												39.1075 (109)
Fabric Energy Efficiency (TFEE)												39.1 (109)

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

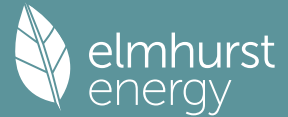
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1067 (8)
Pressure test	Yes
Pressure Test Method	Blower Door

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Measured/design AP50												5.0000 (17)
Infiltration rate												0.3567 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3032 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.3866	0.3790	0.3715	0.3336	0.3260	0.2881	0.2881	0.2805	0.3032	0.3260	0.3411	0.3563 (22b)
	0.5747	0.5718	0.5690	0.5556	0.5531	0.5415	0.5415	0.5393	0.5460	0.5531	0.5582	0.5635 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 137.0918		(33)

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

150.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E3 Sill	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160
E6 Intermediate floor within a dwelling	57.0000	0.0040	0.2280
E20 Exposed floor (normal)	6.5000	0.0460	0.2990
E10 Eaves (insulation at ceiling level)	44.5000	0.0820	3.6490
E12 Gable (insulation at ceiling level)	3.5000	0.0820	0.2870
E11 Eaves (insulation at rafter level)	9.0000	0.0750	0.6750
E16 Corner (normal)	48.5000	0.0540	2.6190

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

16.5265 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 153.6183 (37)

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

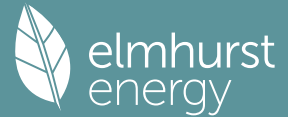
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	124.3810	123.7529	123.1373	120.2458	119.7048	117.1863	117.1863	116.7199	118.1564	119.7048	120.7992	121.9434 (38)
Average = Sum(39)m / 12 =	277.9992	277.3712	276.7556	273.8640	273.3230	270.8046	270.8046	270.3382	271.7746	273.3230	274.4175	275.5616 (39)
												273.8614

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0491	1.0467	1.0444	1.0334	1.0314	1.0219	1.0219	1.0201	1.0256	1.0314	1.0355	1.0399 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0864 (42)
Hot water usage for mixer showers													
85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379	85.1379 (42a)	
Hot water usage for baths													
32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	32.6816 (42b)	
Hot water usage for other uses													
46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	46.2381 (42c)	
Average daily hot water use (litres/day)													151.2346 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576	(44)
Distribution loss (46)m = 0.15 x (45)m	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745	(45)
Water storage loss (or HIU loss):													
Store volume	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312	(46)
a) If manufacturer declared loss factor is known (kWh/day):													300.0000 (47)
Temperature factor from Table 2b													2.0000 (48)
Enter (49) or (54) in (55)													0.5400 (49)
Total storage loss													1.0800 (55)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
Primary loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
WWHRS	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Electric shower(s)	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
													3180.0886 (64)

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Heat gains from water heating, kWh/month
132.0172 117.2509 125.5272 112.3323 110.3002 100.8936 100.5203 103.5702 103.6940 113.8561 118.9476 130.8047 (65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	(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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Water heating gains (Table 5)	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128	(72)
Total internal gains	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g Specific data or Table 6c	FF Access factor Table 6d	Gains W
Northeast	11.0000	11.2829	0.6300	0.7000	0.7700	37.9303 (75)
Southeast	3.0000	36.7938	0.6300	0.7000	0.7700	33.7340 (77)
Southwest	30.0000	36.7938	0.6300	0.7000	0.7700	337.3402 (79)
Northwest	0.5000	11.2829	0.6300	0.7000	0.7700	1.7241 (81)
Southwest	1.5000	39.9751	0.6300	0.7000	1.0000	23.7992 (82)

Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879	(83)
Total gains	1424.9695	1744.6358	2033.6341	2300.7638	2468.5659	2428.6416	2327.1705	2156.9343	1976.0487	1688.6253	1429.1708	1331.9309	(84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.7183	39.8083	39.8968	40.3181	40.3979	40.7736	40.7736	40.8439	40.6280	40.3979	40.2368	40.0697	
alpha	3.6479	3.6539	3.6598	3.6879	3.6932	3.7182	3.7182	3.7229	3.7085	3.6932	3.6825	3.6713	
util living area	0.9906	0.9801	0.9572	0.9028	0.7983	0.6404	0.4904	0.5426	0.7665	0.9350	0.9830	0.9926	(86)
MIT	19.4423	19.6583	19.9724	20.3502	20.6548	20.8354	20.8939	20.8835	20.7514	20.3376	19.8136	19.4042	(87)
Th 2	20.0427	20.0446	20.0465	20.0556	20.0572	20.0651	20.0651	20.0666	20.0621	20.0572	20.0538	20.0503	(88)
util rest of house	0.9887	0.9760	0.9482	0.8820	0.7554	0.5676	0.3949	0.4455	0.7035	0.9168	0.9788	0.9911	(89)
MIT 2	18.1980	18.4740	18.8718	19.3455	19.7035	19.8989	19.9473	19.9424	19.8199	19.3406	18.6804	18.1549	(90)
Living area fraction	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869	(91)
MIT	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9837	0.9677	0.9355	0.8660	0.7424	0.5620	0.3930	0.4427	0.6926	0.9016	0.9712	0.9870	(94)
Useful gains	1401.7829	1688.2263	1902.3697	1992.5512	1832.5983	1364.8084	914.5625	954.9242	1368.5581	1522.5333	1387.9841	1314.5771	(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	3900.1783	3799.7395	3456.1544	2889.7240	2215.0093	1461.7622	933.5439	984.5193	1581.2715	2417.7886	3210.7204	3881.8129	(97)
Space heating kWh	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98a)
Space heating requirement - total per year (kWh/year)												9252.7005	
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	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9252.7005	
Space heating per m ²										(98c) / (4) =		34.9159	(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 %)													219.3000 (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	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	847.6088	647.0300	527.1390	294.5574	129.7372	0.0000	0.0000	0.0000	0.0000	303.7255	598.4360	870.9637	(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)

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
Efficiency of water heater	(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148	(217)
Space cooling fuel requirement	(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4219.1977	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1670.2146	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												381.2835	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												6270.6958	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4219.1977	16.4900	695.7457 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	16.4900	275.4184 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	381.2835	16.4900	62.8736 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1034.0377 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2008 (257)
SAP value		80.5347
SAP rating (Section 12)		81 (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	4219.1977	0.1553	655.2219 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			890.6823 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Total CO2, kg/year			945.7133 (272)
CO2 emissions per m2			3.5700 (273)
EI value			95.9121
EI rating			96 (274)
EI band			A

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1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

2. Ventilation rate

m3 per hour												
Number of open chimneys	0 * 80 =	0.0000	(6a)									
Number of open flues	0 * 20 =	0.0000	(6b)									
Number of chimneys / flues attached to closed fire	1 * 10 =	10.0000	(6c)									
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)									
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)									
Number of blocked chimneys	0 * 20 =	0.0000	(6f)									
Number of intermittent extract fans	6 * 10 =	60.0000	(7a)									
Number of passive vents	0 * 10 =	0.0000	(7b)									
Number of flueless gas fires	0 * 40 =	0.0000	(7c)									
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) =	0.1067	(8)									
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	5.0000	(17)										
Infiltration rate	0.3567	(18)										
Number of sides sheltered	2	(19)										
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)									
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3032	(21)									
Wind speed	Jan 3.9000	Feb 3.5000	Mar 3.5000	Apr 3.4000	May 3.4000	Jun 3.1000	Jul 3.2000	Aug 3.0000	Sep 2.9000	Oct 3.1000	Nov 3.0000	Dec 3.3000 (22)
Wind factor	0.9750	0.8750	0.8750	0.8500	0.8500	0.7750	0.8000	0.7500	0.7250	0.7750	0.7500	0.8250 (22a)
Adj infiltr rate	0.2956	0.2653	0.2653	0.2577	0.2577	0.2350	0.2426	0.2274	0.2198	0.2350	0.2274	0.2502 (22b)
Effective ac	0.5437	0.5352	0.5352	0.5332	0.5332	0.5276	0.5294	0.5259	0.5242	0.5276	0.5259	0.5313 (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							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	137.0918	(33)

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

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E3 Sill	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160
E6 Intermediate floor within a dwelling	57.0000	0.0040	0.2280
E20 Exposed floor (normal)	6.5000	0.0460	0.2990
E10 Eaves (insulation at ceiling level)	44.5000	0.0820	3.6490
E12 Gable (insulation at ceiling level)	3.5000	0.0820	0.2870
E11 Eaves (insulation at rafter level)	9.0000	0.0750	0.6750
E16 Corner (normal)	48.5000	0.0540	2.6190
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.5265 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 153.6183 (37)

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

(38)m	Jan 117.6651	Feb 115.8245	Mar 115.8245	Apr 115.3954	May 115.3954	Jun 114.1829	Jul 114.5746	Aug 113.8035	Sep 113.4366	Oct 114.1829	Nov 113.8035	Dec 114.9788 (38)
Heat transfer coeff	271.2834	269.4428	269.4428	269.0137	269.0137	267.8011	268.1929	267.4218	267.0549	267.8011	267.4218	268.5971 (39)
Average = Sum(39)m / 12 =												268.5406
HLP	Jan 1.0237	Feb 1.0168	Mar 1.0168	Apr 1.0151	May 1.0151	Jun 1.0106	Jul 1.0120	Aug 1.0091	Sep 1.0078	Oct 1.0106	Nov 1.0091	Dec 1.0136 (40)
HLP (average)												1.0134
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0864 (42)
Hot water usage for mixer showers	85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379 (42a)

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Hot water usage for baths	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816 (42b)
Hot water usage for other uses	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381 (42c)
Average daily hot water use (litres/day)												151.2346 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576 (44)
Energy content (annual)	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745 (45)
Distribution loss (46)m = 0.15 x (45)m	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047 (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	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050 (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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Water heating gains (Table 5)	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128 (72)
Total internal gains	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430 (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
Northeast	11.0000	14.6130	0.6300	0.7000	0.7700	49.1253 (75)
Southeast	3.0000	45.0642	0.6300	0.7000	0.7700	41.3166 (77)
Southwest	30.0000	45.0642	0.6300	0.7000	0.7700	413.1660 (79)
Northwest	0.5000	14.6130	0.6300	0.7000	0.7700	2.2330 (81)
Southwest	1.5000	50.1759	0.6300	0.7000	1.0000	29.8722 (82)

Solar gains	535.7130	795.0814	1135.4145	1529.9207	1730.0072	1893.4468	1783.8811	1589.2775	1340.1542	962.3448	628.5378	448.1700 (83)
Total gains	1526.1547	1783.1746	2092.0403	2428.7062	2568.5535	2678.1187	2536.7621	2345.6442	2127.0393	1803.3810	1534.2216	1410.2131 (84)

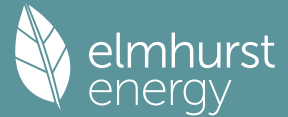
7. Mean internal temperature (heating season)

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	40.7016	40.9796	40.9796	41.0450	41.0450	41.2308	41.1706	41.2893	41.3461	41.2308	41.2893	41.1087
alpha	3.7134	3.7320	3.7320	3.7363	3.7363	3.7487	3.7447	3.7526	3.7564	3.7487	3.7526	3.7406
util living area	0.9863	0.9761	0.9453	0.8699	0.7357	0.5300	0.3840	0.4121	0.6817	0.9004	0.9735	0.9893 (86)
MIT	19.6276	19.7845	20.1166	20.4784	20.7471	20.8808	20.9093	20.9073	20.8231	20.4937	20.0037	19.5936 (87)
Th 2	20.0636	20.0694	20.0694	20.0707	20.0707	20.0745	20.0733	20.0757	20.0769	20.0745	20.0757	20.0720 (88)
util rest of house	0.9833	0.9712	0.9338	0.8430	0.6834	0.4526	0.2911	0.3136	0.6071	0.8729	0.9669	0.9870 (89)
MIT 2	18.4496	18.6525	19.0696	19.5105	19.8146	19.9456	19.9645	19.9662	19.9017	19.5420	18.9375	18.4127 (90)
Living area fraction									fLA = Living area / (4) =			0.1057 (91)
MIT	18.5741	18.7721	19.1802	19.6128	19.9131	20.0444	20.0643	20.0657	19.9991	19.6425	19.0502	18.5375 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5741	18.7721	19.1802	19.6128	19.9131	20.0444	20.0643	20.0657	19.9991	19.6425	19.0502	18.5375 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9769	0.9621	0.9200	0.8276	0.6736	0.4500	0.2902	0.3125	0.6002	0.8572	0.9570	0.9817 (94)

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Useful gains	1490.8836	1715.5034	1924.6483	2010.1013	1730.2584	1205.1814	736.1114	732.9159	1276.6206	1545.7860	1468.2608	1384.3595 (95)
Ext temp.	5.1000	5.4000	7.2000	9.6000	12.6000	15.4000	17.3000	17.3000	14.8000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	3655.2960	3603.0107	3227.9852	2693.5747	1967.3249	1243.7673	741.3665	739.6031	1388.4397	2180.5768	2955.0571	3609.2666 (97)
Space heating kWh	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98a)
Space heating requirement - total per year (kWh/year)												7714.9972
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	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7714.9972
Space heating per m2											(98c) / (4) =	29.1132 (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 %)												219.3000 (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	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	734.3013	578.3880	442.1717	224.3962	80.4275	0.0000	0.0000	0.0000	0.0000	215.3600	488.1411	754.8248 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Efficiency of water heater												
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3518.0106 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												1670.2146 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												381.2835 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												5569.5087 (238)

10a. Fuel costs - using BEDF prices (587)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3518.0106	28.4300	1000.1704 (240)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1670.2146	28.4300	474.8420 (247)	
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)	
Energy for lighting	381.2835	28.4300	108.3989 (250)	
Additional standing charges			0.0000 (251)	
Total energy cost			1583.4113 (255)	

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

Energy	Emission factor	Emissions
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	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3518.0106	0.1559	548.6253 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			784.0856 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Total CO2, kg/year			839.1166 (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	3518.0106	1.5774	5549.1341 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	1.5213	2540.8682 (278)
Space and water heating			8090.0023 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	381.2835	1.5338	584.8253 (282)
Total Primary energy kWh/year			8674.8276 (286)

SAP 10 EPC IMPROVEMENTS

DJ1002 (Be Lean)

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating			SAP increase too small
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Recommended
Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 3.2	-£ 323	-152 kg (18.2%)
V2 Wind turbine	+ 7.8	-£ 712	-347 kg (50.6%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 101	-44 kg (5.3%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar photovoltaic panels	£323	0.58 kg/m²	B 84 A 97
Wind turbine	£712	1.31 kg/m²	A 92 A 98
Total Savings	£1035	1.89 kg/m²	

Potential energy efficiency rating: A 92
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 587 TEST (28 Nov 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £1583	Potential £1583	£0 Saving
Electricity			
Space heating	£1000	£1000	£0
Water heating	£475	£475	£0
Lighting	£108	£108	£0
Generated (PV)	-£0	-£323	£323
Generated (wind)	-£0	-£712	£712
Total cost of fuels	£1583	£548	£1035
Total cost of uses	£1583	£548	£1035
Delivered energy	21 kWh/m²	7 kWh/m²	14 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.3 tonnes	0.5 tonnes
CO2 emissions per m²	3 kg/m²	1 kg/m²	2 kg/m²
Primary energy	33 kWh/m²	12 kWh/m²	21 kWh/m²

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

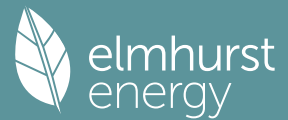
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (5)

2. Ventilation rate

m3 per hour

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Number of open chimneys 0 * 80 = 0.0000 (6a)
Number of open flues 0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire 1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler 0 * 20 = 0.0000 (6d)
Number of flues attached to other heater 0 * 35 = 0.0000 (6e)
Number of blocked chimneys 0 * 20 = 0.0000 (6f)
Number of intermittent extract fans 6 * 10 = 60.0000 (7a)
Number of passive vents 0 * 10 = 0.0000 (7b)
Number of flueless gas fires 0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 70.0000 / (5) = 0.1067 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3567 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3032 (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												
	0.3866	0.3790	0.3715	0.3336	0.3260	0.2881	0.2881	0.2805	0.3032	0.3260	0.3411	0.3563 (22b)
Effective ac	0.5747	0.5718	0.5690	0.5556	0.5531	0.5415	0.5415	0.5393	0.5460	0.5531	0.5582	0.5635 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30a)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 137.0918		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 150.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E3 Sill	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160
E6 Intermediate floor within a dwelling	57.0000	0.0040	0.2280
E20 Exposed floor (normal)	6.5000	0.0460	0.2990
E10 Eaves (insulation at ceiling level)	44.5000	0.0820	3.6490
E12 Gable (insulation at ceiling level)	3.5000	0.0820	0.2870
E11 Eaves (insulation at rafter level)	9.0000	0.0750	0.6750
E16 Corner (normal)	48.5000	0.0540	2.6190

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.5265 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 153.6183 (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	124.3810	123.7529	123.1373	120.2458	119.7048	117.1863	117.1863	116.7199	118.1564	119.7048	120.7992	121.9434 (38)
Heat transfer coeff	277.9992	277.3712	276.7556	273.8640	273.3230	270.8046	270.8046	270.3382	271.7746	273.3230	274.4175	275.5616 (39)
Average = Sum(39)m / 12 =												273.8614

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0491	1.0467	1.0444	1.0334	1.0314	1.0219	1.0219	1.0201	1.0256	1.0314	1.0355	1.0399 (40)
HLP (average)												1.0334
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0864 (42)
Hot water usage for mixer showers 85.4653 84.1809 82.3093 78.7284 76.0857 73.1387 71.4636 73.3210 75.3571 78.5213 82.1792 85.1379 (42a)
Hot water usage for baths 32.7924 32.3054 31.6196 30.3551 29.4082 28.3583 27.7912 28.4722 29.2137 30.3372 31.6277 32.6816 (42b)
Hot water usage for other uses 46.2381 44.5567 42.8754 41.1940 39.5126 37.8312 37.8312 39.5126 41.1940 42.8754 44.5567 46.2381 (42c)
Average daily hot water use (litres/day) 151.2346 (43)
Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Energy conte 164.4959 161.0431 156.8043 150.2775 145.0066 139.3282 137.0860 141.3058 145.7648 151.7339 158.3637 164.0576 (44)
Energy content (annual) 260.5213 229.3233 241.0024 205.7223 195.2067 171.3203 165.7936 174.9661 179.7426 205.9014 225.6181 256.8745 (45)
Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 2511.9926
Water storage loss (or HIU loss): 39.0782 34.3985 36.1504 30.8584 29.2810 25.6980 24.8690 26.2449 26.9614 30.8852 33.8427 38.5312 (46)
Store volume 300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.0000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0800 (55)
Total storage loss 33.4800 30.2400 33.4800 32.4000 33.4800 32.4000 33.4800 33.4800 32.4000 33.4800 32.4000 33.4800 (56)

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If cylinder contains dedicated solar storage												
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Total per year (kWh/year) = Sum(64)m =												3180.0886 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047 (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	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050 (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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Water heating gains (Table 5)	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128 (72)
Total internal gains	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430 (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
Northeast				11.0000	11.2829		0.6300		0.7000		0.7700		37.9303 (75)
Southeast				3.0000	36.7938		0.6300		0.7000		0.7700		33.7340 (77)
Southwest				30.0000	36.7938		0.6300		0.7000		0.7700		337.3402 (79)
Northwest				0.5000	11.2829		0.6300		0.7000		0.7700		1.7241 (81)
Southwest				1.5000	39.9751		0.6300		0.7000		1.0000		23.7992 (82)
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879	(83)
Total gains	1424.9695	1744.6358	2033.6341	2300.7638	2468.5659	2428.6416	2327.1705	2156.9343	1976.0487	1688.6253	1429.1708	1331.9309	(84)

7. Mean internal temperature (heating season)

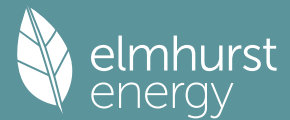
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.7183	39.8083	39.8968	40.3181	40.3979	40.7736	40.7736	40.8439	40.6280	40.3979	40.2368	40.0697
alpha	3.6479	3.6539	3.6598	3.6879	3.6932	3.7182	3.7182	3.7229	3.7085	3.6932	3.6825	3.6713
util living area	0.9906	0.9801	0.9572	0.9028	0.7983	0.6404	0.4904	0.5426	0.7665	0.9350	0.9830	0.9926 (86)
MIT	19.4423	19.6583	19.9724	20.3502	20.6548	20.8354	20.8939	20.8835	20.7514	20.3376	19.8136	19.4042 (87)
Th 2	20.0427	20.0446	20.0465	20.0556	20.0572	20.0651	20.0651	20.0666	20.0621	20.0572	20.0538	20.0503 (88)
util rest of house	0.9887	0.9760	0.9482	0.8820	0.7554	0.5676	0.3949	0.4455	0.7035	0.9168	0.9788	0.9911 (89)
MIT 2	18.1980	18.4740	18.8718	19.3455	19.7035	19.8989	19.9473	19.9424	19.8199	19.3406	18.6804	18.1549 (90)
Living area fraction	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869 (92)
MIT	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9837	0.9677	0.9355	0.8660	0.7424	0.5620	0.3930	0.4427	0.6926	0.9016	0.9712	0.9870 (94)
Useful gains	1401.7829	1688.2263	1902.3697	1992.5512	1832.5983	1364.8084	914.5625	954.9242	1368.5581	1522.5333	1387.9841	1314.5771 (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	3900.1783	3799.7395	3456.1544	2889.7240	2215.0093	1461.7622	933.5439	984.5193	1581.2715	2417.7886	3210.7204	3881.8129 (97)
Space heating kWh	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234 (98a)
Space heating requirement - total per year (kWh/year)												9252.7005
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	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9252.7005
Space heating per m ²												34.9159 (99)

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

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Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	219.3000	(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	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	847.6088	647.0300	527.1390	294.5574	129.7372	0.0000	0.0000	0.0000	0.0000	303.7255	598.4360	870.9637	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.9453	-64.8155	-100.8408	-119.9429	-131.3185	-117.3179	-115.6504	-106.0870	-89.9128	-75.4726	-47.7074	-35.6503	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4219.1977	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1670.2146	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	381.2835	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1046.6615	(233)
Wind generation	-3575.5408	(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	2721.1557	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4219.1977	16.4900	695.7457	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1670.2146	16.4900	275.4184	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	381.2835	16.4900	62.8736	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1046.6615	16.4900	-172.5945	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-172.5945	(252)
Wind Turbine electricity used in dwelling	-2502.8785	16.4900	-412.7247	
Wind Turbine electricity exported	0.0000	5.5900	0.0000	
Total			-412.7247	(252)
Total energy cost			448.7186	(255)

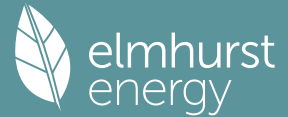
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.5211	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	91.5531	
SAP rating (Section 12)		92	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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Full SAP Calculation Printout



Space heating - main system 1	4219.1977	0.1553	655.2219 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			890.6823 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1046.6615	0.1339	-140.1676
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-140.1676 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-347.1801 (269)
Total CO2, kg/year			458.3656 (272)
CO2 emissions per m2			1.7300 (273)
EI value			98.0187
EI rating			98 (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	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1067 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3567 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3032 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.9000	3.5000	3.5000	3.4000	3.4000	3.1000	3.2000	3.0000	2.9000	3.1000	3.0000	3.3000 (22)
Wind factor	0.9750	0.8750	0.8750	0.8500	0.8500	0.7750	0.8000	0.7500	0.7250	0.7750	0.7500	0.8250 (22a)
Adj infilt rate	0.2956	0.2653	0.2653	0.2577	0.2577	0.2350	0.2426	0.2274	0.2198	0.2350	0.2274	0.2502 (22b)
Effective ac	0.5437	0.5352	0.5352	0.5332	0.5332	0.5276	0.5294	0.5259	0.5242	0.5276	0.5259	0.5313 (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							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.0918		(33)

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

List of Thermal Bridges

150.0000 (35)

	Length	Psi-value	Total
K1 Element	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E2 Other lintels (including other steel lintels)	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160

Ventilation heat loss calculated monthly (39)m = 0.33 x (25)m x (5)													
(38)m	Jan 117.6651	Feb 115.8245	Mar 115.8245	Apr 115.3954	May 115.3954	Jun 114.1829	Jul 114.5746	Aug 113.8035	Sep 113.4366	Oct 114.1829	Nov 113.8035	Dec 114.9788	(38)
Heat transfer coeff	271.2834	269.4428	269.4428	269.0137	269.0137	267.8011	268.1929	267.4218	267.0549	267.8011	267.4218	268.5971	(39)
Average = Sum(39)m / 12 =												268.5406	
HLP	Jan 1.0237	Feb 1.0168	Mar 1.0168	Apr 1.0151	May 1.0151	Jun 1.0106	Jul 1.0120	Aug 1.0091	Sep 1.0078	Oct 1.0106	Nov 1.0091	Dec 1.0136	(40)
HLP (average)												1.0134	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

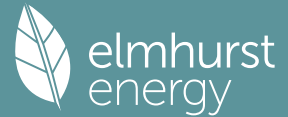
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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576 (44)
Energy content (annual)	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745 (45)
Distribution loss	(46)m = 0.15 x (45)m											
Water storage loss (or HIU loss):	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312 (46)
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Electric shower(s)	Total per year (kWh/year) = Sum(64)m =											3180.0886 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047 (65)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	(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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Water heating gains (Table 5)	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128	(72)
Total internal gains	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430	(73)

[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
Northeast					11.0000	14.6130		0.6300	0.7000	0.7700		49.1253 (75)
Southeast					3.0000	45.0642		0.6300	0.7000	0.7700		41.3166 (77)
Southwest					30.0000	45.0642		0.6300	0.7000	0.7700		413.1660 (79)
Northwest					0.5000	14.6130		0.6300	0.7000	0.7700		2.2330 (81)
Southwest					1.5000	50.1759		0.6300	0.7000	1.0000		29.8722 (82)
Solar gains	535.7130	795.0814	1135.4145	1529.9207	1730.0072	1893.4468	1783.8811	1589.2775	1340.1542	962.3448	628.5378	448.1700 (83)
Total gains	1526.1547	1783.1746	2092.0403	2428.7062	2568.5535	2678.1187	2536.7621	2345.6442	2127.0393	1803.3810	1534.2216	1410.2131 (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	40.7016	40.9796	40.9796	41.0450	41.0450	41.2308	41.1706	41.2893	41.3461	41.2308	41.2893	41.1087
alpha	3.7134	3.7320	3.7320	3.7363	3.7363	3.7487	3.7447	3.7526	3.7564	3.7487	3.7526	3.7406
util living area	0.9863	0.9761	0.9453	0.8699	0.7357	0.5300	0.3840	0.4121	0.6817	0.9004	0.9735	0.9893 (86)
MIT	19.6276	19.7845	20.1166	20.4784	20.7471	20.8808	20.9093	20.9073	20.8231	20.4937	20.0037	19.5936 (87)
Th 2	20.0636	20.0694	20.0694	20.0707	20.0707	20.0745	20.0733	20.0757	20.0769	20.0745	20.0757	20.0720 (88)
util rest of house	0.9833	0.9712	0.9338	0.8430	0.6834	0.4526	0.2911	0.3136	0.6071	0.8729	0.9669	0.9870 (89)
MIT 2	18.4496	18.6525	19.0696	19.5105	19.8146	19.9456	19.9645	19.9662	19.9017	19.5420	18.9375	18.4127 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.5741	18.7721	19.1802	19.6128	19.9131	20.0444	20.0643	20.0657	19.9991	19.6425	19.0502	18.5375 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5741	18.7721	19.1802	19.6128	19.9131	20.0444	20.0643	20.0657	19.9991	19.6425	19.0502	18.5375 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9769	0.9621	0.9200	0.8276	0.6736	0.4500	0.2902	0.3125	0.6002	0.8572	0.9570	0.9817 (94)
Useful gains	1490.8836	1715.5034	1924.6483	2010.1013	1730.2584	1205.1814	736.1114	732.9159	1276.6206	1545.7860	1468.2608	1384.3595 (95)
Ext temp.	5.1000	5.4000	7.2000	9.6000	12.6000	15.4000	17.3000	17.3000	14.8000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	3655.2960	3603.0107	3227.9852	2693.5747	1967.3249	1243.7673	741.3665	739.6031	1388.4397	2180.5768	2955.0571	3609.2666 (97)
Space heating kWh	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98a)
Space heating requirement - total per year (kWh/year)												7714.9972
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	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7714.9972
Space heating per m2										(98c) / (4) =		29.1132 (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 %)

219.3000 (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	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	734.3013	578.3880	442.1717	224.3962	80.4275	0.0000	0.0000	0.0000	0.0000	215.3600	488.1411	754.8248 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-51.1804	-68.2970	-105.2708	-126.4769	-134.2588	-128.6340	-125.5742	-115.9811	-98.8059	-83.2508	-56.3485	-42.9191 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3518.0106 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												1670.2146 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												381.2835 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1136.9973 (233)

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Wind generation	-3575.5408 (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	1929.6328 (238)

10a. Fuel costs - using BEDF prices (587)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3518.0106	28.4300	1000.1704 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	28.4300	474.8420 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	381.2835	28.4300	108.3989 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1136.9973	28.4300	-323.2483
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-323.2483 (252)
Wind Turbine electricity used in dwelling	-2502.8785	28.4300	-711.5684
Wind Turbine electricity exported	0.0000	5.8100	0.0000
Total			-711.5684 (252)
Total energy cost			548.5946 (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	3518.0106	0.1559	548.6253 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			784.0856 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1136.9973	0.1341	-152.4303
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-152.4303 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-347.1801 (269)
Total CO2, kg/year			339.5063 (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	3518.0106	1.5774	5549.1341 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	1.5213	2540.8682 (278)
Space and water heating			8090.0023 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	381.2835	1.5338	584.8253 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1136.9973	1.4954	-1700.3196
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1700.3196 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.5128	-3786.3546
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-3786.3546 (283)
Total Primary energy kWh/year			3188.1534 (286)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Thu 11 Dec 2025 10:07:52

Project Information			
Assessed By	Joe Solti	Building Type	House, Detached
OCDEA Registration	EES/003578	Assessment Date	2025-12-11

Dwelling Details			
Assessment Type	As designed	Total Floor Area	265 m ²
Site Reference	DJ-10	Plot Reference	DJ1003 (Be Clean)
Address	Land East of Spring Gardens, Washington, RH20 3BP		

Client Details	
Name	.
Company	KG Designs
Address	Longacre, Bentons Lane, Dial Post, Horsham, RH13 8NW

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	7.45 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	3.63 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	39.51 kWh _{PE} /m ²		
Dwelling primary energy	37.54 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	39.1 kWh/m ²		
Dwelling fabric energy efficiency	38.3 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.19	Walls (1) (0.22)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.13	Exposed Floor (0.18)	OK
Roofs	0.16	0.11	Roof (2) (0.14)	OK
Windows, doors, and roof windows	1.6	1.2	Doors (NE) (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	112	0.22
Exposed wall: Walls (2)	108.5	0.16
Ground floor: Ground Floor, Ground Floor	133	0.13
Upper floor: Exposed Floor, Exposed Floor	9.5	0.18
Exposed roof: Roof (1)	136	0.11
Exposed roof: Roof (2)	9	0.14

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Doors (NE), Doors (part glazed)	2	North East	N/A	1.2
Doors (NE), Doors (solid)	2	North East	N/A	1.2
Doors (NW), Doors (part glazed)	2	North West	N/A	1.2
Windows (NE), Windows	7	North East	0.7	1.2
Windows (NE), Windows	4	North East	0.7	1.2
Windows (NW), Windows	0.5	North West	0.7	1.2
Windows (SE), Windows	1.5	South East	0.7	1.2
Windows (SE), Windows	1.5	South East	0.7	1.2
Windows (SW), Windows	18	South West	0.7	1.2
Windows (SW), Windows	12	South West	0.7	1.2
Roof Windows, Roof Windows	1.5	South West	0.7	1.2

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.144	
External wall	E3: Sill	Calculated by person with suitable expertise	0.021 (!)	
External wall	E3: Sill	Calculated by person with suitable expertise	0.048	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.016 (!)	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.064	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.054	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.004 (!)	
External wall	E20: Exposed floor (normal)	Calculated by person with suitable expertise	0.046	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.082	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.082	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.075	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.054	
3 Air permeability (better than typically expected values are flagged with a subsequent (!))				
Maximum permitted air permeability at 50Pa		8 m ³ /hm ²		
Dwelling air permeability at 50Pa		5 m ³ /hm ² , Design value		OK
Air permeability test certificate reference				
4 Space heating				
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity				
Efficiency	219.3%			
Emitter type	Both radiators and underfloor			
Flow temperature				
System type	Air source heat pump			
Manufacturer				
Model				
Commissioning				
Secondary heating system: Closed room heater				
Fuel	Dual fuel appliance (mineral and wood)			
Efficiency	65.0%			
Commissioning				
5 Hot water				
Cylinder/store - type: Cylinder				
Capacity	300 litres			
Declared heat loss	2 kWh/day			
Primary pipework insulated	Yes			
Manufacturer				
Model				
Commissioning				
Waste water heat recovery system 1 - type: N/A				
Efficiency				
Manufacturer				
Model				

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

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Plot Reference	DJ-10			Issued on Date	11/12/2025
Assessment Reference	DJ1003 (Be Clean)	Plot Type Ref	New Dwelling		
Plot Address	Land East of Spring Gardens, Washington, West Sussex, RH20 3BP			SAP Version	10.2
SAP Rating	81 B	DER	3.63	TER	7.45
Environmental	96 A	% DER < TER			51.28
CO ₂ Emissions (t/year)	0.84	DFEE	38.30	TFEE	39.11
Compliance Check	See BREL	% DFEE < TFEE			2.07
% DPER < TPER	4.99	DPER	37.54	TPER	39.51
Assessor Details	Mr. Joe Solti			Assessor ID	5122-0001
Client	KG Designs, .				

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	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (5)

2. Ventilation rate

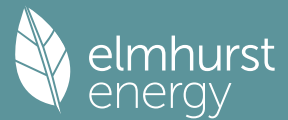
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 70.0000 / (5) = 0.1067 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3567 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3032 (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	0.3866	0.3790	0.3715	0.3336	0.3260	0.2881	0.2881	0.2805	0.3032	0.3260	0.3411	0.3563 (22b)
Effective ac	0.5747	0.5718	0.5690	0.5556	0.5531	0.5415	0.5415	0.5393	0.5460	0.5531	0.5582	0.5635 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m ²)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.0918		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				26.0000	0.0500	1.3000	
E2 Other lintels (including other steel lintels)				13.0000	0.1440	1.8720	
E3 Sill				11.5000	0.0210	0.2415	

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E3 Sill								4.5000	0.0480	0.2160		
E4 Jamb								49.0000	0.0160	0.7840		
E4 Jamb								22.5000	0.0640	1.4400		
E5 Ground floor (normal)								54.0000	0.0540	2.9160		
E6 Intermediate floor within a dwelling								57.0000	0.0040	0.2280		
E20 Exposed floor (normal)								6.5000	0.0460	0.2990		
E10 Eaves (insulation at ceiling level)								44.5000	0.0820	3.6490		
E12 Gable (insulation at ceiling level)								3.5000	0.0820	0.2870		
E11 Eaves (insulation at rafter level)								9.0000	0.0750	0.6750		
E16 Corner (normal)								48.5000	0.0540	2.6190		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											16.5265	(36)
Point Thermal bridges											0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	153.6183 (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	124.3810	123.7529	123.1373	120.2458	119.7048	117.1863	117.1863	116.7199	118.1564	119.7048	120.7992	121.9434 (38)
Average = Sum(39)m / 12 =	277.9992	277.3712	276.7556	273.8640	273.3230	270.8046	270.8046	270.3382	271.7746	273.3230	274.4175	275.5616 (39)
												273.8614
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0491	1.0467	1.0444	1.0334	1.0314	1.0219	1.0219	1.0201	1.0256	1.0314	1.0355	1.0399 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												3.0864 (42)
Hot water usage for mixer showers												
	85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379 (42a)
Hot water usage for baths												
	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816 (42b)
Hot water usage for other uses												
	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381 (42c)
Average daily hot water use (litres/day)												151.2346 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576 (44)
Energy conte	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2511.9926
	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss												
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage												
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
												Total per year (kWh/year) = Sum(64)m = 3180.0886 (64)
12Total per year (kWh/year)												3180 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month												
	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254	229.6330	222.2254 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227 (68)
Pumps, fans	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Total internal gains	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128 (72)
	898.2273	923.5296	882.7336	853.5422	808.2053	779.1389	747.7691	747.4140	770.8587	796.3608	846.1061	877.6573 (73)

6. Solar gains												

[Jan]												
	Area											Gains
	m2											W
Northeast	11.0000											37.9303 (75)
Southeast	3.0000											33.7340 (77)
Southwest	30.0000											337.3402 (79)
Northwest	0.5000											1.7241 (81)
Southwest	1.5000											23.7992 (82)

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Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1332.7552	1680.0722	1959.7419	2255.5205	2438.2250	2423.1087	2322.0587	2147.9816	1960.0222	1643.9499	1369.5931	1247.5452 (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	39.7183	39.8083	39.8968	40.3181	40.3979	40.7736	40.7736	40.8439	40.6280	40.3979	40.2368	40.0697
alpha	3.6479	3.6539	3.6598	3.6879	3.6932	3.7182	3.7182	3.7229	3.7085	3.6932	3.6825	3.6713
util living area	0.9925	0.9823	0.9615	0.9075	0.8030	0.6415	0.4913	0.5445	0.7699	0.9396	0.9851	0.9941 (86)
MIT	19.4018	19.6311	19.9440	20.3363	20.6489	20.8350	20.8938	20.8831	20.7488	20.3218	19.7881	19.3668 (87)
Th 2	20.0427	20.0446	20.0465	20.0556	20.0572	20.0651	20.0651	20.0666	20.0621	20.0572	20.0538	20.0503 (88)
util rest of house	0.9909	0.9786	0.9533	0.8874	0.7605	0.5686	0.3957	0.4471	0.7072	0.9223	0.9814	0.9928 (89)
MIT 2	18.1463	18.4396	18.8366	19.3292	19.6974	19.8985	19.9472	19.9421	19.8175	19.3218	18.6483	18.1071 (90)
Living area fraction									fLA =	Living area / (4) =		0.1057 (91)
MIT	18.2790	18.5655	18.9536	19.4356	19.7979	19.9975	20.0472	20.0416	19.9159	19.4275	18.7687	18.2402 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2790	18.5655	18.9536	19.4356	19.7979	19.9975	20.0472	20.0416	19.9159	19.4275	18.7687	18.2402 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9867	0.9709	0.9411	0.8715	0.7473	0.5630	0.3938	0.4444	0.6961	0.9075	0.9744	0.9893 (94)
Useful gains	1314.9750	1631.1148	1844.3467	1965.5782	1822.1276	1364.1380	914.4110	954.4952	1364.2808	1491.8146	1334.5844	1234.2217 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.1000	14.0000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	3886.1493	3790.4243	3446.6022	2885.3185	2213.3527	1461.6611	933.5207	984.4540	1580.6026	2412.7553	3202.0929	3868.9422 (97)
Space heating kWh	1912.9537	1451.0560	1192.0781	662.2130	291.0714	0.0000	0.0000	0.0000	0.0000	685.1799	1344.6061	1960.2320 (98a)
Space heating requirement - total per year (kWh/year)												9499.3903
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	1912.9537	1451.0560	1192.0781	662.2130	291.0714	0.0000	0.0000	0.0000	0.0000	685.1799	1344.6061	1960.2320 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9499.3903
Space heating per m2										(98c) / (4) =		35.8468 (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 %)												219.3000 (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	1912.9537	1451.0560	1192.0781	662.2130	291.0714	0.0000	0.0000	0.0000	0.0000	685.1799	1344.6061	1960.2320 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	872.2999	661.6762	543.5833	301.9667	132.7275	0.0000	0.0000	0.0000	0.0000	312.4395	613.1355	893.8586 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (232)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567 (231)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												4331.6873 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												1670.2146 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

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Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	381.2835 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated – Micro CHP (Appendix N)	0.0000 (235)
Appendix Q – special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	6383.1854 (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	4331.6873	0.1553	672.6968 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			908.1572 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Total CO2, kg/year			963.1882 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6300 (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	4331.6873	1.5749	6822.1116 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	1.5213	2540.8682 (278)
Space and water heating			9362.9798 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	381.2835	1.5338	584.8253 (282)
Total Primary energy kWh/year			9947.8051 (286)
Dwelling Primary energy Rate (DPER)			37.5400 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

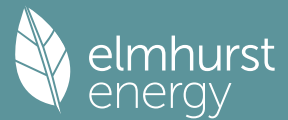
2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0610 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3110 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2643 (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	0.3370	0.3304	0.3238	0.2908	0.2842	0.2511	0.2511	0.2445	0.2643	0.2842	0.2974	0.3106 (22b)
Effective ac	0.5568	0.5546	0.5524	0.5423	0.5404	0.5315	0.5315	0.5299	0.5349	0.5404	0.5442	0.5482 (25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			2.0000	1.0000	2.0000		(26)
TER Semi-glazed door			4.0000	1.0000	4.0000		(26a)
TER Opening Type			44.5000	1.1450	50.9542		(27)
TER Roof Window			1.5000	1.1450	2.1226		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1300	1.2350		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.1800	20.1600		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1800	19.5300		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1100	0.9900		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	133.2418		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 150.0000 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.0500	0.6500
E2 Other lintels (including other steel lintels)	11.5000	0.0500	0.5750
E3 Sill	4.5000	0.0500	0.2250
E3 Sill	49.0000	0.0500	2.4500
E4 Jamb	22.5000	0.0500	1.1250
E4 Jamb	54.0000	0.1600	8.6400
E5 Ground floor (normal)	57.0000	0.0000	0.0000
E6 Intermediate floor within a dwelling	6.5000	0.3200	2.0800
E20 Exposed floor (normal)	44.5000	0.0600	2.6700
E10 Eaves (insulation at ceiling level)	3.5000	0.0600	0.2100
E12 Gable (insulation at ceiling level)	9.0000	0.0400	0.3600
E11 Eaves (insulation at rafter level)	48.5000	0.0900	4.3650
E16 Corner (normal)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 24.6500 (36)

Point Thermal bridges (36a) = 0.0000

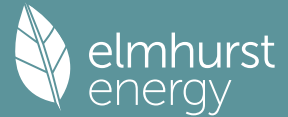
Total fabric heat loss (33) + (36) + (36a) = 157.8918 (37)

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	120.4989	120.0216	119.5537	117.3562	116.9451	115.0311	115.0311	114.6767	115.7683	116.9451	117.7768	118.6464	(38)
Average = Sum(39)m / 12 =	278.3907	277.9134	277.4456	275.2480	274.8369	272.9229	272.9229	272.5685	273.6602	274.8369	275.6686	276.5382	(39)
	275.2461												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0505	1.0487	1.0470	1.0387	1.0371	1.0299	1.0299	1.0286	1.0327	1.0371	1.0403	1.0435	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													
Assumed occupancy													3.0864 (42)
Hot water usage for mixer showers	75.9692	74.8275	73.1639	69.9808	67.6318	65.0122	63.5232	65.1742	66.9841	69.7967	73.0482	75.6781	(42a)
Hot water usage for baths	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	(42b)
Hot water usage for other uses	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	(42c)
Average daily hot water use (litres/day)													142.4795 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	154.9998	151.6897	147.6588	141.5299	136.5526	131.2017	129.1456	133.1590	137.3918	143.0093	149.2327	154.5978	(44)
Energy content (annual)	245.4817	216.0041	226.9461	193.7473	183.8260	161.3278	156.1904	164.8787	169.4178	194.0622	212.6093	242.0628	(45)
Distribution loss (46)m = 0.15 x (45)m	36.8223	32.4006	34.0419	29.0621	27.5739	24.1992	23.4286	24.7318	25.4127	29.1093	31.8914	36.3094	(46)
Water storage loss (or HIU loss):													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1127 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1409 (55)
Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	304.1105	268.9591	285.5750	250.4849	242.4549	218.0653	214.8192	223.5075	226.1554	252.6911	269.3469	300.6916	(62)
WWHRS	-34.7299	-30.7154	-32.1634	-26.6326	-24.8206	-21.2392	-19.9083	-21.1705	-21.9749	-25.9060	-29.3483	-34.0868	(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	269.3806	238.2437	253.4115	223.8523	217.6342	196.8262	194.9109	202.3370	204.1805	226.7851	239.9985	266.6049	(64)
12Total per year (kWh/year)													2734.1653 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	128.5257	114.1854	122.3626	109.8110	108.0252	99.0315	98.8364	101.7252	101.7215	111.4287	116.0826	127.3889	(65)

5. Internal gains (see Table 5 and 5a)													
Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	222.2254	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227	(68)
Pumps, fans	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

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Water heating gains (Table 5)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Total internal gains	172.7496	169.9188	164.4659	152.5153	145.1952	137.5438	132.8446	136.7274	141.2798	149.7698	161.2259	(72)
	896.5344	921.9678	881.4801	853.0405	808.1476	776.5527	745.5058	744.9343	768.1191	796.0982	845.1270	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
Northeast	11.0000	11.2829	0.6300	0.7000	0.7700	0.7700	37.9303	(75)
Southeast	3.0000	36.7938	0.6300	0.7000	0.7700	0.7700	33.7340	(77)
Southwest	30.0000	36.7938	0.6300	0.7000	0.7700	0.7700	337.3402	(79)
Northwest	0.5000	11.2829	0.6300	0.7000	0.7700	0.7700	1.7241	(81)
Southwest	1.5000	39.9751	0.6300	0.7000	1.0000	1.0000	23.7992	(82)

Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879	(83)
Total gains	1331.0623	1678.5104	1958.4885	2255.0188	2438.1672	2420.5225	2319.7953	2145.5018	1957.2826	1643.6873	1368.6140	1245.9541	(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	39.6625	39.7306	39.7976	40.1153	40.1753	40.4571	40.4571	40.5097	40.3481	40.1753	40.0541	39.9282	
alpha	3.6442	3.6487	3.6532	3.6744	3.6784	3.6971	3.6971	3.7006	3.6899	3.6784	3.6703	3.6619	
util living area	0.9925	0.9824	0.9617	0.9081	0.8044	0.6449	0.4947	0.5482	0.7724	0.9400	0.9852	0.9941	(86)
MIT	18.9776	19.2821	19.6985	20.2180	20.6373	20.8865	20.9675	20.9526	20.7701	20.1990	19.4866	18.9255	(87)
Th 2	20.0414	20.0429	20.0444	20.0512	20.0525	20.0585	20.0585	20.0596	20.0562	20.0525	20.0499	20.0472	(88)
util rest of house	0.9909	0.9787	0.9535	0.8880	0.7619	0.5716	0.3981	0.4499	0.7097	0.9227	0.9815	0.9928	(89)
MIT 2	17.6527	18.0413	18.5688	19.2167	19.7099	19.9753	20.0425	20.0343	19.8675	19.2063	18.3088	17.5898	(90)
Living area fraction	17.7927	18.1724	18.6882	19.3225	19.8078	20.0716	20.1402	20.1313	19.9628	19.3112	18.4332	17.7310	(91)
MIT	17.7927	18.1724	18.6882	19.3225	19.8078	20.0716	20.1402	20.1313	19.9628	19.3112	18.4332	17.7310	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7927	18.1724	18.6882	19.3225	19.8078	20.0716	20.1402	20.1313	19.9628	19.3112	18.4332	17.7310	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9852	0.9684	0.9379	0.8692	0.7495	0.5727	0.4068	0.4578	0.7027	0.9051	0.9722	0.9880	(94)
Useful gains	1311.3011	1625.4248	1836.8307	1960.0771	1827.5144	1386.3321	943.7138	982.2266	1375.3504	1487.6451	1330.6289	1231.0475	(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	3756.2501	3688.5760	3381.5535	2868.7607	2228.3356	1493.3243	966.2011	1017.0428	1604.4241	2394.1553	3124.2209	3741.8300	(97)
Space heating kWh	1819.0421	1386.4376	1149.2738	654.2522	298.2110	0.0000	0.0000	0.0000	0.0000	674.4436	1291.3862	1868.0222	(98a)
Space heating requirement - total per year (kWh/year)												9141.0686	
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	1819.0421	1386.4376	1149.2738	654.2522	298.2110	0.0000	0.0000	0.0000	0.0000	674.4436	1291.3862	1868.0222	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9141.0686	
Space heating per m2										(98c) / (4) =		34.4946	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													92.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1819.0421	1386.4376	1149.2738	654.2522	298.2110	0.0000	0.0000	0.0000	0.0000	674.4436	1291.3862	1868.0222	(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)	1970.7931	1502.0993	1245.1504	708.8323	323.0888	0.0000	0.0000	0.0000	0.0000	730.7082	1399.1183	2023.8593	(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	269.3806	238.2437	253.4115	223.8523	217.6342	196.8262	194.9109	202.3370	204.1805	226.7851	239.9985	266.6049	(64)	
Efficiency of water heater (217)m	87.5267	87.3553	87.0268	86.3183	84.7666	79.8000	79.8000	79.8000	79.8000	86.3494	87.2577	87.5665	(216)	
Fuel for water heating, kWh/month	307.7696	272.7296	291.1879	259.3336	256.7453	246.6493	244.2492	253.5551	255.8653	262.6367	275.0457	304.4597	(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	7.3041	7.3041	7.0685	7.3041	(231)	
Lighting	46.1741	37.0425	33.3527	24.4356	18.8748	15.4209	17.2182	22.3809	29.0705	38.1421	43.0814	47.4574	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-106.3719	-141.6157	-192.2308	-203.5227	-209.1064	-191.2324	-188.4550	-182.5596	-171.2612	-155.2418	-113.7421	-92.9368	(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)	

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Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-88.3663	-181.7133	-353.9191	-521.5973	-680.5765	-680.8927	-673.2372	-574.4473	-426.7846	-256.8822	-116.9273	-70.2382 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1												9903.6497 (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												3230.2270 (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)												372.6511 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-6573.8582 (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												7018.6695 (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	9903.6497	0.2100	2079.7664	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3230.2270	0.2100	678.3477	(264)
Space and water heating			2758.1141	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	372.6511	0.1443	53.7851	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1948.2762	0.1359	-264.7578	
PV Unit electricity exported	-4625.5820	0.1265	-584.9097	
Total			-849.6674	(269)
Total CO2, kg/year			1974.1610	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.4500	(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	9903.6497	1.1300	11191.1241	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3230.2270	1.1300	3650.1565	(278)
Space and water heating			14841.2806	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	372.6511	1.5338	571.5847	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1948.2762	1.5023	-2926.9163	
PV Unit electricity exported	-4625.5820	0.4642	-2147.1300	
Total			-5074.0463	(283)
Total Primary energy kWh/year			10468.9197	(286)
Target Primary Energy Rate (TPER)			39.5100	(287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)	
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (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)

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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 * 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) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
40.0000 / (5) = 0.0610 (8)
Yes
Blower Door
5.0000 (17)
0.3110 (18)
2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2643 (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													
	0.3370	0.3304	0.3238	0.2908	0.2842	0.2511	0.2511	0.2445	0.2643	0.2842	0.2974	0.3106	(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	0.5568	0.5546	0.5524	0.5423	0.5404	0.5315	0.5315	0.5299	0.5349	0.5404	0.5442	0.5482	(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								
Doors (part glazed)			4.0000	1.2000	4.8000			(26a)
Doors (solid)			2.0000	1.2000	2.4000			(26)
Windows			44.5000	1.1450	50.9542			(27)
Roof Windows			1.5000	1.1450	1.7176			(27a)
Ground Floor			133.0000	0.1300	17.2900			(28a)
Exposed Floor			9.5000	0.1800	1.7100			(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400			(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600			(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600			(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600			(30)
Total net area of external elements Aum(A, m2)			560.0000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	137.0918		(33)

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

150.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E3 Sill	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160
E6 Intermediate floor within a dwelling	57.0000	0.0040	0.2280
E20 Exposed floor (normal)	6.5000	0.0460	0.2990
E10 Eaves (insulation at ceiling level)	44.5000	0.0820	3.6490
E12 Gable (insulation at ceiling level)	3.5000	0.0820	0.2870
E11 Eaves (insulation at rafter level)	9.0000	0.0750	0.6750
E16 Corner (normal)	48.5000	0.0540	2.6190

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

Point Thermal Bridges

Total fabric heat loss

(36a) = 16.5265 (36)
(33) + (36) + (36a) = 153.6183 (37)

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

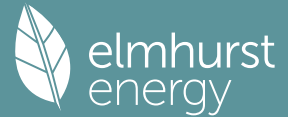
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	120.4989	120.0216	119.5537	117.3562	116.9451	115.0311	115.0311	114.6767	115.7683	116.9451	117.7768	118.6464	(38)
Heat transfer coeff	274.1171	273.6398	273.1720	270.9745	270.5633	268.6493	268.6493	268.2949	269.3866	270.5633	271.3951	272.2646	(39)
Average = Sum(39)m / 12 =												270.9725	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0344	1.0326	1.0308	1.0225	1.0210	1.0138	1.0138	1.0124	1.0166	1.0210	1.0241	1.0274	(40)
HLP (average)												1.0225	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0864 (42)
Hot water usage for mixer showers													(42a)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Hot water usage for baths													(42b)
	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	
Hot water usage for other uses													(42c)
	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	
Average daily hot water use (litres/day)												72.4384	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	79.0306	76.8622	74.4950	71.5491	68.9208	66.1895	65.6224	67.9848	70.4077	73.2125	76.1845	78.9197	(44)
Energy conte	125.1651	109.4507	114.4960	97.9471	92.7807	81.3877	79.3646	84.1794	86.8197	99.3487	108.5388	123.5692	(45)
Energy content (annual)										Total = Sum(45)m =		1203.0477	
Distribution loss (46)m = 0.15 x (45)m													(46)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water storage loss (or HIU loss):													
Total storage loss													(56)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
If cylinder contains dedicated solar storage													(57)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338	(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)

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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	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1022.5906	(64)
Electric shower(s)	60.8386	54.2077	59.1928	56.4869	57.5469	54.8941	56.7240	57.5469	56.4869	59.1928	58.0797	60.8386	(64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											692.0360	(64a)
Heat gains from water heating, kWh/month	41.8072	36.8102	39.1286	34.9355	34.1026	31.0184	31.0460	32.2748	32.5709	35.9098	37.5844	41.4681	(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	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	229.6330	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	(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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Water heating gains (Table 5)	56.1925	54.7771	52.5922	48.5215	45.8368	43.0812	41.7284	43.3802	45.2374	48.2659	52.2006	55.7367	(72)
Total internal gains	776.9773	803.8262	766.6064	746.0466	705.7893	682.0901	654.3897	651.5870	672.0767	691.5942	733.1016	757.5813	(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	
Northeast					11.0000	11.2829	0.6300	0.7000			0.7700	37.9303 (75)	
Southeast					3.0000	36.7938	0.6300	0.7000			0.7700	33.7340 (77)	
Southwest					30.0000	36.7938	0.6300	0.7000			0.7700	337.3402 (79)	
Northwest					0.5000	11.2829	0.6300	0.7000			0.7700	1.7241 (81)	
Southwest					1.5000	39.9751	0.6300	0.7000			1.0000	23.7992 (82)	
Solar gains		434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains		1211.5052	1560.3688	1843.6148	2148.0250	2335.8089	2326.0598	2228.6792	2052.1545	1861.2402	1539.1833	1256.5887	1127.4691 (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	40.2808	40.3511	40.4202	40.7480	40.8099	41.1007	41.1007	41.1550	40.9882	40.8099	40.6848	40.5549	
alpha	3.6854	3.6901	3.6947	3.7165	3.7207	3.7400	3.7400	3.7437	3.7325	3.7207	3.7123	3.7037	
util living area	0.9945	0.9859	0.9674	0.9171	0.8165	0.6574	0.5059	0.5622	0.7882	0.9490	0.9887	0.9958	(86)
MIT	18.9412	19.2490	19.6696	20.1985	20.6268	20.8832	20.9665	20.9505	20.7597	20.1710	19.4513	18.8893	(87)
Th 2	20.0548	20.0563	20.0577	20.0646	20.0659	20.0719	20.0719	20.0730	20.0696	20.0659	20.0633	20.0606	(88)
util rest of house	0.9933	0.9829	0.9603	0.8986	0.7756	0.5848	0.4090	0.4637	0.7276	0.9340	0.9858	0.9949	(89)
MIT 2	18.1533	18.4601	18.8766	19.3940	19.7891	20.0045	20.0589	20.0522	19.9139	19.3776	18.6680	18.1057	(90)
Living area fraction	18.2365	18.5435	18.9604	19.4790	19.8776	20.0974	20.1548	20.1471	20.0032	19.4614	18.7508	18.1885	(91)
MIT	18.2365	18.5435	18.9604	19.4790	19.8776	20.0974	20.1548	20.1471	20.0032	19.4614	18.7508	18.1885	(92)
Temperature adjustment	18.2365	18.5435	18.9604	19.4790	19.8776	20.0974	20.1548	20.1471	20.0032	19.4614	18.7508	18.1885	(93)

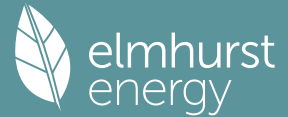
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9900	0.9763	0.9496	0.8847	0.7663	0.5870	0.4180	0.4720	0.7227	0.9215	0.9801	0.9922	(94)
Ext temp.	1199.4404	1523.4351	1750.6917	1900.2864	1789.9220	1365.3106	931.6295	968.6148	1345.1804	1418.3331	1231.6370	1118.6969	(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	3820.2469	3733.4016	3403.8393	2866.6446	2212.5515	1476.8678	954.9844	1005.3229	1590.2553	2397.5770	3161.9693	3808.5658	(97)
Space heating requirement - total per year (kWh/year)	1949.8801	1485.0975	1229.9419	695.7779	314.4363	0.0000	0.0000	0.0000	0.0000	728.5575	1389.8392	2001.2624	(98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating contribution - total per year (kWh/year)	1949.8801	1485.0975	1229.9419	695.7779	314.4363	0.0000	0.0000	0.0000	0.0000	728.5575	1389.8392	2001.2624	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1949.8801	1485.0975	1229.9419	695.7779	314.4363	0.0000	0.0000	0.0000	0.0000	728.5575	1389.8392	2001.2624	(99)
Space heating per m ²	(98c) / (4) =											36.9615	(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	2525.3039	1988.0052	2039.0413	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7991	0.8667	0.8313	0.0000	0.0000	0.0000	0.0000	(101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2017.9642	1723.0508	1695.1284	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2591.3686	2482.6836	2283.0948	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	412.8512	565.1668	437.4470	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	103.2128	141.2917	109.3617	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												353.8662	(107)
Energy for space heating												36.9615	(99)
Energy for space cooling												1.3353	(108)
Total												38.2968	(109)
Fabric Energy Efficiency (DFEE)												38.3	(109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

2. Ventilation rate

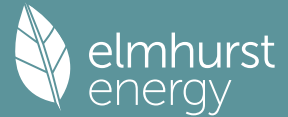
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0610 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3110	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2643 (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	0.3370	0.3304	0.3238	0.2908	0.2842	0.2511	0.2511	0.2445	0.2643	0.2842	0.2974	0.3106 (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	0.5568	0.5546	0.5524	0.5423	0.5404	0.5315	0.5315	0.5299	0.5349	0.5404	0.5442	0.5482 (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			2.0000	1.0000	2.0000		(26)
TER Semi-glazed door			4.0000	1.0000	4.0000		(26a)
TER Opening Type			44.5000	1.1450	50.9542		(27)
TER Roof Window			1.5000	1.1450	2.1226		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1300	1.2350		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.1800	20.1600		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1800	19.5300		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1100	0.9900		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	133.2418		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							150.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				26.0000	0.0500	1.3000	
E2 Other lintels (including other steel lintels)				13.0000	0.0500	0.6500	
E3 Sill				11.5000	0.0500	0.5750	
E3 Sill				4.5000	0.0500	0.2250	
E4 Jamb				49.0000	0.0500	2.4500	
E4 Jamb				22.5000	0.0500	1.1250	
E5 Ground floor (normal)				54.0000	0.1600	8.6400	
E6 Intermediate floor within a dwelling				57.0000	0.0000	0.0000	
E20 Exposed floor (normal)				6.5000	0.3200	2.0800	
E10 Eaves (insulation at ceiling level)				44.5000	0.0600	2.6700	

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E12 Gable (insulation at ceiling level)	3.5000	0.0600	0.2100
E11 Eaves (insulation at rafter level)	9.0000	0.0400	0.3600
E16 Corner (normal)	48.5000	0.0900	4.3650
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			24.6500 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	157.8918 (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	120.4989	120.0216	119.5537	117.3562	116.9451	115.0311	115.0311	114.6767	115.7683	116.9451	117.7768	118.6464 (38)
Heat transfer coeff	278.3907	277.9134	277.4456	275.2480	274.8369	272.9229	272.9229	272.5685	273.6602	274.8369	275.6686	276.5382 (39)
Average = Sum(39)m / 12 =												275.2461
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0505	1.0487	1.0470	1.0387	1.0371	1.0299	1.0299	1.0286	1.0327	1.0371	1.0403	1.0435 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0864 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												32.7924 (42b)
Hot water usage for other uses												46.2381 (42c)
Average daily hot water use (litres/day)												72.4384 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	79.0306	76.8622	74.4950	71.5491	68.9208	66.1895	65.6224	67.9848	70.4077	73.2125	76.1845	78.9197 (44)
Energy content (annual)	125.1651	109.4507	114.4960	97.9471	92.7807	81.3877	79.3646	84.1794	86.8197	99.3487	108.5388	123.5692 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1203.0477
Water storage loss (or HIU 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	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338 (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	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 1022.5906 (64)
Electric shower(s)												1023 (64)
Heat gains from water heating, kWh/month												
	60.8386	54.2077	59.1928	56.4869	57.5469	54.8941	56.7240	57.5469	56.4869	59.1928	58.0797	60.8386 (64a)
	41.8072	36.8102	39.1286	34.9355	34.1026	31.0184	31.0460	32.2748	32.5709	35.9098	37.5844	41.4681 (65)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 692.0360 (64a)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	229.6330	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227 (68)
Pumps, fans	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Total internal gains	56.1925	54.7771	52.5922	48.5215	45.8368	43.0812	41.7284	43.3802	45.2374	48.2659	52.2006	55.7367 (72)
	776.9773	803.8262	766.6064	746.0466	705.7893	682.0901	654.3897	651.5870	672.0767	691.5942	733.1016	757.5813 (73)

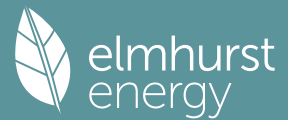
6. Solar gains

[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			
Northeast				11.0000	11.2829	0.6300	0.7000	0.7700	37.9303 (75)			
Southeast				3.0000	36.7938	0.6300	0.7000	0.7700	33.7340 (77)			
Southwest				30.0000	36.7938	0.6300	0.7000	0.7700	337.3402 (79)			
Northwest				0.5000	11.2829	0.6300	0.7000	0.7700	1.7241 (81)			
Southwest				1.5000	39.9751	0.6300	0.7000	1.0000	23.7992 (82)			
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1211.5052	1560.3688	1843.6148	2148.0250	2335.8089	2326.0598	2228.6792	2052.1545	1861.2402	1539.1833	1256.5887	1127.4691 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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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	39.6625	39.7306	39.7976	40.1153	40.1753	40.4571	40.4571	40.5097	40.3481	40.1753	40.0541	39.9282
alpha	3.6442	3.6487	3.6532	3.6744	3.6784	3.6971	3.6971	3.7006	3.6899	3.6784	3.6703	3.6619
util living area	0.9945	0.9859	0.9678	0.9187	0.8202	0.6632	0.5121	0.5684	0.7924	0.9499	0.9887	0.9958 (86)
MIT	18.9069	19.2150	19.6383	20.1726	20.6095	20.8753	20.9636	20.9466	20.7476	20.1484	19.4220	18.8549 (87)
Th 2	20.0414	20.0429	20.0444	20.0512	20.0525	20.0585	20.0585	20.0596	20.0562	20.0525	20.0499	20.0472 (88)
util rest of house	0.9933	0.9830	0.9608	0.9003	0.7794	0.5899	0.4132	0.4682	0.7318	0.9350	0.9859	0.9948 (89)
MIT 2	18.1097	18.4168	18.8360	19.3590	19.7627	19.9866	20.0444	20.0371	19.8926	19.3457	18.6294	18.0619 (90)
Living area fraction									FLA = Living area /	(4) =		0.1057 (91)
MIT	18.1939	18.5011	18.9208	19.4450	19.8522	20.0805	20.1415	20.1332	19.9829	19.4305	18.7131	18.1457 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1939	18.5011	18.9208	19.4450	19.8522	20.0805	20.1415	20.1332	19.9829	19.4305	18.7131	18.1457 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9900	0.9763	0.9500	0.8861	0.7696	0.5917	0.4223	0.4765	0.7264	0.9223	0.9801	0.9921 (94)
Useful gains	1199.3459	1523.4598	1751.3498	1903.3844	1797.5945	1376.3979	941.1123	977.8328	1352.0167	1419.5165	1231.6074	1118.6067 (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	3867.9370	3779.9371	3446.0956	2902.4817	2240.5236	1495.7531	966.5541	1017.5593	1609.9160	2426.9546	3201.3725	3856.5216 (97)
Space heating kWh	1985.4318	1516.3527	1260.8909	719.3501	329.5392	0.0000	0.0000	0.0000	0.0000	749.5339	1418.2308	2037.0087 (98a)
Space heating requirement - total per year (kWh/year)												10016.3380
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	1985.4318	1516.3527	1260.8909	719.3501	329.5392	0.0000	0.0000	0.0000	0.0000	749.5339	1418.2308	2037.0087 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10016.3380
Space heating per m2										(98c) / (4) =		37.7975 (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	2565.4756	2019.6297	2071.5206	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7910	0.8599	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2029.3904	1736.7483	1706.4473	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2591.3686	2482.6836	2283.0948	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	404.6244	554.9759	429.0257	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	101.1561	138.7440	107.2564	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												347.1565 (107)
Energy for space heating												37.7975 (99)
Energy for space cooling												1.3100 (108)
Total												39.1075 (109)
Fabric Energy Efficiency (TFEE)												39.1 (109)

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

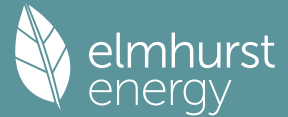
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1067 (8)
Pressure test	Yes
Pressure Test Method	Blower Door

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Measured/design AP50												5.0000 (17)
Infiltration rate												0.3567 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3032 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.3866	0.3790	0.3715	0.3336	0.3260	0.2881	0.2881	0.2805	0.3032	0.3260	0.3411	0.3563 (22b)
	0.5747	0.5718	0.5690	0.5556	0.5531	0.5415	0.5415	0.5393	0.5460	0.5531	0.5582	0.5635 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 137.0918		(33)

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

150.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E3 Sill	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160
E6 Intermediate floor within a dwelling	57.0000	0.0040	0.2280
E20 Exposed floor (normal)	6.5000	0.0460	0.2990
E10 Eaves (insulation at ceiling level)	44.5000	0.0820	3.6490
E12 Gable (insulation at ceiling level)	3.5000	0.0820	0.2870
E11 Eaves (insulation at rafter level)	9.0000	0.0750	0.6750
E16 Corner (normal)	48.5000	0.0540	2.6190

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

16.5265 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 153.6183 (37)

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

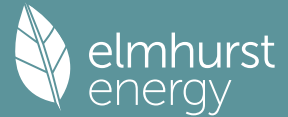
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	124.3810	123.7529	123.1373	120.2458	119.7048	117.1863	117.1863	116.7199	118.1564	119.7048	120.7992	121.9434 (38)
Average = Sum(39)m / 12 =	277.9992	277.3712	276.7556	273.8640	273.3230	270.8046	270.8046	270.3382	271.7746	273.3230	274.4175	275.5616 (39)
												273.8614

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0491	1.0467	1.0444	1.0334	1.0314	1.0219	1.0219	1.0201	1.0256	1.0314	1.0355	1.0399 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0864 (42)
Hot water usage for mixer showers													
85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379	85.1379 (42a)	
Hot water usage for baths													
32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	32.6816 (42b)	
Hot water usage for other uses													
46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	46.2381 (42c)	
Average daily hot water use (litres/day)													151.2346 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576	(44)
Distribution loss (46)m = 0.15 x (45)m	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745	(45)
Water storage loss (or HIU loss):													
Store volume	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312	(46)
a) If manufacturer declared loss factor is known (kWh/day):													300.0000 (47)
Temperature factor from Table 2b													2.0000 (48)
Enter (49) or (54) in (55)													0.5400 (49)
Total storage loss													1.0800 (55)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
Primary loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
WWHRS	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Electric shower(s)	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
													Total per year (kWh/year) = Sum(64)m = 3180.0886 (64)

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Heat gains from water heating, kWh/month
 132.0172 117.2509 125.5272 112.3323 110.3002 100.8936 100.5203 103.5702 103.6940 113.8561 118.9476 130.8047 (65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	(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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Water heating gains (Table 5)	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128	(72)
Total internal gains	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430	(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	
Northeast					11.0000	11.2829	0.6300	0.7000	0.7700		37.9303 (75)	
Southeast					3.0000	36.7938	0.6300	0.7000	0.7700		33.7340 (77)	
Southwest					30.0000	36.7938	0.6300	0.7000	0.7700		337.3402 (79)	
Northwest					0.5000	11.2829	0.6300	0.7000	0.7700		1.7241 (81)	
Southwest					1.5000	39.9751	0.6300	0.7000	1.0000		23.7992 (82)	
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1424.9695	1744.6358	2033.6341	2300.7638	2468.5659	2428.6416	2327.1705	2156.9343	1976.0487	1688.6253	1429.1708	1331.9309 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.7183	39.8083	39.8968	40.3181	40.3979	40.7736	40.7736	40.8439	40.6280	40.3979	40.2368	40.0697	
alpha	3.6479	3.6539	3.6598	3.6879	3.6932	3.7182	3.7182	3.7229	3.7085	3.6932	3.6825	3.6713	
util living area	0.9906	0.9801	0.9572	0.9028	0.7983	0.6404	0.4904	0.5426	0.7665	0.9350	0.9830	0.9926	(86)
MIT	19.4423	19.6583	19.9724	20.3502	20.6548	20.8354	20.8939	20.8835	20.7514	20.3376	19.8136	19.4042	(87)
Th 2	20.0427	20.0446	20.0465	20.0556	20.0572	20.0651	20.0651	20.0666	20.0621	20.0572	20.0538	20.0503	(88)
util rest of house	0.9887	0.9760	0.9482	0.8820	0.7554	0.5676	0.3949	0.4455	0.7035	0.9168	0.9788	0.9911	(89)
MIT 2	18.1980	18.4740	18.8718	19.3455	19.7035	19.8989	19.9473	19.9424	19.8199	19.3406	18.6804	18.1549	(90)
Living area fraction	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869	(91)
MIT	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9837	0.9677	0.9355	0.8660	0.7424	0.5620	0.3930	0.4427	0.6926	0.9016	0.9712	0.9870	(94)
Useful gains	1401.7829	1688.2263	1902.3697	1992.5512	1832.5983	1364.8084	914.5625	954.9242	1368.5581	1522.5333	1387.9841	1314.5771	(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	3900.1783	3799.7395	3456.1544	2889.7240	2215.0093	1461.7622	933.5439	984.5193	1581.2715	2417.7886	3210.7204	3881.8129	(97)
Space heating kWh	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98a)
Space heating requirement - total per year (kWh/year)												9252.7005	
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	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9252.7005	
Space heating per m ²												34.9159	(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 %)													219.3000 (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	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	847.6088	647.0300	527.1390	294.5574	129.7372	0.0000	0.0000	0.0000	0.0000	303.7255	598.4360	870.9637	(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)

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
Efficiency of water heater	(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148	(217)
Space cooling fuel requirement	(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4219.1977	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1670.2146	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												381.2835	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												6270.6958	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4219.1977	16.4900	695.7457 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	16.4900	275.4184 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	381.2835	16.4900	62.8736 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1034.0377 (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] = 1.2008 (257)
SAP value	80.5347
SAP rating (Section 12)	81 (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	4219.1977	0.1553	655.2219 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			890.6823 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Total CO2, kg/year			945.7133 (272)
CO2 emissions per m2			3.5700 (273)
EI value			95.9121
EI rating			96 (274)
EI band			A

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (5)

2. Ventilation rate

												m3 per hour		
Number of open chimneys													0 * 80 =	0.0000 (6a)
Number of open flues													0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire													1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler													0 * 20 =	0.0000 (6d)
Number of flues attached to other heater													0 * 35 =	0.0000 (6e)
Number of blocked chimneys													0 * 20 =	0.0000 (6f)
Number of intermittent extract fans													6 * 10 =	60.0000 (7a)
Number of passive vents													0 * 10 =	0.0000 (7b)
Number of flueless gas fires													0 * 40 =	0.0000 (7c)
												Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												70.0000 / (5) =	0.1067 (8)
Pressure test													Yes	
Pressure Test Method													Blower Door	
Measured/design AP50													5.0000 (17)	
Infiltration rate													0.3567 (18)	
Number of sides sheltered													2 (19)	
Shelter factor													(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) =	0.3032 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind speed	3.9000	3.5000	3.5000	3.4000	3.4000	3.1000	3.2000	3.0000	2.9000	3.1000	3.0000	3.3000	(22)	
Wind factor	0.9750	0.8750	0.8750	0.8500	0.8500	0.7750	0.8000	0.7500	0.7250	0.7750	0.7500	0.8250	(22a)	
Adj infiltr rate	0.2956	0.2653	0.2653	0.2577	0.2577	0.2350	0.2426	0.2274	0.2198	0.2350	0.2274	0.2502	(22b)	
Effective ac	0.5437	0.5352	0.5352	0.5332	0.5332	0.5276	0.5294	0.5259	0.5242	0.5276	0.5259	0.5313	(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							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000		112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m ²)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	137.0918	(33)

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

List of Thermal Bridges													
K1 Element													
E2 Other lintels (including other steel lintels)													
E2 Other lintels (including other steel lintels)													
E3 Sill													
E3 Sill													
E4 Jamb													
E4 Jamb													
E5 Ground floor (normal)													
E6 Intermediate floor within a dwelling													
E20 Exposed floor (normal)													
E10 Eaves (insulation at ceiling level)													
E12 Gable (insulation at ceiling level)													
E11 Eaves (insulation at rafter level)													
E16 Corner (normal)													

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

Point Thermal bridges													
Total fabric heat loss													

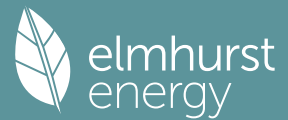
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	117.6651	115.8245	115.8245	115.3954	115.3954	114.1829	114.5746	113.8035	113.4366	114.1829	113.8035	114.9788 (38)
Heat transfer coeff	271.2834	269.4428	269.4428	269.0137	269.0137	267.8011	268.1929	267.4218	267.0549	267.8011	267.4218	268.5971 (39)
Average = Sum(39)m / 12 =												268.5406

HLP	Jan 1.0237	Feb 1.0168	Mar 1.0168	Apr 1.0151	May 1.0151	Jun 1.0106	Jul 1.0120	Aug 1.0091	Sep 1.0078	Oct 1.0106	Nov 1.0091	Dec 1.0136 (40)
HLP (average)												1.0134
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

												3.0864 (42)
Assumed occupancy												
Hot water usage for mixer showers												
85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379 (42a)	

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Hot water usage for baths	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816 (42b)
Hot water usage for other uses	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381 (42c)
Average daily hot water use (litres/day)												151.2346 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576 (44)
Energy content (annual)	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745 (45)
Distribution loss (46)m = 0.15 x (45)m	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
												Total per year (kWh/year) = Sum(64)m = 3180.0886 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047 (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	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050 (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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Water heating gains (Table 5)	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128 (72)
Total internal gains	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430 (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
Northeast	11.0000	14.6130	0.6300	0.7000	0.7700	49.1253 (75)
Southeast	3.0000	45.0642	0.6300	0.7000	0.7700	41.3166 (77)
Southwest	30.0000	45.0642	0.6300	0.7000	0.7700	413.1660 (79)
Northwest	0.5000	14.6130	0.6300	0.7000	0.7700	2.2330 (81)
Southwest	1.5000	50.1759	0.6300	0.7000	1.0000	29.8722 (82)

Solar gains	535.7130	795.0814	1135.4145	1529.9207	1730.0072	1893.4468	1783.8811	1589.2775	1340.1542	962.3448	628.5378	448.1700 (83)
Total gains	1526.1547	1783.1746	2092.0403	2428.7062	2568.5535	2678.1187	2536.7621	2345.6442	2127.0393	1803.3810	1534.2216	1410.2131 (84)

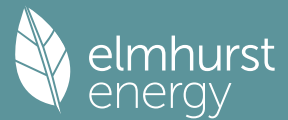
7. Mean internal temperature (heating season)

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	40.7016	40.9796	40.9796	41.0450	41.0450	41.2308	41.1706	41.2893	41.3461	41.2308	41.2893	41.1087
alpha	3.7134	3.7320	3.7320	3.7363	3.7363	3.7487	3.7447	3.7526	3.7564	3.7487	3.7526	3.7406
util living area	0.9863	0.9761	0.9453	0.8699	0.7357	0.5300	0.3840	0.4121	0.6817	0.9004	0.9735	0.9893 (86)
MIT	19.6276	19.7845	20.1166	20.4784	20.7471	20.8808	20.9093	20.9073	20.8231	20.4937	20.0037	19.5936 (87)
Th 2	20.0636	20.0694	20.0694	20.0707	20.0707	20.0745	20.0733	20.0757	20.0769	20.0745	20.0757	20.0720 (88)
util rest of house	0.9833	0.9712	0.9338	0.8430	0.6834	0.4526	0.2911	0.3136	0.6071	0.8729	0.9669	0.9870 (89)
MIT 2	18.4496	18.6525	19.0696	19.5105	19.8146	19.9456	19.9645	19.9662	19.9017	19.5420	18.9375	18.4127 (90)
Living area fraction									FLA = Living area / (4) =			0.1057 (91)
MIT	18.5741	18.7721	19.1802	19.6128	19.9131	20.0444	20.0643	20.0657	19.9991	19.6425	19.0502	18.5375 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5741	18.7721	19.1802	19.6128	19.9131	20.0444	20.0643	20.0657	19.9991	19.6425	19.0502	18.5375 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9769	0.9621	0.9200	0.8276	0.6736	0.4500	0.2902	0.3125	0.6002	0.8572	0.9570	0.9817 (94)

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Useful gains	1490.8836	1715.5034	1924.6483	2010.1013	1730.2584	1205.1814	736.1114	732.9159	1276.6206	1545.7860	1468.2608	1384.3595 (95)
Ext temp.	5.1000	5.4000	7.2000	9.6000	12.6000	15.4000	17.3000	17.3000	14.8000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	3655.2960	3603.0107	3227.9852	2693.5747	1967.3249	1243.7673	741.3665	739.6031	1388.4397	2180.5768	2955.0571	3609.2666 (97)
Space heating kWh	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98a)
Space heating requirement - total per year (kWh/year)												7714.9972
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	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7714.9972
Space heating per m2											(98c) / (4) =	29.1132 (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 %)												219.3000 (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	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	734.3013	578.3880	442.1717	224.3962	80.4275	0.0000	0.0000	0.0000	0.0000	215.3600	488.1411	754.8248 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Efficiency of water heater												190.4000 (216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (217)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3518.0106 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												1670.2146 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												381.2835 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												5569.5087 (238)

10a. Fuel costs - using BEDF prices (587)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3518.0106	28.4300	1000.1704 (240)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1670.2146	28.4300	474.8420 (247)	
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)	
Energy for lighting	381.2835	28.4300	108.3989 (250)	
Additional standing charges			0.0000 (251)	
Total energy cost			1583.4113 (255)	

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

Energy	Emission factor	Emissions
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	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3518.0106	0.1559	548.6253 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			784.0856 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Total CO2, kg/year			839.1166 (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	3518.0106	1.5774	5549.1341 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	1.5213	2540.8682 (278)
Space and water heating			8090.0023 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	381.2835	1.5338	584.8253 (282)
Total Primary energy kWh/year			8674.8276 (286)

SAP 10 EPC IMPROVEMENTS

DJ1003 (Be Clean)

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating			SAP increase too small
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Recommended
Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 3.2	-£ 323	-152 kg (18.2%)
V2 Wind turbine	+ 7.8	-£ 712	-347 kg (50.6%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 101	-44 kg (5.3%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar photovoltaic panels	£323	0.58 kg/m²	B 84 A 97
Wind turbine	£712	1.31 kg/m²	A 92 A 98
Total Savings	£1035	1.89 kg/m²	

Potential energy efficiency rating: A 92
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 587 TEST (28 Nov 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £1583	Potential £1583	£0 Saving
Electricity			
Space heating	£1000	£1000	£0
Water heating	£475	£475	£0
Lighting	£108	£108	£0
Generated (PV)	-£0	-£323	£323
Generated (wind)	-£0	-£712	£712
Total cost of fuels	£1583	£548	£1035
Total cost of uses	£1583	£548	£1035
Delivered energy	21 kWh/m²	7 kWh/m²	14 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.3 tonnes	0.5 tonnes
CO2 emissions per m²	3 kg/m²	1 kg/m²	2 kg/m²
Primary energy	33 kWh/m²	12 kWh/m²	21 kWh/m²

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

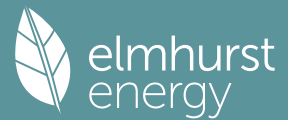
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (5)

2. Ventilation rate

m3 per hour

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Number of open chimneys 0 * 80 = 0.0000 (6a)
Number of open flues 0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire 1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler 0 * 20 = 0.0000 (6d)
Number of flues attached to other heater 0 * 35 = 0.0000 (6e)
Number of blocked chimneys 0 * 20 = 0.0000 (6f)
Number of intermittent extract fans 6 * 10 = 60.0000 (7a)
Number of passive vents 0 * 10 = 0.0000 (7b)
Number of flueless gas fires 0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 70.0000 / (5) = 0.1067 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3567 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3032 (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												
	0.3866	0.3790	0.3715	0.3336	0.3260	0.2881	0.2881	0.2805	0.3032	0.3260	0.3411	0.3563 (22b)
Effective ac	0.5747	0.5718	0.5690	0.5556	0.5531	0.5415	0.5415	0.5393	0.5460	0.5531	0.5582	0.5635 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30a)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 137.0918		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 150.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E2 Other lintels (including other steel lintels)	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160
E6 Intermediate floor within a dwelling	57.0000	0.0040	0.2280
E20 Exposed floor (normal)	6.5000	0.0460	0.2990
E10 Eaves (insulation at ceiling level)	44.5000	0.0820	3.6490
E12 Gable (insulation at ceiling level)	3.5000	0.0820	0.2870
E11 Eaves (insulation at rafter level)	9.0000	0.0750	0.6750
E16 Corner (normal)	48.5000	0.0540	2.6190

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.5265 (36)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 153.6183 (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	124.3810	123.7529	123.1373	120.2458	119.7048	117.1863	117.1863	116.7199	118.1564	119.7048	120.7992	121.9434 (38)
Heat transfer coeff	277.9992	277.3712	276.7556	273.8640	273.3230	270.8046	270.8046	270.3382	271.7746	273.3230	274.4175	275.5616 (39)
Average = Sum(39)m / 12 =												273.8614

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0491	1.0467	1.0444	1.0334	1.0314	1.0219	1.0219	1.0201	1.0256	1.0314	1.0355	1.0399 (40)
HLP (average)												1.0334
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0864 (42)
Hot water usage for mixer showers 85.4653 84.1809 82.3093 78.7284 76.0857 73.1387 71.4636 73.3210 75.3571 78.5213 82.1792 85.1379 (42a)
Hot water usage for baths 32.7924 32.3054 31.6196 30.3551 29.4082 28.3583 27.7912 28.4722 29.2137 30.3372 31.6277 32.6816 (42b)
Hot water usage for other uses 46.2381 44.5567 42.8754 41.1940 39.5126 37.8312 37.8312 39.5126 41.1940 42.8754 44.5567 46.2381 (42c)
Average daily hot water use (litres/day) 151.2346 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576 (44)
Energy conte	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745 (45)
Energy content (annual)										Total = Sum(45)m =		2511.9926
Distribution loss (46)m = 0.15 x (45)m	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss												
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)

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If cylinder contains dedicated solar storage											
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month											
	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301 (64)
Total per year (kWh/year) = Sum(64)m =											3180.0886 (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 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month											
	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476 (65)
											130.8047 (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	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050 (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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Water heating gains (Table 5)	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128 (72)
Total internal gains	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430 (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
Northeast				11.0000	11.2829		0.6300		0.7000		0.7700		37.9303 (75)
Southeast				3.0000	36.7938		0.6300		0.7000		0.7700		33.7340 (77)
Southwest				30.0000	36.7938		0.6300		0.7000		0.7700		337.3402 (79)
Northwest				0.5000	11.2829		0.6300		0.7000		0.7700		1.7241 (81)
Southwest				1.5000	39.9751		0.6300		0.7000		1.0000		23.7992 (82)
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879	(83)
Total gains	1424.9695	1744.6358	2033.6341	2300.7638	2468.5659	2428.6416	2327.1705	2156.9343	1976.0487	1688.6253	1429.1708	1331.9309	(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	39.7183	39.8083	39.8968	40.3181	40.3979	40.7736	40.7736	40.8439	40.6280	40.3979	40.2368	40.0697
alpha	3.6479	3.6539	3.6598	3.6879	3.6932	3.7182	3.7182	3.7229	3.7085	3.6932	3.6825	3.6713
util living area	0.9906	0.9801	0.9572	0.9028	0.7983	0.6404	0.4904	0.5426	0.7665	0.9350	0.9830	0.9926 (86)
MIT	19.4423	19.6583	19.9724	20.3502	20.6548	20.8354	20.8939	20.8835	20.7514	20.3376	19.8136	19.4042 (87)
Th 2	20.0427	20.0446	20.0465	20.0556	20.0572	20.0651	20.0651	20.0666	20.0621	20.0572	20.0538	20.0503 (88)
util rest of house	0.9887	0.9760	0.9482	0.8820	0.7554	0.5676	0.3949	0.4455	0.7035	0.9168	0.9788	0.9911 (89)
MIT 2	18.1980	18.4740	18.8718	19.3455	19.7035	19.8989	19.9473	19.9424	19.8199	19.3406	18.6804	18.1549 (90)
Living area fraction	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869 (92)
MIT	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9837	0.9677	0.9355	0.8660	0.7424	0.5620	0.3930	0.4427	0.6926	0.9016	0.9712	0.9870 (94)
Useful gains	1401.7829	1688.2263	1902.3697	1992.5512	1832.5983	1364.8084	914.5625	954.9242	1368.5581	1522.5333	1387.9841	1314.5771 (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	3900.1783	3799.7395	3456.1544	2889.7240	2215.0093	1461.7622	933.5439	984.5193	1581.2715	2417.7886	3210.7204	3881.8129 (97)
Space heating kWh	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234 (98a)
Space heating requirement - total per year (kWh/year)												9252.7005
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	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9252.7005
Space heating per m2												34.9159 (99)

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

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Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	219.3000	(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	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	847.6088	647.0300	527.1390	294.5574	129.7372	0.0000	0.0000	0.0000	0.0000	303.7255	598.4360	870.9637	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.9453	-64.8155	-100.8408	-119.9429	-131.3185	-117.3179	-115.6504	-106.0870	-89.9128	-75.4726	-47.7074	-35.6503	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4219.1977	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1670.2146	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	381.2835	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1046.6615	(233)
Wind generation	-3575.5408	(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	2721.1557	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4219.1977	16.4900	695.7457	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1670.2146	16.4900	275.4184	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	381.2835	16.4900	62.8736	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1046.6615	16.4900	-172.5945	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-172.5945	(252)
Wind Turbine electricity used in dwelling	-2502.8785	16.4900	-412.7247	
Wind Turbine electricity exported	0.0000	5.5900	0.0000	
Total			-412.7247	(252)
Total energy cost			448.7186	(255)

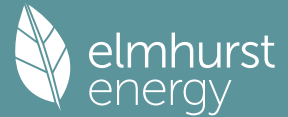
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.5211	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	91.5531	
SAP rating (Section 12)		92	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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Space heating - main system 1	4219.1977	0.1553	655.2219 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			890.6823 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1046.6615	0.1339	-140.1676
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-140.1676 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-347.1801 (269)
Total CO2, kg/year			458.3656 (272)
CO2 emissions per m2			1.7300 (273)
EI value			98.0187
EI rating			98 (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	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1067 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3567 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3032 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.9000	3.5000	3.5000	3.4000	3.4000	3.1000	3.2000	3.0000	2.9000	3.1000	3.0000	3.3000 (22)
Wind factor	0.9750	0.8750	0.8750	0.8500	0.8500	0.7750	0.8000	0.7500	0.7250	0.7750	0.7500	0.8250 (22a)
Adj infilt rate	0.2956	0.2653	0.2653	0.2577	0.2577	0.2350	0.2426	0.2274	0.2198	0.2350	0.2274	0.2502 (22b)
Effective ac	0.5437	0.5352	0.5352	0.5332	0.5332	0.5276	0.5294	0.5259	0.5242	0.5276	0.5259	0.5313 (25)

3. Heat losses and heat loss parameter

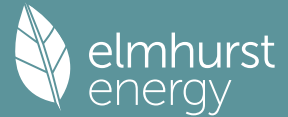
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.0918		(33)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E3 Sill	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160

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E6 Intermediate floor within dwelling						57.0000		0.0040		0.2280			
E20 Exposed floor (normal)						6.5000		0.0460		0.2990			
E10 Eaves (insulation at ceiling level)						44.5000		0.0820		3.6490			
E12 Gable (insulation at ceiling level)						3.5000		0.0820		0.2870			
E11 Eaves (insulation at rafter level)						9.0000		0.0750		0.6750			
E16 Corner (normal)						48.5000		0.0540		2.6190			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											16.5265	(36)	
Point Thermal bridges											0.0000		
Total fabric heat loss									(33) + (36) + (36a) =		153.6183	(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	117.6651	115.8245	115.8245	115.3954	115.3954	114.1829	114.5746	113.8035	113.4366	114.1829	113.8035	114.9788	(38)
Average = Sum(39)m / 12 =	271.2834	269.4428	269.4428	269.0137	269.0137	267.8011	268.1929	267.4218	267.0549	267.8011	267.4218	268.5971	(39)
												268.5406	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0237	1.0168	1.0168	1.0151	1.0151	1.0106	1.0120	1.0091	1.0078	1.0106	1.0091	1.0136	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy												3.0864	(42)
Hot water usage for mixer showers													
	85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379	(42a)
Hot water usage for baths													
	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	(42b)
Hot water usage for other uses													
	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	(42c)
Average daily hot water use (litres/day)												151.2346	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576	(44)
Energy conte	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745	(45)
Energy content (annual)										Total = Sum(45)m =		2511.9926	
Distribution loss (46)m = 0.15 x (45)m													
	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312	(46)
Water storage loss (or HIU loss):													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0800	(55)
Total storage loss													
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
If cylinder contains dedicated solar storage													
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
									Total per year (kWh/year) = Sum(64)m =			3180.0886	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month													
	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047	(65)

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

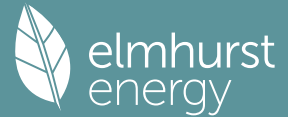
Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219	(68)
Pumps, fans	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Total internal gains	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128	(72)
	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430	(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						
Northeast			11.0000	14.6130	0.6300	0.7000	0.7700	49.1253	(75)				
Southeast			3.0000	45.0642	0.6300	0.7000	0.7700	41.3166	(77)				
Southwest			30.0000	45.0642	0.6300	0.7000	0.7700	413.1660	(79)				
Northwest			0.5000	14.6130	0.6300	0.7000	0.7700	2.2330	(81)				
Southwest			1.5000	50.1759	0.6300	0.7000	1.0000	29.8722	(82)				

Solar gains	535.7130	795.0814	1135.4145	1529.9207	1730.0072	1893.4468	1783.8811	1589.2775	1340.1542	962.3448	628.5378	448.1700	(83)
Total gains	1526.1547	1783.1746	2092.0403	2428.7062	2568.5535	2678.1187	2536.7621	2345.6442	2127.0393	1803.3810	1534.2216	1410.2131	(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	40.7016	40.9796	40.9796	41.0450	41.0450	41.2308	41.1706	41.2893	41.3461	41.2308	41.2893	41.1087
alpha	3.7134	3.7320	3.7320	3.7363	3.7363	3.7487	3.7447	3.7526	3.7564	3.7487	3.7526	3.7406
util living area	0.9863	0.9761	0.9453	0.8699	0.7357	0.5300	0.3840	0.4121	0.6817	0.9004	0.9735	0.9893 (86)
MIT	19.6276	19.7845	20.1166	20.4784	20.7471	20.8808	20.9093	20.9073	20.8231	20.4937	20.0037	19.5936 (87)
Th 2	20.0636	20.0694	20.0694	20.0707	20.0707	20.0745	20.0733	20.0757	20.0769	20.0745	20.0757	20.0720 (88)
util rest of house	0.9833	0.9712	0.9338	0.8430	0.6834	0.4526	0.2911	0.3136	0.6071	0.8729	0.9669	0.9870 (89)
MIT 2	18.4496	18.6525	19.0696	19.5105	19.8146	19.9456	19.9645	19.9662	19.9017	19.5420	18.9375	18.4127 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.5741	18.7721	19.1802	19.6128	19.9131	20.0444	20.0643	20.0657	19.9991	19.6425	19.0502	18.5375 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5741	18.7721	19.1802	19.6128	19.9131	20.0444	20.0643	20.0657	19.9991	19.6425	19.0502	18.5375 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9769	0.9621	0.9200	0.8276	0.6736	0.4500	0.2902	0.3125	0.6002	0.8572	0.9570	0.9817 (94)
Useful gains	1490.8836	1715.5034	1924.6483	2010.1013	1730.2584	1205.1814	736.1114	732.9159	1276.6206	1545.7860	1468.2608	1384.3595 (95)
Ext temp.	5.1000	5.4000	7.2000	9.6000	12.6000	15.4000	17.3000	17.3000	14.8000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	3655.2960	3603.0107	3227.9852	2693.5747	1967.3249	1243.7673	741.3665	739.6031	1388.4397	2180.5768	2955.0571	3609.2666 (97)
Space heating kWh	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98a)
Space heating requirement - total per year (kWh/year)												7714.9972
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	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7714.9972
Space heating per m2										(98c) / (4) =		29.1132 (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 %)

219.3000 (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	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	734.3013	578.3880	442.1717	224.3962	80.4275	0.0000	0.0000	0.0000	0.0000	215.3600	488.1411	754.8248 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-51.1804	-68.2970	-105.2708	-126.4769	-134.2588	-128.6340	-125.5742	-115.9811	-98.8059	-83.2508	-56.3485	-42.9191 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3518.0106 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												1670.2146 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												381.2835 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1136.9973 (233)

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Wind generation	-3575.5408 (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	1929.6328 (238)

10a. Fuel costs - using BEDF prices (587)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3518.0106	28.4300	1000.1704 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	28.4300	474.8420 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	381.2835	28.4300	108.3989 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1136.9973	28.4300	-323.2483
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-323.2483 (252)
Wind Turbine electricity used in dwelling	-2502.8785	28.4300	-711.5684
Wind Turbine electricity exported	0.0000	5.8100	0.0000
Total			-711.5684 (252)
Total energy cost			548.5946 (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	3518.0106	0.1559	548.6253 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			784.0856 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1136.9973	0.1341	-152.4303
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-152.4303 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-347.1801 (269)
Total CO2, kg/year			339.5063 (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	3518.0106	1.5774	5549.1341 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	1.5213	2540.8682 (278)
Space and water heating			8090.0023 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	381.2835	1.5338	584.8253 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1136.9973	1.4954	-1700.3196
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1700.3196 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.5128	-3786.3546
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-3786.3546 (283)
Total Primary energy kWh/year			3188.1534 (286)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Thu 11 Dec 2025 10:09:30

Project Information			
Assessed By	Joe Solti	Building Type	House, Detached
OCDEA Registration	EES/003578	Assessment Date	2025-12-11

Dwelling Details			
Assessment Type	As designed	Total Floor Area	265 m ²
Site Reference	DJ-10	Plot Reference	DJ1004 (Be Green)
Address	Land East of Spring Gardens, Washington, RH20 3BP		

Client Details	
Name	.
Company	KG Designs
Address	Longacre, Bentons Lane, Dial Post, Horsham, RH13 8NW

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	7.45 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	2.85 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	39.51 kWh _{PE} /m ²		
Dwelling primary energy	29.48 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	39.1 kWh/m ²		
Dwelling fabric energy efficiency	38.3 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.19	Walls (1) (0.22)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.13	Exposed Floor (0.18)	OK
Roofs	0.16	0.11	Roof (2) (0.14)	OK
Windows, doors, and roof windows	1.6	1.2	Doors (NE) (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	112	0.22
Exposed wall: Walls (2)	108.5	0.16
Ground floor: Ground Floor, Ground Floor	133	0.13
Upper floor: Exposed Floor, Exposed Floor	9.5	0.18
Exposed roof: Roof (1)	136	0.11
Exposed roof: Roof (2)	9	0.14

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Doors (NE), Doors (part glazed)	2	North East	N/A	1.2
Doors (NE), Doors (solid)	2	North East	N/A	1.2
Doors (NW), Doors (part glazed)	2	North West	N/A	1.2
Windows (NE), Windows	7	North East	0.7	1.2
Windows (NE), Windows	4	North East	0.7	1.2
Windows (NW), Windows	0.5	North West	0.7	1.2
Windows (SE), Windows	1.5	South East	0.7	1.2
Windows (SE), Windows	1.5	South East	0.7	1.2
Windows (SW), Windows	18	South West	0.7	1.2
Windows (SW), Windows	12	South West	0.7	1.2
Roof Windows, Roof Windows	1.5	South West	0.7	1.2

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.144	
External wall	E3: Sill	Calculated by person with suitable expertise	0.021 (!)	
External wall	E3: Sill	Calculated by person with suitable expertise	0.048	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.016 (!)	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.064	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.054	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.004 (!)	
External wall	E20: Exposed floor (normal)	Calculated by person with suitable expertise	0.046	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.082	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.082	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.075	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.054	
3 Air permeability (better than typically expected values are flagged with a subsequent (!))				
Maximum permitted air permeability at 50Pa		8 m ³ /hm ²		
Dwelling air permeability at 50Pa		5 m ³ /hm ² , Design value		OK
Air permeability test certificate reference				
4 Space heating				
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity				
Efficiency	219.3%			
Emitter type	Both radiators and underfloor			
Flow temperature				
System type	Air source heat pump			
Manufacturer				
Model				
Commissioning				
Secondary heating system: Closed room heater				
Fuel	Dual fuel appliance (mineral and wood)			
Efficiency	65.0%			
Commissioning				
5 Hot water				
Cylinder/store - type: Cylinder				
Capacity	300 litres			
Declared heat loss	2 kWh/day			
Primary pipework insulated	Yes			
Manufacturer				
Model				
Commissioning				
Waste water heat recovery system 1 - type: N/A				
Efficiency				
Manufacturer				
Model				

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	2 kWp	
Orientation	South West	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

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Plot Reference	DJ-10			Issued on Date	11/12/2025
Assessment Reference	DJ1004 (Be Green)	Plot Type Ref	New Dwelling		
Plot Address	Land East of Spring Gardens, Washington, West Sussex, RH20 3BP			SAP Version	10.2
SAP Rating	85 B	DER	2.85	TER	7.45
Environmental	97 A	% DER < TER			61.74
CO ₂ Emissions (t/year)	0.6	DFEE	38.30	TFEE	39.11
Compliance Check	See BREL	% DFEE < TFEE			2.07
% DPER < TPER	25.39	DPER	29.48	TPER	39.51
Assessor Details	Mr. Joe Solti			Assessor ID	5122-0001
Client	KG Designs, .				

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	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (5)

2. Ventilation rate

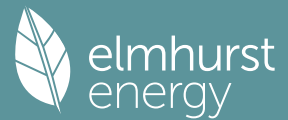
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 70.0000 / (5) = 0.1067 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3567 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3032 (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	0.3866	0.3790	0.3715	0.3336	0.3260	0.2881	0.2881	0.2805	0.3032	0.3260	0.3411	0.3563 (22b)
Effective ac	0.5747	0.5718	0.5690	0.5556	0.5531	0.5415	0.5415	0.5393	0.5460	0.5531	0.5582	0.5635 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m ²)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.0918		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				26.0000	0.0500	1.3000	
E2 Other lintels (including other steel lintels)				13.0000	0.1440	1.8720	
E3 Sill				11.5000	0.0210	0.2415	

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E3 Sill								4.5000	0.0480	0.2160		
E4 Jamb								49.0000	0.0160	0.7840		
E4 Jamb								22.5000	0.0640	1.4400		
E5 Ground floor (normal)								54.0000	0.0540	2.9160		
E6 Intermediate floor within a dwelling								57.0000	0.0040	0.2280		
E20 Exposed floor (normal)								6.5000	0.0460	0.2990		
E10 Eaves (insulation at ceiling level)								44.5000	0.0820	3.6490		
E12 Gable (insulation at ceiling level)								3.5000	0.0820	0.2870		
E11 Eaves (insulation at rafter level)								9.0000	0.0750	0.6750		
E16 Corner (normal)								48.5000	0.0540	2.6190		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											16.5265	(36)
Point Thermal bridges											0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	153.6183 (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	124.3810	123.7529	123.1373	120.2458	119.7048	117.1863	117.1863	116.7199	118.1564	119.7048	120.7992	121.9434 (38)
Average = Sum(39)m / 12 =	277.9992	277.3712	276.7556	273.8640	273.3230	270.8046	270.8046	270.3382	271.7746	273.3230	274.4175	275.5616 (39)
												273.8614
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0491	1.0467	1.0444	1.0334	1.0314	1.0219	1.0219	1.0201	1.0256	1.0314	1.0355	1.0399 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												3.0864 (42)
Hot water usage for mixer showers												
	85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379 (42a)
Hot water usage for baths												
	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816 (42b)
Hot water usage for other uses												
	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381 (42c)
Average daily hot water use (litres/day)												151.2346 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576 (44)
Energy conte	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												2511.9926
	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss												
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage												
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
12Total per year (kWh/year)												3180.0886 (64)
Electric shower(s)												3180 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047 (65)

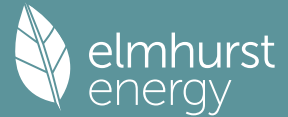
5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	222.2254	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227 (68)
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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Water heating gains (Table 5)	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128 (72)
Total internal gains	898.2273	923.5296	882.7336	853.5422	808.2053	779.1389	747.7691	747.4140	770.8587	796.3608	846.1061	877.6573 (73)

6. Solar gains												

[Jan]												
	Area											
	m2											
	Solar flux											
	Table 6a											
	W/m2											
	Specific data											
	or Table 6b											
	g											
	Specific data											
	or Table 6c											
	FF											
	Access											
	factor											
	Table 6d											
	Gains											
	W											
Northeast	11.0000											37.9303 (75)
Southeast	3.0000											33.7340 (77)
Southwest	30.0000											337.3402 (79)
Northwest	0.5000											1.7241 (81)
Southwest	1.5000											23.7992 (82)

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Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1332.7552	1680.0722	1959.7419	2255.5205	2438.2250	2423.1087	2322.0587	2147.9816	1960.0222	1643.9499	1369.5931	1247.5452 (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	39.7183	39.8083	39.8968	40.3181	40.3979	40.7736	40.7736	40.8439	40.6280	40.3979	40.2368	40.0697
alpha	3.6479	3.6539	3.6598	3.6879	3.6932	3.7182	3.7182	3.7229	3.7085	3.6932	3.6825	3.6713
util living area	0.9925	0.9823	0.9615	0.9075	0.8030	0.6415	0.4913	0.5445	0.7699	0.9396	0.9851	0.9941 (86)
MIT	19.4018	19.6311	19.9440	20.3363	20.6489	20.8350	20.8938	20.8831	20.7488	20.3218	19.7881	19.3668 (87)
Th 2	20.0427	20.0446	20.0465	20.0556	20.0572	20.0651	20.0651	20.0666	20.0621	20.0572	20.0538	20.0503 (88)
util rest of house	0.9909	0.9786	0.9533	0.8874	0.7605	0.5686	0.3957	0.4471	0.7072	0.9223	0.9814	0.9928 (89)
MIT 2	18.1463	18.4396	18.8366	19.3292	19.6974	19.8985	19.9472	19.9421	19.8175	19.3218	18.6483	18.1071 (90)
Living area fraction									fLA =	Living area / (4) =		0.1057 (91)
MIT	18.2790	18.5655	18.9536	19.4356	19.7979	19.9975	20.0472	20.0416	19.9159	19.4275	18.7687	18.2402 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2790	18.5655	18.9536	19.4356	19.7979	19.9975	20.0472	20.0416	19.9159	19.4275	18.7687	18.2402 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9867	0.9709	0.9411	0.8715	0.7473	0.5630	0.3938	0.4444	0.6961	0.9075	0.9744	0.9893 (94)
Useful gains	1314.9750	1631.1148	1844.3467	1965.5782	1822.1276	1364.1380	914.4110	954.4952	1364.2808	1491.8146	1334.5844	1234.2217 (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	3886.1493	3790.4243	3446.6022	2885.3185	2213.3527	1461.6611	933.5207	984.4540	1580.6026	2412.7553	3202.0929	3868.9422 (97)
Space heating kWh	1912.9537	1451.0560	1192.0781	662.2130	291.0714	0.0000	0.0000	0.0000	0.0000	685.1799	1344.6061	1960.2320 (98a)
Space heating requirement - total per year (kWh/year)												9499.3903
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	1912.9537	1451.0560	1192.0781	662.2130	291.0714	0.0000	0.0000	0.0000	0.0000	685.1799	1344.6061	1960.2320 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9499.3903
Space heating per m2										(98c) / (4) =		35.8468 (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 %)												219.3000 (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	1912.9537	1451.0560	1192.0781	662.2130	291.0714	0.0000	0.0000	0.0000	0.0000	685.1799	1344.6061	1960.2320 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	872.2999	661.6762	543.5833	301.9667	132.7275	0.0000	0.0000	0.0000	0.0000	312.4395	613.1355	893.8586 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-46.3355	-75.2526	-123.1414	-155.2747	-179.0360	-165.8585	-163.7271	-147.9762	-122.0864	-92.7572	-54.2581	-38.9712 (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	-1.2509	-3.7563	-10.3163	-21.9163	-38.3677	-47.2548	-46.8368	-37.0067	-24.0526	-7.9497	-2.1085	-0.9024 (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												4331.6873 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												1670.2146 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

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Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	381.2835 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1606.3939 (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	4776.7914 (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	4331.6873	0.1553	672.6968 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			908.1572 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1364.6749	0.1326	-180.9756
PV Unit electricity exported	-241.7190	0.1163	-28.1034
Total			-209.0791 (269)
Total CO2, kg/year			754.1091 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.8500 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4331.6873	1.5749	6822.1116 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	1.5213	2540.8682 (278)
Space and water heating			9362.9798 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	381.2835	1.5338	584.8253 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1364.6749	1.4900	-2033.3910
PV Unit electricity exported	-241.7190	0.4261	-102.9864
Total			-2136.3774 (283)
Total Primary energy kWh/year			7811.4277 (286)
Dwelling Primary energy Rate (DPER)			29.4800 (287)

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

1. Overall dwelling characteristics

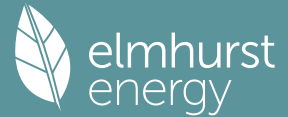
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0610 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3110 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2643 (21)

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

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Adj infilt rate	0.3370	0.3304	0.3238	0.2908	0.2842	0.2511	0.2511	0.2445	0.2643	0.2842	0.2974	0.3106 (22b)
Effective ac	0.5568	0.5546	0.5524	0.5423	0.5404	0.5315	0.5315	0.5299	0.5349	0.5404	0.5442	0.5482 (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			2.0000	1.0000	2.0000		(26)
TER Semi-glazed door			4.0000	1.0000	4.0000		(26a)
TER Opening Type			44.5000	1.1450	50.9542		(27)
TER Roof Window			1.5000	1.1450	2.1226		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1300	1.2350		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.1800	20.1600		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1800	19.5300		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1100	0.9900		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	133.2418		(33)

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

150.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.0500	0.6500
E3 Sill	11.5000	0.0500	0.5750
E3 Sill	4.5000	0.0500	0.2250
E4 Jamb	49.0000	0.0500	2.4500
E4 Jamb	22.5000	0.0500	1.1250
E5 Ground floor (normal)	54.0000	0.1600	8.6400
E6 Intermediate floor within a dwelling	57.0000	0.0000	0.0000
E20 Exposed floor (normal)	6.5000	0.3200	2.0800
E10 Eaves (insulation at ceiling level)	44.5000	0.0600	2.6700
E12 Gable (insulation at ceiling level)	3.5000	0.0600	0.2100
E11 Eaves (insulation at rafter level)	9.0000	0.0400	0.3600
E16 Corner (normal)	48.5000	0.0900	4.3650

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

24.6500 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 157.8918 (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	120.4989	120.0216	119.5537	117.3562	116.9451	115.0311	115.0311	114.6767	115.7683	116.9451	117.7768	118.6464 (38)
Heat transfer coeff	278.3907	277.9134	277.4456	275.2480	274.8369	272.9229	272.9229	272.5685	273.6602	274.8369	275.6686	276.5382 (39)
Average = Sum(39)m / 12 =												275.2461

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0505	1.0487	1.0470	1.0387	1.0371	1.0299	1.0299	1.0286	1.0327	1.0371	1.0403	1.0435 (40)
HLP (average)												1.0387
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

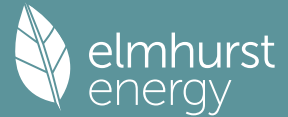
4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0864 (42)
Hot water usage for mixer showers												
75.9692	74.8275	73.1639	69.9808	67.6318	65.0122	63.5232	65.1742	66.9841	69.7967	73.0482	75.6781	(42a)
Hot water usage for baths												
32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	(42b)
Hot water usage for other uses												
46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	(42c)
Average daily hot water use (litres/day)												142.4795 (43)
Daily hot water use												
154.9998	151.6897	147.6588	141.5299	136.5526	131.2017	129.1456	133.1590	137.3918	143.0093	149.2327	154.5978	(44)
Energy conte	245.4817	216.0041	226.9461	193.7473	183.8260	161.3278	156.1904	164.8787	169.4178	194.0622	212.6093	242.0628 (45)
Energy content (annual)										Total = Sum(45)m =		2366.5543
Distribution loss (46)m = 0.15 x (45)m												
36.8223	32.4006	34.0419	29.0621	27.5739	24.1992	23.4286	24.7318	25.4127	29.1093	31.8914	36.3094	(46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1409 (55)
Total storage loss												
35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage												
35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
304.1105	268.9591	285.5750	250.4849	242.4549	218.0653	214.8192	223.5075	226.1554	252.6911	269.3469	300.6916	(62)
WWHRS	-34.7299	-30.7154	-32.1634	-26.6326	-24.8206	-21.2392	-19.9083	-21.1705	-21.9749	-25.9060	-29.3483	-34.0868 (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												
269.3806	238.2437	253.4115	223.8523	217.6342	196.8262	194.9109	202.3370	204.1805	226.7851	239.9985	266.6049	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2734.1653 (64)
Electric shower(s)												2734 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
128.5257	114.1854	122.3626	109.8110	108.0252	99.0315	98.8364	101.7252	101.7215	111.4287	116.0826	127.3889	(65)

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

Metabolic gains (Table 5), Watts

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	229.6330	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	(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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Water heating gains (Table 5)	172.7496	169.9188	164.4659	152.5153	145.1952	137.5438	132.8446	136.7274	141.2798	149.7698	161.2259	171.2217	(72)
Total internal gains	896.5344	921.9678	881.4801	853.0405	808.1476	776.5527	745.5058	744.9343	768.1191	796.0982	845.1270	876.0663	(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	

Northeast					11.0000	11.2829	0.6300	0.7000			0.7700	37.9303 (75)	
Southeast					3.0000	36.7938	0.6300	0.7000			0.7700	33.7340 (77)	
Southwest					30.0000	36.7938	0.6300	0.7000			0.7700	337.3402 (79)	
Northwest					0.5000	11.2829	0.6300	0.7000			0.7700	1.7241 (81)	
Southwest					1.5000	39.9751	0.6300	0.7000			1.0000	23.7992 (82)	

Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879	(83)
Total gains	1331.0623	1678.5104	1958.4885	2255.0188	2438.1672	2420.5225	2319.7953	2145.5018	1957.2826	1643.6873	1368.6140	1245.9541	(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	39.6625	39.7306	39.7976	40.1153	40.1753	40.4571	40.4571	40.5097	40.3481	40.1753	40.0541	39.9282		
alpha	3.6442	3.6487	3.6532	3.6744	3.6784	3.6971	3.6971	3.7006	3.6899	3.6784	3.6703	3.6619		
util living area	0.9925	0.9824	0.9617	0.9081	0.8044	0.6449	0.4947	0.5482	0.7724	0.9400	0.9852	0.9941	(86)	
MIT	18.9776	19.2821	19.6985	20.2180	20.6373	20.8865	20.9675	20.9526	20.7701	20.1990	19.4866	18.9255	(87)	
Th 2	20.0414	20.0429	20.0444	20.0512	20.0525	20.0585	20.0585	20.0596	20.0562	20.0525	20.0499	20.0472	(88)	
util rest of house	0.9909	0.9787	0.9535	0.8880	0.7619	0.5716	0.3981	0.4499	0.7097	0.9227	0.9815	0.9928	(89)	
MIT 2	17.6527	18.0413	18.5688	19.2167	19.7099	19.9753	20.0425	20.0343	19.8675	19.2063	18.3088	17.5898	(90)	
Living area fraction									fLA = Living area / (4) =			0.1057	(91)	
MIT	17.7927	18.1724	18.6882	19.3225	19.8078	20.0716	20.1402	20.1313	19.9628	19.3112	18.4332	17.7310	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.7927	18.1724	18.6882	19.3225	19.8078	20.0716	20.1402	20.1313	19.9628	19.3112	18.4332	17.7310	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9852	0.9684	0.9379	0.8692	0.7495	0.5727	0.4068	0.4578	0.7027	0.9051	0.9722	0.9880	(94)	
Useful gains	1311.3011	1625.4248	1836.8307	1960.0771	1827.5144	1386.3321	943.7138	982.2266	1375.3504	1487.6451	1330.6289	1231.0475	(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	3756.2501	3688.5760	3381.5535	2868.7607	2228.3356	1493.3243	966.2011	1017.0428	1604.4241	2394.1553	3124.2209	3741.8300	(97)	
Space heating kWh	1819.0421	1386.4376	1149.2738	654.2522	298.2110	0.0000	0.0000	0.0000	0.0000	674.4436	1291.3862	1868.0222	(98a)	
Space heating requirement - total per year (kWh/year)												9141.0686		
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	1819.0421	1386.4376	1149.2738	654.2522	298.2110	0.0000	0.0000	0.0000	0.0000	674.4436	1291.3862	1868.0222	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												9141.0686		
Space heating per m ²										(98c) / (4) =		34.4946	(99)	

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													92.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1819.0421	1386.4376	1149.2738	654.2522	298.2110	0.0000	0.0000	0.0000	0.0000	674.4436	1291.3862	1868.0222	(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)	1970.7931	1502.0993	1245.1504	708.8323	323.0888	0.0000	0.0000	0.0000	0.0000	730.7082	1399.1183	2023.8593	(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	269.3806	238.2437	253.4115	223.8523	217.6342	196.8262	194.9109	202.3370	204.1805	226.7851	239.9985	266.6049	(64)	
Efficiency of water heater	87.5267	87.3553	87.0268	86.3183	84.7666	79.8000	79.8000	79.8000	79.8000	86.3494	87.2577	87.5665	(216)	
(217)m													(217)	

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Fuel for water heating, kWh/month	307.7696	272.7296	291.1879	259.3336	256.7453	246.6493	244.2492	253.5551	255.8653	262.6367	275.0457	304.4597	(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	46.1741	37.0425	33.3527	24.4356	18.8748	15.4209	17.2182	22.3809	29.0705	38.1421	43.0814	47.4574	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-106.3719	-141.6157	-192.2308	-203.5227	-209.1064	-191.2324	-188.4550	-182.5596	-171.2612	-155.2418	-113.7421	-92.9368	(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	-88.3663	-181.7133	-353.9191	-521.5973	-680.5765	-680.8927	-673.2372	-574.4473	-426.7846	-256.8822	-116.9273	-70.2382	(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												9903.6497	(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												3230.2270	(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)												372.6511	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-6573.8582	(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												7018.6695	(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	9903.6497	0.2100	2079.7664	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3230.2270	0.2100	678.3477	(264)
Space and water heating			2758.1141	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	372.6511	0.1443	53.7851	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1948.2762	0.1359	-264.7578	
PV Unit electricity exported	-4625.5820	0.1265	-584.9097	
Total			-849.6674	(269)
Total CO2, kg/year			1974.1610	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.4500	(273)

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

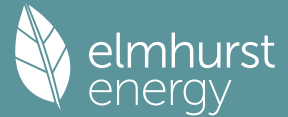
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	9903.6497	1.1300	11191.1241	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3230.2270	1.1300	3650.1565	(278)
Space and water heating			14841.2806	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	372.6511	1.5338	571.5847	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1948.2762	1.5023	-2926.9163	
PV Unit electricity exported	-4625.5820	0.4642	-2147.1300	
Total			-5074.0463	(283)
Total Primary energy kWh/year			10468.9197	(286)
Target Primary Energy Rate (TPER)			39.5100	(287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)	
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (5)	

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2. Ventilation rate

													m3 per hour
Number of open chimneys													0 * 80 = 0.0000 (6a)
Number of open flues													0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire													0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler													0 * 20 = 0.0000 (6d)
Number of flues attached to other heater													0 * 35 = 0.0000 (6e)
Number of blocked chimneys													0 * 20 = 0.0000 (6f)
Number of intermittent extract fans													4 * 10 = 40.0000 (7a)
Number of passive vents													0 * 10 = 0.0000 (7b)
Number of flueless gas fires													0 * 40 = 0.0000 (7c)
													Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												40.0000 / (5) = 0.0610 (8)
Pressure test													Yes
Pressure Test Method													Blower Door
Measured/design AP50													5.0000 (17)
Infiltration rate													0.3110 (18)
Number of sides sheltered													2 (19)
Shelter factor													(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) = 0.2643 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.3370	0.3304	0.3238	0.2908	0.2842	0.2511	0.2511	0.2445	0.2643	0.2842	0.2974	0.3106	(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	0.5568	0.5546	0.5524	0.5423	0.5404	0.5315	0.5315	0.5299	0.5349	0.5404	0.5442	0.5482	(25)

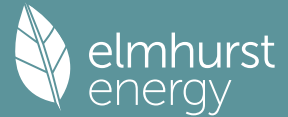
3. Heat losses and heat loss parameter

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													
Doors (part glazed)			4.0000	1.2000	4.8000			(26a)					
Doors (solid)			2.0000	1.2000	2.4000			(26)					
Windows			44.5000	1.1450	50.9542			(27)					
Roof Windows			1.5000	1.1450	1.7176			(27a)					
Ground Floor			133.0000	0.1300	17.2900			(28a)					
Exposed Floor			9.5000	0.1800	1.7100			(28b)					
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400			(29a)					
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600			(29a)					
Roof (loft)	136.0000		136.0000	0.1100	14.9600			(30)					
Roof (skeilings)	10.5000	1.5000	9.0000	0.1400	1.2600			(30)					
Total net area of external elements Aum(A, m2)			560.0000					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	137.0918		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							150.0000	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				26.0000	0.0500	1.3000							
E2 Other lintels (including other steel lintels)				13.0000	0.1440	1.8720							
E3 Sill				11.5000	0.0210	0.2415							
E3 Sill				4.5000	0.0480	0.2160							
E4 Jamb				49.0000	0.0160	0.7840							
E4 Jamb				22.5000	0.0640	1.4400							
E5 Ground floor (normal)				54.0000	0.0540	2.9160							
E6 Intermediate floor within a dwelling				57.0000	0.0040	0.2280							
E20 Exposed floor (normal)				6.5000	0.0460	0.2990							
E10 Eaves (insulation at ceiling level)				44.5000	0.0820	3.6490							
E12 Gable (insulation at ceiling level)				3.5000	0.0820	0.2870							
E11 Eaves (insulation at rafter level)				9.0000	0.0750	0.6750							
E16 Corner (normal)				48.5000	0.0540	2.6190							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.5265	(36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss							(33) + (36) + (36a) =	153.6183 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 120.4989	Feb 120.0216	Mar 119.5537	Apr 117.3562	May 116.9451	Jun 115.0311	Jul 115.0311	Aug 114.6767	Sep 115.7683	Oct 116.9451	Nov 117.7768	Dec 118.6464	(38)
Heat transfer coeff	274.1171	273.6398	273.1720	270.9745	270.5633	268.6493	268.6493	268.2949	269.3866	270.5633	271.3951	272.2646	(39)
Average = Sum(39)m / 12 =												270.9725	
HLP	Jan 1.0344	Feb 1.0326	Mar 1.0308	Apr 1.0225	May 1.0210	Jun 1.0138	Jul 1.0138	Aug 1.0124	Sep 1.0166	Oct 1.0210	Nov 1.0241	Dec 1.0274	(40)
HLP (average)												1.0225	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0864 (42)
Hot water usage for mixer showers													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	32.6816	(42b)
Hot water usage for other uses													
46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	46.2381	(42c)
Average daily hot water use (litres/day)													72.4384 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
79.0306	76.8622	74.4950	71.5491	68.9208	66.1895	65.6224	67.9848	70.4077	73.2125	76.1845	78.9197	78.9197	(44)
Energy conte	125.1651	109.4507	114.4960	97.9471	92.7807	81.3877	79.3646	84.1794	86.8197	99.3487	108.5388	123.5692	(45)
Energy content (annual)													Total = Sum(45)m = 1203.0477
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)

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Water storage loss (or HIU loss):												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
WWHRS	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338 (64)
Total per year (kWh/year)											1022.5906 (64)	
Electric shower(s)											1023 (64)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											60.8386 (64a)	692.0360 (64a)
Heat gains from water heating, kWh/month												
	41.8072	36.8102	39.1286	34.9355	34.1026	31.0184	31.0460	32.2748	32.5709	35.9098	37.5844	41.4681 (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	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	229.6330	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321 (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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Water heating gains (Table 5)	56.1925	54.7771	52.5922	48.5215	45.8368	43.0812	41.7284	43.3802	45.2374	48.2659	52.2006	55.7367 (72)
Total internal gains	776.9773	803.8262	766.6064	746.0466	705.7893	682.0901	654.3897	651.5870	672.0767	691.5942	733.1016	757.5813 (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			
Northeast				11.0000	11.2829	0.6300	0.7000	0.7700	37.9303 (75)			
Southeast				3.0000	36.7938	0.6300	0.7000	0.7700	33.7340 (77)			
Southwest				30.0000	36.7938	0.6300	0.7000	0.7700	337.3402 (79)			
Northwest				0.5000	11.2829	0.6300	0.7000	0.7700	1.7241 (81)			
Southwest				1.5000	39.9751	0.6300	0.7000	1.0000	23.7992 (82)			
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1211.5052	1560.3688	1843.6148	2148.0250	2335.8089	2326.0598	2228.6792	2052.1545	1861.2402	1539.1833	1256.5887	1127.4691 (84)

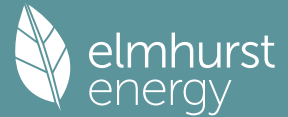
7. Mean internal temperature (heating season)

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	40.2808	40.3511	40.4202	40.7480	40.8099	41.1007	41.1007	41.1550	40.9882	40.8099	40.6848	40.5549
alpha	3.6854	3.6901	3.6947	3.7165	3.7207	3.7400	3.7400	3.7437	3.7325	3.7207	3.7123	3.7037
util living area	0.9945	0.9859	0.9674	0.9171	0.8165	0.6574	0.5059	0.5622	0.7882	0.9490	0.9887	0.9958 (86)
MIT	18.9412	19.2490	19.6696	20.1985	20.6268	20.8932	20.9665	20.9505	20.7597	20.1710	19.4513	18.8993 (87)
Th 2	20.0548	20.0563	20.0577	20.0646	20.0659	20.0719	20.0719	20.0730	20.0696	20.0659	20.0633	20.0606 (88)
util rest of house	0.9933	0.9829	0.9603	0.8986	0.7756	0.5848	0.4090	0.4637	0.7276	0.9340	0.9858	0.9949 (89)
MIT 2	18.1533	18.4601	18.8766	19.3940	19.7891	20.0045	20.0589	20.0522	19.9139	19.3776	18.6680	18.1057 (90)
Living area fraction	18.2365	18.5435	18.9604	19.4790	19.8776	20.0974	20.1548	20.1471	20.0032	19.4614	18.7508	0.1057 (91)
MIT	18.2365	18.5435	18.9604	19.4790	19.8776	20.0974	20.1548	20.1471	20.0032	19.4614	18.7508	18.1885 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2365	18.5435	18.9604	19.4790	19.8776	20.0974	20.1548	20.1471	20.0032	19.4614	18.7508	18.1885 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9900	0.9763	0.9496	0.8847	0.7663	0.5870	0.4180	0.4720	0.7227	0.9215	0.9801	0.9922 (94)
Useful gains	1199.4404	1523.4351	1750.6917	1900.2864	1789.9220	1365.3106	931.6295	968.6148	1345.1804	1418.3331	1231.6370	1118.6969 (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	3820.2469	3733.4016	3403.8393	2866.6446	2212.5515	1476.8678	954.9844	1005.3229	1590.2553	2397.5770	3161.9693	3808.5658 (97)
Space heating kWh	1949.8801	1485.0975	1229.9419	695.7779	314.4363	0.0000	0.0000	0.0000	0.0000	728.5575	1389.8392	2001.2624 (98a)
Space heating requirement - total per year (kWh/year)												9794.7928
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	1949.8801	1485.0975	1229.9419	695.7779	314.4363	0.0000	0.0000	0.0000	0.0000	728.5575	1389.8392	2001.2624 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9794.7928
Space heating per m ²												36.9615 (99)

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8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	2525.3039	1988.0052	2039.0413	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7991	0.8667	0.8313	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2017.9642	1723.0508	1695.1284	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	2591.3686	2482.6836	2283.0948	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	412.8512	565.1668	437.4470	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	103.2128	141.2917	109.3617	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												353.8662 (107)
Energy for space heating												36.9615 (99)
Energy for space cooling												1.3353 (108)
Total												38.2968 (109)
Fabric Energy Efficiency (DFEE)												38.3 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

2. Ventilation rate

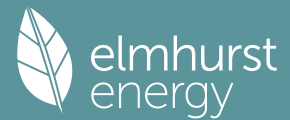
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.0610 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3110 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2643 (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	0.3370	0.3304	0.3238	0.2908	0.2842	0.2511	0.2511	0.2445	0.2643	0.2842	0.2974	0.3106 (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	0.5568	0.5546	0.5524	0.5423	0.5404	0.5315	0.5315	0.5299	0.5349	0.5404	0.5442	0.5482 (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							
TER Opaque door			2.0000	1.0000	2.0000		(26)
TER Semi-glazed door			4.0000	1.0000	4.0000		(26a)
TER Opening Type			44.5000	1.1450	50.9542		(27)
TER Roof Window			1.5000	1.1450	2.1226		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1300	1.2350		(28b)
Wall (cavity)	145.0000		112.0000	0.1800	20.1600		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1800	19.5300		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1100	0.9900		(30)
Total net area of external elements Aum(A, m ²)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	133.2418	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E2 Other lintels (including other steel lintels)	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.0500	0.6500
E3 Sill	11.5000	0.0500	0.5750
E3 Sill	4.5000	0.0500	0.2250
E4 Jamb	49.0000	0.0500	2.4500
E4 Jamb	22.5000	0.0500	1.1250
E5 Ground floor (normal)	54.0000	0.1600	8.6400
E6 Intermediate floor within a dwelling	57.0000	0.0000	0.0000
E20 Exposed floor (normal)	6.5000	0.3200	2.0800
E10 Eaves (insulation at ceiling level)	44.5000	0.0600	2.6700
E12 Gable (insulation at ceiling level)	3.5000	0.0600	0.2100
E11 Eaves (insulation at rafter level)	9.0000	0.0400	0.3600
E16 Corner (normal)	48.5000	0.0900	4.3650
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			24.6500 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	157.8918 (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	120.4989	120.0216	119.5537	117.3562	116.9451	115.0311	115.0311	114.6767	115.7683	116.9451	117.7768	118.6464	(38)
Heat transfer coeff	278.3907	277.9134	277.4456	275.2480	274.8369	272.9229	272.9229	272.5685	273.6602	274.8369	275.6686	276.5382	(39)
Average = Sum(39)m / 12 =												275.2461	
HLP	1.0505	1.0487	1.0470	1.0387	1.0371	1.0299	1.0299	1.0286	1.0327	1.0371	1.0403	1.0435	(40)
HLP (average)												1.0387	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0864 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	(42b)
Hot water usage for other uses	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	(42c)
Average daily hot water use (litres/day)												72.4384	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	79.0306	76.8622	74.4950	71.5491	68.9208	66.1895	65.6224	67.9848	70.4077	73.2125	76.1845	78.9197	(44)
Energy content (annual)	125.1651	109.4507	114.4960	97.9471	92.7807	81.3877	79.3646	84.1794	86.8197	99.3487	108.5388	123.5692	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
WWHRS	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338	(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	106.3904	93.0331	97.3216	83.2550	78.8636	69.1796	67.4599	71.5525	73.7968	84.4464	92.2580	105.0338	(64)
12Total per year (kWh/year)												1022.5906	(64)
Electric shower(s)												1023	(64)
Heat gains from water heating, kWh/month													
	60.8386	54.2077	59.1928	56.4869	57.5469	54.8941	56.7240	57.5469	56.4869	59.1928	58.0797	60.8386	(64a)
												692.0360	(64a)
	41.8072	36.8102	39.1286	34.9355	34.1026	31.0184	31.0460	32.2748	32.5709	35.9098	37.5844	41.4681	(65)

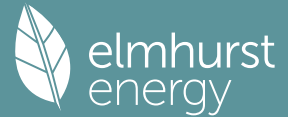
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	154.3215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	222.2254	246.0353	222.2254	229.6330	222.2254	229.6330	222.2254	222.2254	229.6330	222.2254	229.6330	222.2254	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	429.2629	433.7173	422.4923	398.5957	368.4305	340.0795	321.1393	316.6849	327.9099	351.8065	381.9717	410.3227	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	38.4321	(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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Water heating gains (Table 5)	56.1925	54.7771	52.5922	48.5215	45.8368	43.0812	41.7284	43.3802	45.2374	48.2659	52.2006	55.7367	(72)
Total internal gains	776.9773	803.8262	766.6064	746.0466	705.7893	682.0901	654.3897	651.5870	672.0767	691.5942	733.1016	757.5813	(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
Northeast	11.0000	11.2829	0.6300	0.7000	0.7700	37.9303 (75)
Southeast	3.0000	36.7938	0.6300	0.7000	0.7700	33.7340 (77)
Southwest	30.0000	36.7938	0.6300	0.7000	0.7700	337.3402 (79)
Northwest	0.5000	11.2829	0.6300	0.7000	0.7700	1.7241 (81)
Southwest	1.5000	39.9751	0.6300	0.7000	1.0000	23.7992 (82)

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Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1211.5052	1560.3688	1843.6148	2148.0250	2335.8089	2326.0598	2228.6792	2052.1545	1861.2402	1539.1833	1256.5887	1127.4691 (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	39.6625	39.7306	39.7976	40.1153	40.1753	40.4571	40.4571	40.5097	40.3481	40.1753	40.0541	39.9282
alpha	3.6442	3.6487	3.6532	3.6744	3.6784	3.6971	3.6971	3.7006	3.6899	3.6784	3.6703	3.6619
util living area	0.9945	0.9859	0.9678	0.9187	0.8202	0.6632	0.5121	0.5684	0.7924	0.9499	0.9887	0.9958 (86)
MIT	18.9069	19.2150	19.6383	20.1726	20.6095	20.8753	20.9636	20.9466	20.7476	20.1484	19.4220	18.8549 (87)
Th 2	20.0414	20.0429	20.0444	20.0512	20.0525	20.0585	20.0585	20.0596	20.0562	20.0525	20.0499	20.0472 (88)
util rest of house	0.9933	0.9830	0.9608	0.9003	0.7794	0.5899	0.4132	0.4682	0.7318	0.9350	0.9859	0.9948 (89)
MIT 2	18.1097	18.4168	18.8360	19.3590	19.7627	19.9866	20.0444	20.0371	19.8926	19.3457	18.6294	18.0619 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.1939	18.5011	18.9208	19.4450	19.8522	20.0805	20.1415	20.1332	19.9829	19.4305	18.7131	18.1457 (92)
Temperature adjustment												
adjusted MIT	18.1939	18.5011	18.9208	19.4450	19.8522	20.0805	20.1415	20.1332	19.9829	19.4305	18.7131	18.1457 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9900	0.9763	0.9500	0.8861	0.7696	0.5917	0.4223	0.4765	0.7264	0.9223	0.9801	0.9921 (94)
Useful gains	1199.3459	1523.4598	1751.3498	1903.3844	1797.5945	1376.3979	941.1123	977.8328	1352.0167	1419.5165	1231.6074	1118.6067 (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	3867.9370	3779.9371	3446.0956	2902.4817	2240.5236	1495.7531	966.5541	1017.5593	1609.9160	2426.9546	3201.3725	3856.5216 (97)
Space heating kWh	1985.4318	1516.3527	1260.8909	719.3501	329.5392	0.0000	0.0000	0.0000	0.0000	749.5339	1418.2308	2037.0087 (98a)
Space heating requirement - total per year (kWh/year)												
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												
Space heating kWh	1985.4318	1516.3527	1260.8909	719.3501	329.5392	0.0000	0.0000	0.0000	0.0000	749.5339	1418.2308	2037.0087 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												
Space heating per m2	(98c) / (4) =											

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	2565.4756	2019.6297	2071.5206	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7910	0.8599	0.8238	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2029.3904	1736.7483	1706.4473	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2591.3686	2482.6836	2283.0948	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	404.6244	554.9759	429.0257	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fC = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	101.1561	138.7440	107.2564	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												
Energy for space heating												
Energy for space cooling												
Total												
Fabric Energy Efficiency (TFEE)												

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

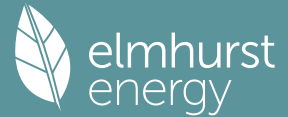
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		655.8000 (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)

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Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	6 * 10 =	60.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) =	0.1067 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3567 (18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3032 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Effective ac	0.3866	0.3790	0.3715	0.3336	0.3260	0.2881	0.2881	0.2805	0.3032	0.3260	0.3411	0.3563	(22b)
	0.5747	0.5718	0.5690	0.5556	0.5531	0.5415	0.5415	0.5393	0.5460	0.5531	0.5582	0.5635	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Doors (part glazed)			4.0000	1.2000	4.8000			(26a)
Doors (solid)			2.0000	1.2000	2.4000			(26)
Windows			44.5000	1.1450	50.9542			(27)
Roof Windows			1.5000	1.1450	1.7176			(27a)
Ground Floor			133.0000	0.1300	17.2900			(28a)
Exposed Floor			9.5000	0.1800	1.7100			(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400			(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600			(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600			(30)
Roof (skeilings)	10.5000	1.5000	9.0000	0.1400	1.2600			(30)
Total net area of external elements Aum(A, m2)			560.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.0918			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							150.0000	(35)

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

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	26.0000	0.0500	1.3000	
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720	
E3 Sill	11.5000	0.0210	0.2415	
E3 Sill	4.5000	0.0480	0.2160	
E4 Jamb	49.0000	0.0160	0.7840	
E4 Jamb	22.5000	0.0640	1.4400	
E5 Ground floor (normal)	54.0000	0.0540	2.9160	
E6 Intermediate floor within a dwelling	57.0000	0.0040	0.2280	
E20 Exposed floor (normal)	6.5000	0.0460	0.2990	
E10 Eaves (insulation at ceiling level)	44.5000	0.0820	3.6490	
E12 Gable (insulation at ceiling level)	3.5000	0.0820	0.2870	
E11 Eaves (insulation at rafter level)	9.0000	0.0750	0.6750	
E16 Corner (normal)	48.5000	0.0540	2.6190	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.5265	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	153.6183 (37)

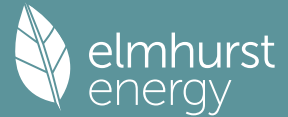
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	124.3810	123.7529	123.1373	120.2458	119.7048	117.1863	117.1863	116.7199	118.1564	119.7048	120.7992	121.9434	(38)
Average = Sum(39)m / 12 =	277.9992	277.3712	276.7556	273.8640	273.3230	270.8046	270.8046	270.3382	271.7746	273.3230	274.4175	275.5616	(39)
												273.8614	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0491	1.0467	1.0444	1.0334	1.0314	1.0219	1.0219	1.0201	1.0256	1.0314	1.0355	1.0399	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0864 (42)
Hot water usage for mixer showers													
85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379	85.1379	(42a)
Hot water usage for baths													
32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	32.6816	(42b)
Hot water usage for other uses													
46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	46.2381	(42c)
Average daily hot water use (litres/day)													151.2346 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576	164.0576	(44)
Energy conte	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745	(45)
Energy content (annual)										Total = Sum(45)m =			2511.9926
Distribution loss (46)m = 0.15 x (45)m													
39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312	38.5312	(46)
Water storage loss (or HIU loss):													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0800 (55)
Total storage loss													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	(56)
If cylinder contains dedicated solar storage													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													

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WHRHS	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047 (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	
(66m)	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	(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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Water heating gains (Table 5)	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128	(72)
Total internal gains	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430	(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
Northeast					11.0000	11.2829	0.6300	0.7000			0.7700	37.9303 (75)
Southeast					3.0000	36.7938	0.6300	0.7000			0.7700	33.7340 (77)
Southwest					30.0000	36.7938	0.6300	0.7000			0.7700	337.3402 (79)
Northwest					0.5000	11.2829	0.6300	0.7000			0.7700	1.7241 (81)
Southwest					1.5000	39.9751	0.6300	0.7000			1.0000	23.7992 (82)
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1424.9695	1744.6358	2033.6341	2300.7638	2468.5659	2428.6416	2327.1705	2156.9343	1976.0487	1688.6253	1429.1708	1331.9309 (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	39.7183	39.8083	39.8968	40.3181	40.3979	40.7736	40.7736	40.8439	40.6280	40.3979	40.2368	40.0697	
alpha	3.6479	3.6539	3.6598	3.6879	3.6932	3.7182	3.7182	3.7229	3.7085	3.6932	3.6825	3.6713	
util living area	0.9906	0.9801	0.9572	0.9028	0.7983	0.6404	0.4904	0.5426	0.7665	0.9350	0.9830	0.9926	(86)
MIT	19.4423	19.6583	19.9724	20.3502	20.6548	20.8354	20.8939	20.8835	20.7514	20.3376	19.8136	19.4042	(87)
Th 2	20.0427	20.0446	20.0465	20.0556	20.0572	20.0651	20.0651	20.0666	20.0621	20.0572	20.0538	20.0503	(88)
util rest of house	0.9887	0.9760	0.9482	0.8820	0.7554	0.5676	0.3949	0.4455	0.7035	0.9168	0.9788	0.9911	(89)
MIT 2	18.1980	18.4740	18.8718	19.3455	19.7035	19.8989	19.9473	19.9424	19.8199	19.3406	18.6804	18.1549	(90)
Living area fraction	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869	(91)
MIT	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869	(92)
Temperature adjustment	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869	(93)
adjusted MIT	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869	(93)

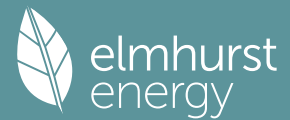
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9837	0.9677	0.9355	0.8660	0.7424	0.5620	0.3930	0.4427	0.6926	0.9016	0.9712	0.9870	(94)
Useful gains	1401.7829	1688.2263	1902.3697	1992.5512	1832.5983	1364.8084	914.5625	954.9242	1368.5581	1522.5333	1387.9841	1314.5771	(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	3900.1783	3799.7395	3456.1544	2889.7240	2215.0093	1461.7622	933.5439	984.5193	1581.2715	2417.7886	3210.7204	3881.8129	(97)
Space heating kWh	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98a)
Space heating requirement - total per year (kWh/year)												9252.7005	
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	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9252.7005	
Space heating per m2												34.9159	(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 %)	219.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	65.0000	(208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	847.6088	647.0300	527.1390	294.5574	129.7372	0.0000	0.0000	0.0000	0.0000	303.7255	598.4360	870.9637	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148	(217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-46.3188	-75.2168	-123.0257	-155.1307	-178.9104	-165.8585	-163.7271	-147.9762	-122.0864	-92.6933	-54.2367	-38.9600	(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)	-1.2676	-3.7921	-10.4320	-22.0603	-38.4933	-47.2548	-46.8368	-37.0067	-24.0526	-8.0137	-2.1299	-0.9136	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4219.1977	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1670.2146	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												381.2835	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1606.3939	(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												4664.3018	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4219.1977	16.4900	695.7457	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1670.2146	16.4900	275.4184	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	381.2835	16.4900	62.8736	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1364.1406	16.4900	-224.9468	
PV Unit electricity exported	-242.2534	5.5900	-13.5420	
Total			-238.4887	(252)
Total energy cost			795.5490	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.9239	(257)
SAP value		85.0242	
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	4219.1977	0.1553	655.2219	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1670.2146	0.1410	235.4604	(264)
Space and water heating			890.6823	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	381.2835	0.1443	55.0310	(268)
Energy saving/generation technologies				

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PV Unit electricity used in dwelling	-1364.1406	0.1326	-180.8986
PV Unit electricity exported	-242.2534	0.1164	-28.1866
Total			-209.0852 (269)
Total CO2, kg/year			736.6281 (272)
CO2 emissions per m2			2.7800 (273)
EI value			96.8159
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	133.0000 (1b)	x	2.4000 (2b)	=	319.2000 (1b) - (3b)	
First floor	132.0000 (1c)	x	2.5500 (2c)	=	336.6000 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000				(4)	
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	655.8000 (5)	

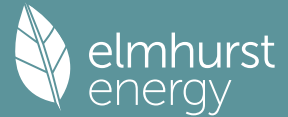
2. Ventilation rate

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	6 * 10 =	60.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	
Pressure test	70.0000 / (5) =	
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	
Infiltration rate	5.0000 (17)	
Number of sides sheltered	0.3567 (18)	
	2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	
	0.8500 (20)	
	0.3032 (21)	
Wind speed	Jan	Feb
Wind factor	3.9000	3.5000
Adj infilt rate	0.9750	0.8750
Effective ac	0.2956	0.2653
	0.5437	0.5352
	0.2653	0.2577
	0.5332	0.5332
	0.2350	0.2426
	0.5276	0.5294
	0.2274	0.2274
	0.2198	0.2350
	0.5242	0.5276
	0.5259	0.5259
	0.2502 (22b)	0.5313 (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							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skeilings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m2)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		137.0918		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							150.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				26.0000	0.0500	1.3000	
E2 Other lintels (including other steel lintels)				13.0000	0.1440	1.8720	
E3 Sill				11.5000	0.0210	0.2415	
E3 Sill				4.5000	0.0480	0.2160	
E4 Jamb				49.0000	0.0160	0.7840	
E4 Jamb				22.5000	0.0640	1.4400	
E5 Ground floor (normal)				54.0000	0.0540	2.9160	
E6 Intermediate floor within a dwelling				57.0000	0.0040	0.2280	
E20 Exposed floor (normal)				6.5000	0.0460	0.2990	
E10 Eaves (insulation at ceiling level)				44.5000	0.0820	3.6490	
E12 Gable (insulation at ceiling level)				3.5000	0.0820	0.2870	
E11 Eaves (insulation at rafter level)				9.0000	0.0750	0.6750	
E16 Corner (normal)				48.5000	0.0540	2.6190	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.5265 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	153.6183 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							

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(38)m	Jan 117.6651	Feb 115.8245	Mar 115.8245	Apr 115.3954	May 115.3954	Jun 114.1829	Jul 114.5746	Aug 113.8035	Sep 113.4366	Oct 114.1829	Nov 113.8035	Dec 114.9788	(38)
Heat transfer coeff	271.2834	269.4428	269.4428	269.0137	269.0137	267.8011	268.1929	267.4218	267.0549	267.8011	267.4218	268.5971	(39)
Average = Sum(39)m / 12 =												268.5406	
HLP	Jan 1.0237	Feb 1.0168	Mar 1.0168	Apr 1.0151	May 1.0151	Jun 1.0106	Jul 1.0120	Aug 1.0091	Sep 1.0078	Oct 1.0106	Nov 1.0091	Dec 1.0136	(40)
HLP (average)												1.0134	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0864	(42)
Hot water usage for mixer showers	85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379	(42a)	
Hot water usage for baths	32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	(42b)	
Hot water usage for other uses	46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	(42c)	
Average daily hot water use (litres/day)												151.2346	(43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy content (annual)	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576	(44)	
Distribution loss (46)m = 0.15 x (45)m	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745	(45)	
Water storage loss (or HIU loss):										Total = Sum(45)m =		2511.9926		
Store volume	39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312	(46)	
a) If manufacturer declared loss factor is known (kWh/day):													300.0000	(47)
Temperature factor from Table 2b													2.0000	(48)
Enter (49) or (54) in (55)													0.5400	(49)
Total storage loss													1.0800	(55)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)	
Primary loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)	
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
WWHRS	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(62)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Electric shower(s)	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)	
										Total per year (kWh/year) = Sum(64)m =		3180.0886	(64)	
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
										Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =		0.0000	(64a)	
	132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047	(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	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	(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)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Water heating gains (Table 5)	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128	(72)
Total internal gains	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430	(73)

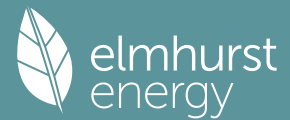
6. Solar gains

[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		
Northeast					11.0000	14.6130		0.6300	0.7000	0.7700	49.1253 (75)		
Southeast					3.0000	45.0642		0.6300	0.7000	0.7700	41.3166 (77)		
Southwest					30.0000	45.0642		0.6300	0.7000	0.7700	413.1660 (79)		
Northwest					0.5000	14.6130		0.6300	0.7000	0.7700	2.2330 (81)		
Southwest					1.5000	50.1759		0.6300	0.7000	1.0000	29.8722 (82)		
Solar gains		535.7130	795.0814	1135.4145	1529.9207	1730.0072	1893.4468	1783.8811	1589.2775	1340.1542	962.3448	628.5378	448.1700 (83)
Total gains		1526.1547	1783.1746	2092.0403	2428.7062	2568.5535	2678.1187	2536.7621	2345.6442	2127.0393	1803.3810	1534.2216	1410.2131 (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	40.7016	40.9796	40.9796	41.0450	41.0450	41.2308	41.1706	41.2893	41.3461	41.2308	41.2893	41.1087
alpha	3.7134	3.7320	3.7320	3.7363	3.7363	3.7487	3.7447	3.7526	3.7564	3.7487	3.7526	3.7406
util living area												

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	0.9863	0.9761	0.9453	0.8699	0.7357	0.5300	0.3840	0.4121	0.6817	0.9004	0.9735	0.9893 (86)
MIT	19.6276	19.7845	20.1166	20.4784	20.7471	20.8808	20.9093	20.9073	20.8231	20.4937	20.0037	19.5936 (87)
Th 2	20.0636	20.0694	20.0694	20.0707	20.0707	20.0745	20.0733	20.0757	20.0769	20.0745	20.0757	20.0720 (88)
util rest of house												
	0.9833	0.9712	0.9338	0.8430	0.6834	0.4526	0.2911	0.3136	0.6071	0.8729	0.9669	0.9870 (89)
MIT 2	18.4496	18.6525	19.0696	19.5105	19.8146	19.9456	19.9645	19.9662	19.9017	19.5420	18.9375	18.4127 (90)
Living area fraction									FLA = Living area / (4) =			0.1057 (91)
MIT	18.5741	18.7721	19.1802	19.6128	19.9131	20.0444	20.0643	20.0657	19.9991	19.6425	19.0502	18.5375 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5741	18.7721	19.1802	19.6128	19.9131	20.0444	20.0643	20.0657	19.9991	19.6425	19.0502	18.5375 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9769	0.9621	0.9200	0.8276	0.6736	0.4500	0.2902	0.3125	0.6002	0.8572	0.9570	0.9817	(94)
Useful gains	1490.8836	1715.5034	1924.6483	2010.1013	1730.2584	1205.1814	736.1114	732.9159	1276.6206	1545.7860	1468.2608	1384.5395	(95)
Ext temp.	5.1000	5.4000	7.2000	9.6000	12.6000	15.4000	17.3000	17.3000	14.8000	11.5000	8.0000	5.1000	(96)
Heat loss rate W	3655.2960	3603.0107	3227.9852	2693.5747	1967.3249	1243.7673	741.3665	739.6031	1388.4397	2180.5768	2955.0571	3609.2666	(97)
Space heating kWh	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308	(98a)
Space heating requirement - total per year (kWh/year)												7714.9972	
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	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7714.9972	
Space heating per m2										(98c) / (4) =		29.1132	(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 %)													219.3000 (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	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	734.3013	578.3880	442.1717	224.3962	80.4275	0.0000	0.0000	0.0000	0.0000	215.3600	488.1411	754.8248	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-57.6748	-80.0016	-130.1741	-166.9690	-185.9719	-185.1223	-180.5834	-164.4081	-136.2629	-104.9147	-65.5663	-47.7449	(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	-2.0546	-4.4905	-12.5107	-27.9208	-45.4630	-60.6171	-58.4737	-46.6902	-30.3778	-11.3319	-3.3363	-1.4370	(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												3518.0106	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1670.2146	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												381.2835	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1810.0976	(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												3759.4110	(238)

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10a. Fuel costs - using BEDF prices (587)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3518.0106	28.4300	1000.1704 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	28.4300	474.8420 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	381.2835	28.4300	108.3989 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1505.3939	28.4300	-427.9835
PV Unit electricity exported	-304.7038	5.8100	-17.7033
Total			-445.6868 (252)
Total energy cost			1137.7245 (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	3518.0106	0.1559	548.6253 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			784.0856 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1505.3939	0.1327	-199.7913
PV Unit electricity exported	-304.7038	0.1164	-35.4814
Total			-235.2726 (269)
Total CO2, kg/year			603.8440 (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	3518.0106	1.5774	5549.1341 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	1.5213	2540.8682 (278)
Space and water heating			8090.0023 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	381.2835	1.5338	584.8253 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1505.3939	1.4904	-2243.6174
PV Unit electricity exported	-304.7038	0.4267	-130.0216
Total			-2373.6390 (283)
Total Primary energy kWh/year			6301.1886 (286)

SAP 10 EPC IMPROVEMENTS

DJ1004 (Be Green)

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

N Solar water heating SAP increase too small
U Solar photovoltaic panels Already installed
V2 Wind turbine Recommended

Recommended measures:
V2 Wind turbine SAP change + 8.9 Cost change -£ 774 CO2 change -496 kg (82.1%)

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.9 -£ 96 -44 kg (7.3%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Wind turbine	£774	1.87 kg/m²	A 94	A 99
Total Savings	£774	1.87 kg/m²		
Potential energy efficiency rating:			A 94	
Potential environmental impact rating:				A 99

Fuel prices for cost data on this page from database revision number 587 TEST (28 Nov 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £1583	Potential £1583	Saving £0
Electricity			
Space heating	£1000	£1000	£0
Water heating	£475	£475	£0
Lighting	£108	£108	£0
Generated (PV)	-£446	-£446	£0
Generated (wind)	-£0	-£774	£774
Total cost of fuels	£1137	£363	£774
Total cost of uses	£1137	£363	£774
Delivered energy	14 kWh/m²	1 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.1 tonnes	0.5 tonnes
CO2 emissions per m²	2 kg/m²	0 kg/m²	2 kg/m²
Primary energy	24 kWh/m²	7 kWh/m²	16 kWh/m²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 655.8000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) =	0.1067 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3567	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3032 (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	0.3866	0.3790	0.3715	0.3336	0.3260	0.2881	0.2881	0.2805	0.3032	0.3260	0.3411	0.3563 (22b)
Effective ac	0.5747	0.5718	0.5690	0.5556	0.5531	0.5415	0.5415	0.5393	0.5460	0.5531	0.5582	0.5635 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Doors (part glazed)			4.0000	1.2000	4.8000		(26a)
Doors (solid)			2.0000	1.2000	2.4000		(26)
Windows			44.5000	1.1450	50.9542		(27)
Roof Windows			1.5000	1.1450	1.7176		(27a)
Ground Floor			133.0000	0.1300	17.2900		(28a)
Exposed Floor			9.5000	0.1800	1.7100		(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400		(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600		(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600		(30)
Roof (skellings)	10.5000	1.5000	9.0000	0.1400	1.2600		(30)
Total net area of external elements Aum(A, m ²)			560.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.0918		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 150.0000 (35)

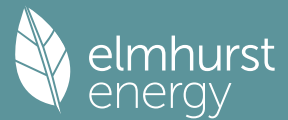
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E3 Sill	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160
E6 Intermediate floor within a dwelling	57.0000	0.0040	0.2280
E20 Exposed floor (normal)	6.5000	0.0460	0.2990
E10 Eaves (insulation at ceiling level)	44.5000	0.0820	3.6490
E12 Gable (insulation at ceiling level)	3.5000	0.0820	0.2870
E11 Eaves (insulation at rafter level)	9.0000	0.0750	0.6750
E16 Corner (normal)	48.5000	0.0540	2.6190

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.5265 (36)
Point Thermal Bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 153.6183 (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	124.3810	123.7529	123.1373	120.2458	119.7048	117.1863	117.1863	116.7199	118.1564	119.7048	120.7992	121.9434 (38)
Average = Sum(39)m / 12 =	277.9992	277.3712	276.7556	273.8640	273.3230	270.8046	270.8046	270.3382	271.7746	273.3230	274.4175	275.5616 (39)
	273.8614											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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HLP	1.0491	1.0467	1.0444	1.0334	1.0314	1.0219	1.0219	1.0201	1.0256	1.0314	1.0355	1.0399 (40)
HLP (average)												1.0334
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0864 (42)
Hot water usage for mixer showers												
85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379	(42a)
Hot water usage for baths												
32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	(42b)
Hot water usage for other uses												
46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	(42c)
Average daily hot water use (litres/day)												151.2346 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												
164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576	(44)
Energy conte	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745 (45)
Energy content (annual)										Total = Sum(45)m =	2511.9926	(45)
Distribution loss (46)m = 0.15 x (45)m												
39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312	(46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss												
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
If cylinder contains dedicated solar storage												
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	(71)
Water heating gains (Table 5)												
177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128	(72)
Total internal gains												
990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430	(73)

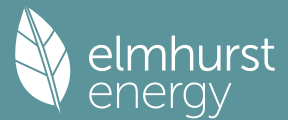
6. Solar gains

[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
Northeast					11.0000	11.2829		0.6300	0.7000	0.7700		37.9303 (75)
Southeast					3.0000	36.7938		0.6300	0.7000	0.7700		33.7340 (77)
Southwest					30.0000	36.7938		0.6300	0.7000	0.7700		337.3402 (79)
Northwest					0.5000	11.2829		0.6300	0.7000	0.7700		1.7241 (81)
Southwest					1.5000	39.9751		0.6300	0.7000	1.0000		23.7992 (82)
Solar gains	434.5279	756.5426	1077.0083	1401.9783	1630.0196	1643.9697	1574.2895	1400.5675	1189.1635	847.5891	523.4870	369.8879 (83)
Total gains	1424.9695	1744.6358	2033.6341	2300.7638	2468.5659	2428.6416	2327.1705	2156.9343	1976.0487	1688.6253	1429.1708	1331.9309 (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	39.7183	39.8083	39.8968	40.3181	40.3979	40.7736	40.7736	40.8439	40.6280	40.3979	40.2368	40.0697
alpha	3.6479	3.6539	3.6598	3.6879	3.6932	3.7182	3.7182	3.7229	3.7085	3.6932	3.6825	3.6713
util living area												
0.9906	0.9801	0.9572	0.9028	0.7983	0.6404	0.4904	0.5426	0.7665	0.9350	0.9830	0.9926	(86)
MIT	19.4423	19.6583	19.9724	20.3502	20.6548	20.8354	20.8939	20.8835	20.7514	20.3376	19.8136	19.4042 (87)
Th 2	20.0427	20.0446	20.0465	20.0556	20.0572	20.0651	20.0651	20.0666	20.0621	20.0572	20.0538	20.0503 (88)
util rest of house												
0.9887	0.9760	0.9482	0.8820	0.7554	0.5676	0.3949	0.4455	0.7035	0.9168	0.9788	0.9911	(89)
MIT 2	18.1980	18.4740	18.8718	19.3455	19.7035	19.8989	19.9473	19.9424	19.8199	19.3406	18.6804	18.1549 (90)

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Living area fraction									fLA = Living area / (4) =		0.1057 (91)	
MIT	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3295	18.5991	18.9881	19.4517	19.8040	19.9978	20.0473	20.0418	19.9183	19.4459	18.8001	18.2869 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9837	0.9677	0.9355	0.8660	0.7424	0.5620	0.3930	0.4427	0.6926	0.9016	0.9712	0.9870	(94)
Useful gains	1401.7829	1688.2263	1902.3697	1992.5512	1832.5983	1364.8084	914.5625	954.9242	1368.5581	1522.5333	1387.9841	1314.5771	(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	3900.1783	3799.7395	3456.1544	2889.7240	2215.0093	1461.7622	933.5439	984.5193	1581.2715	2417.7886	3210.7204	3881.8129	(97)
Space heating kWh	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98a)
Space heating requirement - total per year (kWh/year)												9252.7005	
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	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9252.7005	
Space heating per m2										(98c) / (4) =		34.9159	(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 %)													219.3000 (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	1858.8062	1418.9369	1156.0158	645.9644	284.5138	0.0000	0.0000	0.0000	0.0000	666.0700	1312.3701	1910.0234	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	847.6088	647.0300	527.1390	294.5574	129.7372	0.0000	0.0000	0.0000	0.0000	303.7255	598.4360	870.9637	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(223)
Lighting	47.2437	37.9006	34.1253	25.0017	19.3120	15.7781	17.6171	22.8993	29.7439	39.0257	44.0794	48.5567	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-46.3188	-75.2168	-123.0257	-155.1307	-178.9104	-165.8585	-163.7271	-147.9762	-122.0864	-92.6933	-54.2367	-38.9600	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(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	-1.2676	-3.7921	-10.4320	-22.0603	-38.4933	-47.2548	-46.8368	-37.0067	-24.0526	-8.0137	-2.1299	-0.9136	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	(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												4219.1977	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1670.2146	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												381.2835	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1606.3939	(233)
Wind generation												-3575.5408	(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												1088.7611	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4219.1977	16.4900	695.7457	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1670.2146	16.4900	275.4184	(247)

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Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	381.2835	16.4900	62.8736 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1364.1406	16.4900	-224.9468
PV Unit electricity exported	-242.2534	5.5900	-13.5420
Total			-238.4887 (252)
Wind Turbine electricity used in dwelling	-2502.8785	16.4900	-412.7247
Wind Turbine electricity exported	-1072.6622	5.5900	-59.9618
Total			-472.6865 (252)
Total energy cost			322.8625 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.3749 (257)
SAP value		93.9223
SAP rating (Section 12)		9A (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	4219.1977	0.1553	655.2219 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	1670.2146	0.1410	235.4604 (264)
Space and water heating			890.6823 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	381.2835	0.1443	55.0310 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1364.1406	0.1326	-180.8986
PV Unit electricity exported	-242.2534	0.1164	-28.1866
Total			-209.0852 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-495.9716 (269)
Total CO ₂ , kg/year			240.6565 (272)
CO ₂ emissions per m ²			0.9100 (273)
EI value			98.9597
EI rating			99 (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

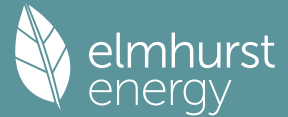
	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	133.0000 (1b)	x 2.4000 (2b)	= 319.2000 (1b) - (3b)
First floor	132.0000 (1c)	x 2.5500 (2c)	= 336.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	265.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	655.8000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	70.0000 / (5) = 0.1067 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3567 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3032 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.9000	3.5000	3.5000	3.4000	3.4000	3.1000	3.2000	3.0000	2.9000	3.1000	3.0000	3.3000 (22)
Wind factor	0.9750	0.8750	0.8750	0.8500	0.8500	0.7750	0.8000	0.7500	0.7250	0.7750	0.7500	0.8250 (22a)
Adj infilt rate	0.2956	0.2653	0.2653	0.2577	0.2577	0.2350	0.2426	0.2274	0.2198	0.2350	0.2274	0.2502 (22b)

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Effective ac 0.5437 0.5352 0.5352 0.5332 0.5332 0.5276 0.5294 0.5259 0.5242 0.5276 0.5259 0.5313 (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								
Doors (part glazed)			4.0000	1.2000	4.8000			(26a)
Doors (solid)			2.0000	1.2000	2.4000			(26)
Windows			44.5000	1.1450	50.9542			(27)
Roof Windows			1.5000	1.1450	1.7176			(27a)
Ground Floor			133.0000	0.1300	17.2900			(28a)
Exposed Floor			9.5000	0.1800	1.7100			(28b)
Wall (cavity)	145.0000	33.0000	112.0000	0.2200	24.6400			(29a)
Wall (clad)	126.0000	17.5000	108.5000	0.1600	17.3600			(29a)
Roof (loft)	136.0000		136.0000	0.1100	14.9600			(30)
Roof (skeilings)	10.5000	1.5000	9.0000	0.1400	1.2600			(30)
Total net area of external elements Aum(A, m2)			560.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.0918			(33)

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

150.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	26.0000	0.0500	1.3000
E2 Other lintels (including other steel lintels)	13.0000	0.1440	1.8720
E3 Sill	11.5000	0.0210	0.2415
E3 Sill	4.5000	0.0480	0.2160
E4 Jamb	49.0000	0.0160	0.7840
E4 Jamb	22.5000	0.0640	1.4400
E5 Ground floor (normal)	54.0000	0.0540	2.9160
E6 Intermediate floor within a dwelling	57.0000	0.0040	0.2280
E20 Exposed floor (normal)	6.5000	0.0460	0.2990
E10 Eaves (insulation at ceiling level)	44.5000	0.0820	3.6490
E12 Gable (insulation at ceiling level)	3.5000	0.0820	0.2870
E11 Eaves (insulation at rafter level)	9.0000	0.0750	0.6750
E16 Corner (normal)	48.5000	0.0540	2.6190

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

16.5265 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 153.6183 (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	117.6651	115.8245	115.8245	115.3954	115.3954	114.1829	114.5746	113.8035	113.4366	114.1829	113.8035	114.9788
Heat transfer coeff	271.2834	269.4428	269.4428	269.0137	269.0137	267.8011	268.1929	267.4218	267.0549	267.8011	267.4218	268.5971
Average = Sum(39)m / 12 =												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0237	1.0168	1.0168	1.0151	1.0151	1.0106	1.0120	1.0091	1.0078	1.0106	1.0091	1.0136
HLP (average)												1.0134
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

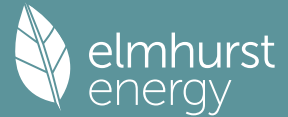
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0864 (42)
Hot water usage for mixer showers													
85.4653	84.1809	82.3093	78.7284	76.0857	73.1387	71.4636	73.3210	75.3571	78.5213	82.1792	85.1379	85.1379	(42a)
Hot water usage for baths													
32.7924	32.3054	31.6196	30.3551	29.4082	28.3583	27.7912	28.4722	29.2137	30.3372	31.6277	32.6816	32.6816	(42b)
Hot water usage for other uses													
46.2381	44.5567	42.8754	41.1940	39.5126	37.8312	37.8312	39.5126	41.1940	42.8754	44.5567	46.2381	46.2381	(42c)
Average daily hot water use (litres/day)													151.2346 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	164.4959	161.0431	156.8043	150.2775	145.0066	139.3282	137.0860	141.3058	145.7648	151.7339	158.3637	164.0576	(44)
Energy conte	260.5213	229.3233	241.0024	205.7223	195.2067	171.3203	165.7936	174.9661	179.7426	205.9014	225.6181	256.8745	(45)
Energy content (annual)										Total = Sum(45)m =		2511.9926	
Distribution loss (46)m = 0.15 x (45)m													
39.0782	34.3985	36.1504	30.8584	29.2810	25.6980	24.8690	26.2449	26.9614	30.8852	33.8427	38.5312	38.5312	(46)
Water storage loss (or HIU loss):													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0800 (55)
Total storage loss													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	(56)
If cylinder contains dedicated solar storage													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	313.6169	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169	313.6169	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
132.0172	117.2509	125.5272	112.3323	110.3002	100.8936	100.5203	103.5702	103.6940	113.8561	118.9476	130.8047	130.8047	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	185.1858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													

Full SAP Calculation Printout



Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	53.9746	47.9398	38.9873	29.5159	22.0634	18.6269	20.1270	26.1619	35.1144	44.5858	52.0382	55.4747 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	640.6909	647.3392	630.5856	594.9190	549.8963	507.5814	479.3124	472.6641	489.4177	525.0843	570.1070	612.4219 (68)
Pumps, fans	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050	56.6050 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572	-123.4572 (71)
Total internal gains	177.4425	174.4806	168.7194	156.0171	148.2529	140.1300	135.1079	139.2072	144.0194	153.0325	165.2050	175.8128 (72)
	990.4416	988.0932	956.6258	898.7855	838.5463	784.6719	752.8810	756.3667	786.8852	841.0361	905.6838	962.0430 (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	
Northeast						11.0000	14.6130	0.6300	0.7000	0.7700	49.1253 (75)	
Southeast						3.0000	45.0642	0.6300	0.7000	0.7700	41.3166 (77)	
Southwest						30.0000	45.0642	0.6300	0.7000	0.7700	413.1660 (79)	
Northwest						0.5000	14.6130	0.6300	0.7000	0.7700	2.2330 (81)	
Southwest						1.5000	50.1759	0.6300	0.7000	1.0000	29.8722 (82)	
Solar gains	535.7130	795.0814	1135.4145	1529.9207	1730.0072	1893.4468	1783.8811	1589.2775	1340.1542	962.3448	628.5378	448.1700 (83)
Total gains	1526.1547	1783.1746	2092.0403	2428.7062	2568.5535	2678.1187	2536.7621	2345.6442	2127.0393	1803.3810	1534.2216	1410.2131 (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	40.7016	40.9796	40.9796	41.0450	41.0450	41.2308	41.1706	41.2893	41.3461	41.2308	41.2893	41.1087
alpha	3.7134	3.7320	3.7320	3.7363	3.7363	3.7487	3.7447	3.7526	3.7564	3.7487	3.7526	3.7406
util living area	0.9863	0.9761	0.9453	0.8699	0.7357	0.5300	0.3840	0.4121	0.6817	0.9004	0.9735	0.9893 (86)
MIT	19.6276	19.7845	20.1166	20.4784	20.7471	20.8808	20.9093	20.9073	20.8231	20.4937	20.0037	19.5936 (87)
Th 2	20.0636	20.0694	20.0694	20.0707	20.0707	20.0745	20.0733	20.0757	20.0769	20.0745	20.0757	20.0720 (88)
util rest of house	0.9833	0.9712	0.9338	0.8430	0.6834	0.4526	0.2911	0.3136	0.6071	0.8729	0.9669	0.9870 (89)
MIT 2	18.4496	18.6525	19.0696	19.5105	19.8146	19.9456	19.9645	19.9662	19.9017	19.5420	18.9375	18.4127 (90)
Living area fraction	18.5741	18.7721	19.1802	19.6128	19.9131	20.0444	20.0643	20.0657	19.9991	19.6425	19.0502	18.5375 (92)
MIT	18.5741	18.7721	19.1802	19.6128	19.9131	20.0444	20.0643	20.0657	19.9991	19.6425	19.0502	18.5375 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5741	18.7721	19.1802	19.6128	19.9131	20.0444	20.0643	20.0657	19.9991	19.6425	19.0502	18.5375 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9769	0.9621	0.9200	0.8276	0.6736	0.4500	0.2902	0.3125	0.6002	0.8572	0.9570	0.9817 (94)
Useful gains	1490.8836	1715.5034	1924.6483	2010.1013	1730.2584	1205.1814	736.1114	732.9159	1276.6206	1545.7860	1468.2608	1384.3595 (95)
Ext temp.	5.1000	5.4000	7.2000	9.6000	12.6000	15.4000	17.3000	17.3000	14.8000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	3655.2960	3603.0107	3227.9852	2693.5747	1967.3249	1243.7673	741.3665	739.6031	1388.4397	2180.5768	2955.0571	3609.2666 (97)
Space heating kWh	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98a)
Space heating requirement - total per year (kWh/year)												7714.9972
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	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7714.9972
Space heating per m2										(98c) / (4) =		29.1132 (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 %)												219.3000 (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
	1610.3229	1268.4049	969.6826	492.1008	176.3775	0.0000	0.0000	0.0000	0.0000	472.2844	1070.4933	1655.3308 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	734.3013	578.3880	442.1717	224.3962	80.4275	0.0000	0.0000	0.0000	0.0000	215.3600	488.1411	754.8248 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	317.2637	280.5745	297.7448	260.6343	251.9491	226.2323	222.5360	231.7085	234.6546	262.6438	280.5301	313.6169 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	166.6301	147.3605	156.3786	136.8878	132.3262	118.8195	116.8782	121.6956	123.2429	137.9432	147.3372	164.7148 (219)
Space cooling fuel requirement												

13a. Primary energy - Individual heating systems including micro-CHP			
	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	3518.0106	1.5774	5549.1341 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1670.2146	1.5213	2540.8682 (278)
Space and water heating			8090.0023 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	381.2835	1.5338	584.8253 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1505.3939	1.4904	-2243.6174
PV Unit electricity exported	-304.7038	0.4267	-130.0216
Total			-2373.6390 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.5128	-3786.3546
Wind Turbine electricity exported	-1072.6622	0.5128	-550.0612
Total			-4336.4158 (283)
Total Primary energy kWh/year			1964.7728 (286)

Part G Compliance Report

PROJECT DETAILS

Project Reference: DJ1001G
Client:
Property: Land East of Spring Gardens
Washington
West Sussex RH20 3BP

Local Authority: Horsham District Council
Agent: KG Designs

Assessor: Joe Solti
Address: Therm Energy Ltd
Contact: 01903 884357
Software: G-Calc 2015 version 3.0.2
Prepared on: 11-Dec-25

RESULT SUMMARY

By following the Government's national calculation methodology for assessing water efficiency in new dwellings this 4 bed dwelling, as designed, achieves a water consumption of 109.4 litres per person per day.

Compliance with Building Regulation 36(1) has been demonstrated.

Table 1: The Water Calculator for New Dwellings

Installation Type	Unit of measure	Value	Use factor	Fixed use	litres/person/day
WC(single flush)	Flush volume (litres)		4.42	0.00	0
WC(dual flush)	Full flush vol.	6	1.46	0.00	8.76
	Part flush vol.	3	2.96	0.00	8.88
WC(multiple fittings)	Average effective Flush vol. (litres)		4.42	0.00	0
Taps(excl. Kitchen)	Flow rate (litres/min)	6	1.58	1.58	11.06
Bath (shower also present)	Capacity to overflow (litres)	180	0.11	0.00	19.8
Shower (bath also present)	Flow rate (litres/min)	8	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)	0	0.50	0.00	0
Shower only	Flow rate (litres/minute)	0	5.6	0.00	0
Kitchen sink taps	Flow rate (litres/minute)	6	0.44	10.36	13
Washing Machine	litres/kg dry load	7	2.1	0.0	14.7
Dishwasher	litres/place setting	1	3.6	0.0	3.6
Waste disposal	litres/use	0	3.08	0.0	0
Water softener	litres/person/day	0	1.0	0.0	0
Total calculated use (litres/person/day)					114.76
Contribution from greywater (litres/person/day)					-
Contribution from rainwater (litres/person/day)					-
Normalisation factor					0.91
Total Water Consumption. Code for Sustainable Homes (litres/person/day)					104.4
External water use					5.0
Total Water Consumption. (36(1)) (litres/person/day)					109.4

Summary of fitting types "As Designed"			
Type	Description	Flow rates, volumes etc.	Qty
Taps	Taps	6 litres/min	1
Baths	Baths	180 litres to overflow	1
Dishwashers	Dishwasher	1 litres/place	1
Washing Machines	Washing Machine	7 litres/kg	1
Showers	Showers	8 litres/min	1
WC's	Toilets	6 / 3 litres flush vols.	1
Kitchen/Utility taps	Taps	6 litres/min	1

The lower section of this table is to be filled in by the builder prior to completion. The descriptions, values and quantities should represent the 'as built' specification. Please note the values above represent design values and should not be exceeded without prior consultation with the agent/designer (KG Designs).
The completed table should be returned to the assessor: Joe Solti (Contact: 01903 884357).

Declaration of fitting types "As Built"			
Type	Make and Model	Flow rates, volumes etc.	Qty
Taps			
Baths			
Dishwashers			
Washing Machines			
Showers			
WC's			
Kitchen/Utility taps			

Project ref: DJ1001G - Land East of Spring Gardens

The above declaration of fittings, values and quantities is a true reflection of those installed on this project.

Name: Signature: Date:

-----End of Report-----