

Building Regulations England Part L (BREL) Compliance Report

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

Date: Tue 04 Aug 2026 10:48:35

Project Information			
Assessed By	Mike Ovenden	Building Type	House, Semi-detached
OCDEA Registration	EES/018685	Assessment Date	2026-08-04

Dwelling Details			
Assessment Type	As designed	Total Floor Area	114 m ²
Site Reference	Plot 1 134 High Street Kimpton	Plot Reference	design rev 2
Address			

Client Details	
Name	Alison Swarbrick
Company	Architecture Studio 5 Ltd
Address	5 Monmouth Road , Harlington , LU5 6NE

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	10.2 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	2.28 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	53.19 kWh _{PE} /m ²		
Dwelling primary energy	21.73 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	38.9 kWh/m ²		
Dwelling fabric energy efficiency	35.6 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	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.1	Heatloss Floor 2 (0.18)	OK
Roofs	0.16	0.12	Roof (1) (0.12)	OK
Windows, doors, and roof windows	1.6	1.22	front door (1.4)	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)	93.0025	0.18
Party wall: Party Wall (1)	68.68	0 (!)
Ground floor: Heatloss Floor 1, Heatloss Floor 1	56	0.1 (!)
Upper floor: Heatloss Floor 2, Heatloss Floor 2	1.75	0.18
Exposed roof: Roof (1)	57.25	0.12

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]
windows front, windows	3.12	South East	0.7	1.2
windows front, windows	2.34	South East	0.7	1.2
windows side, windows	0.9555	South West	0.7	1.2
windows side, windows	0.9555	South West	0.7	1.2
windows side, windows	1.4175	South West	0.7	1.2
windows side, windows	0.7245	South West	0.7	1.2
windows side, windows	0.735	South West	0.7	1.2
windows side, windows	1.2285	South West	0.7	1.2
windows side, windows	0.8775	South West	0.7	1.2
windows rear, windows	2.61	North West	0.7	1.2
windows rear, windows	2.61	North West	0.7	1.2

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
windows rear, windows	0.9555	North West	0.7	1.2
windows rear, windows	3.78	North West	0.7	1.2
front door, doors	2.1105	South West	N/A	1.4
windows side, windows	0.8775	North East	0.7	1.2

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	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.043	cert supplied
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.057	cert supplied
External wall	E21: Exposed floor (inverted)	SAP table default	0.32	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.05	cert supplied
Party wall	P2: Intermediate floor within a dwelling	SAP table default	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.04	cert supplied
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.025 (!)	cert supplied
External wall	E3: Sill	Calculated by person with suitable expertise	0.022 (!)	cert supplied
External wall	E4: Jamb	Calculated by person with suitable expertise	0.017 (!)	cert supplied
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.075	cert supplied
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.001 (!)	cert supplied
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.042	cert supplied
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.033 (!)	cert supplied
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.085	cert supplied

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	5.1 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	370.9%
Emitter type	Both radiator and underfloor
Flow temperature	45°C
System type	Heat Pump
Manufacturer	Vaillant Group UK Ltd
Model	geoTHERM air 4kW
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	210 litres
Declared heat loss	2.58 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: N/A		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	95 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	4.5 kWp	
Orientation	South	
Pitch	30°	
Overshading	Modest	
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		

Full SAP Calculation Printout



Plot Reference	Plot 1 134 High Street Kimpton				Issued on Date	04/08/2026	
Assessment Reference	design rev 2			Plot Type Ref	Design		
Plot Address					SAP Version	10.2	
SAP Rating	91 B		DER	2.28	TER	10.20	
Environmental	98 A		% DER < TER			77.65	
CO ₂ Emissions (t/year)	0.2		DFEE	35.64	TFEE	38.88	
Compliance Check	See BREL		% DFEE < TFEE			8.34	
% DPER < TPER	59.14		DPER	21.73	TPER	53.19	
Assessor Details	Mr. Mike Ovenden				Assessor ID	H824-0001	
Client	11, Alison Swarbrick						

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	57.0000 (1b)	x 2.4000 (2b)	= 136.8000 (1b) - (3b)
First floor	57.2500 (1c)	x 2.6500 (2c)	= 151.7125 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.2500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.5125 (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	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 50.0000 / (5) = 0.1733 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.1000 (17)
Infiltration rate	0.4283 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3962 (21)

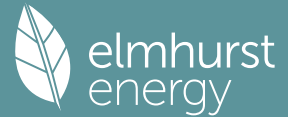
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5051	0.4952	0.4853	0.4358	0.4259	0.3764	0.3764	0.3665	0.3962	0.4259	0.4457	0.4655 (22b)
Effective ac	0.6276	0.6226	0.6178	0.5950	0.5907	0.5708	0.5708	0.5671	0.5785	0.5907	0.5993	0.6084 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
windows			23.1900	1.1450	26.5534		(27)
doors			2.1100	1.4000	2.9540		(26)
Heatloss Floor 1			56.0000	0.1000	5.6000	75.0000	4200.0000 (28a)
Heatloss Floor 2			1.7500	0.1800	0.3150	20.0000	35.0000 (28b)
External Wall 1	118.3000	25.3000	93.0000	0.1800	16.7400	140.0000	13020.0000 (29a)
External Roof 1	57.2500		57.2500	0.1200	6.8700	9.0000	515.2500 (30)
Total net area of external elements A _{um} (A, m ²)			233.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.0324		(33)
Main dwelling							
Party Wall 1			68.6800	0.0000	0.0000	140.0000	9615.2000 (32)
Internal Wall 1			181.1600			9.0000	1630.4400 (32c)
Internal Floor 1			57.0000			18.0000	1026.0000 (32d)
Internal Ceiling 1			57.0000			9.0000	513.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	30554.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							267.4389 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)				8.4500	0.0430	0.3633	

6. Solar gains						
[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	0.8800	11.2829	0.6300	0.7000	0.7700	3.0344 (75)
Southeast	5.4600	36.7938	0.6300	0.7000	0.7700	61.3959 (77)

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Southwest			6.8900		36.7938		0.6300		0.7000		0.7700		77.4758 (79)
Northwest			9.9600		11.2829		0.6300		0.7000		0.7700		34.3442 (81)

Solar gains	176.2504	312.6352	460.7394	626.1550	751.7997	768.5561	731.7344	634.6049	517.4890	354.4203	213.3683	149.3705 (83)
Total gains	841.8449	993.1437	1112.8813	1254.1123	1347.3849	1307.9616	1248.8456	1153.1198	1052.9926	944.1624	840.1643	800.9869 (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	67.4760	67.7299	67.9807	69.1841	69.4139	70.5045	70.5045	70.7102	70.0804	69.4139	68.9505	68.4725	
alpha	5.4984	5.5153	5.5320	5.6123	5.6276	5.7003	5.7003	5.7140	5.6720	5.6276	5.5967	5.5648	
util living area	0.9961	0.9897	0.9728	0.9104	0.7689	0.5768	0.4223	0.4751	0.7375	0.9440	0.9904	0.9970 (86)	
Living	20.0947	20.2474	20.4537	20.7131	20.8765	20.9347	20.9440	20.9428	20.9052	20.6877	20.3510	20.0783	
Non living	18.9459	19.1425	19.4040	19.7275	19.9017	19.9634	19.9686	19.9708	19.9388	19.7080	19.2883	18.9356	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)	
Th 2	20.0000	20.0034	20.0067	20.0223	20.0252	20.0388	20.0388	20.0414	20.0336	20.0252	20.0193	20.0132 (88)	
util rest of house	0.9947	0.9862	0.9635	0.8821	0.7103	0.4957	0.3311	0.3781	0.6555	0.9197	0.9865	0.9959 (89)	
MIT 2	20.0000	20.0034	20.0067	20.0223	20.0252	20.0388	20.0388	20.0414	20.0336	20.0252	20.0193	20.0132 (90)	
Living area fraction									FLA = Living area / (4) =			0.1549 (91)	
MIT	20.1550	20.1578	20.1606	20.1738	20.1762	20.1878	20.1878	20.1899	20.1833	20.1762	20.1712	20.1660 (92)	
Temperature adjustment												0.0000	
adjusted MIT	20.1550	20.1578	20.1606	20.1738	20.1762	20.1878	20.1878	20.1899	20.1833	20.1762	20.1712	20.1660 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9869	0.9651	0.8870	0.7200	0.5086	0.3453	0.3933	0.6691	0.9241	0.9872	0.9961 (94)	
Useful gains	837.5872	980.0845	1074.0447	1112.4246	970.1406	665.1995	431.2355	453.5494	704.6004	872.5027	829.4416	797.8721 (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	1994.3179	1912.0087	1705.5419	1383.0612	1036.4175	672.6645	431.9006	454.9068	736.7528	1170.9181	1609.0077	1979.0615 (97)	
Space heating kWh	860.6077	626.2530	469.8339	194.8584	49.3100	0.0000	0.0000	0.0000	0.0000	222.0210	561.2876	878.8049 (98a)	
Space heating requirement - total per year (kWh/year)												3862.9765	
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	860.6077	626.2530	469.8339	194.8584	49.3100	0.0000	0.0000	0.0000	0.0000	222.0210	561.2876	878.8049 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												3862.9765	
Space heating per m2										(98c) / (4) =		33.8116 (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 %)													370.9193 (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	860.6077	626.2530	469.8339	194.8584	49.3100	0.0000	0.0000	0.0000	0.0000	222.0210	561.2876	878.8049 (98)	
Space heating efficiency (main heating system 1)	370.9193	370.9193	370.9193	370.9193	370.9193	0.0000	0.0000	0.0000	0.0000	370.9193	370.9193	370.9193 (210)	
Space heating fuel (main heating system)	232.0202	168.8381	126.6674	52.5339	13.2940	0.0000	0.0000	0.0000	0.0000	59.8570	151.3234	236.9262 (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	391.9098	347.8244	371.6028	330.5407	323.2601	263.7012	260.5042	270.0890	272.2893	334.2347	351.2994	388.0322 (64)	
Efficiency of water heater (217)m	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600 (216)	
Fuel for water heating, kWh/month	323.9995	287.5532	307.2113	273.2644	267.2454	218.0069	215.3639	223.2878	225.1069	276.3184	290.4261	320.7938 (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	27.6424	22.1757	19.9668	14.6285	11.2995	9.2318	10.3078	13.3984	17.4032	22.8340	25.7909	28.4106 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-89.9055	-149.2990	-251.8866	-331.2955	-400.5958	-387.7254	-382.5721	-339.2730	-270.7138	-189.4300	-106.4251	-75.2818 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)	
Annual totals kWh/year													
Space heating fuel - main system 1												1041.4601 (211)	

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Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	120.9600	
Water heating fuel used	3228.5778	(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)	223.0897	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2974.4037	(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	1518.7240	(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	1041.4601	0.1566	163.0900 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3228.5778	0.1414	456.4375 (264)
Space and water heating			619.5275 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	223.0897	0.1443	32.1987 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2974.4037	0.1316	-391.4568
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-391.4568 (269)
Total CO2, kg/year			260.2694 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.2800 (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	1041.4601	1.5797	1645.2312 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3228.5778	1.5228	4916.4321 (278)
Space and water heating			6561.6633 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	223.0897	1.5338	342.1825 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2974.4037	1.4862	-4420.6493
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-4420.6493 (283)
Total Primary energy kWh/year			2483.1965 (286)
Dwelling Primary energy Rate (DPER)			21.7300 (287)

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

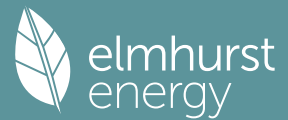
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	57.0000 (1b)	x 2.4000 (2b)	= 136.8000 (1b) - (3b)
First floor	57.2500 (1c)	x 2.6500 (2c)	= 151.7125 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	114.2500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 288.5125 (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) = 0.1386 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3886 (18)
Number of sides sheltered	1 (19)

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Shelter factor
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.9250 \quad (20)$$
$$(21) = (18) \times (20) = 0.3595 \quad (21)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4584	0.4494	0.4404	0.3954	0.3865	0.3415	0.3415	0.3325	0.3595	0.3865	0.4044	0.4224	(22b)
	0.6050	0.6010	0.5970	0.5782	0.5747	0.5583	0.5583	0.5553	0.5646	0.5747	0.5818	0.5892	(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			2.1100	1.0000	2.1100			(26)
TER Opening Type			23.1900	1.1450	26.5534			(27)
Heatloss Floor 1			56.0000	0.1300	7.2800			(28a)
Heatloss Floor 2			1.7500	0.1300	0.2275			(28b)
External Wall 1	118.3000	25.3000	93.0000	0.1800	16.7400			(29a)
External Roof 1	57.2500		57.2500	0.1100	6.2975			(30)
Total net area of external elements Aum(A, m2)			233.3000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	59.2084		(33)
Main dwelling								
Party Wall 1			68.6800	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							267.4389	(35)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E12 Gable (insulation at ceiling level)	8.4500	0.0600	0.5070	
E10 Eaves (insulation at ceiling level)	12.0500	0.0600	0.7230	
E21 Exposed floor (inverted)	3.5000	0.3200	1.1200	
P1 Party wall - Ground floor	12.4000	0.0800	0.9920	
P2 Party wall - Intermediate floor within a dwelling	12.4000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	12.4000	0.1200	1.4880	
E2 Other lintels (including other steel lintels)	17.9300	0.0500	0.8965	
E3 Sill	16.9300	0.0500	0.8465	
E4 Jamb	42.2000	0.0500	2.1100	
E5 Ground floor (normal)	24.0000	0.1600	3.8400	
E6 Intermediate floor within a dwelling	22.0000	0.0000	0.0000	
E16 Corner (normal)	19.9500	0.0900	1.7955	
E18 Party wall between dwellings	10.1000	0.0600	0.6060	
E17 Corner (inverted - internal area greater than external area)	9.6000	-0.0900	-0.8640	

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

Point Thermal Bridges

Total fabric heat loss

$$(36a) = 14.0605 \quad (36)$$
$$(33) + (36) + (36a) = 73.2689 \quad (37)$$

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

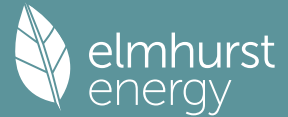
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.6058	57.2174	56.8367	55.0487	54.7142	53.1569	53.1569	52.8686	53.7568	54.7142	55.3910	56.0985	(38)
Heat transfer coeff	130.8747	130.4863	130.1057	128.3177	127.9832	126.4259	126.4259	126.1375	127.0257	127.9832	128.6599	129.3674	(39)
Average = Sum(39)m / 12 =												128.3161	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1455	1.1421	1.1388	1.1231	1.1202	1.1066	1.1066	1.1040	1.1118	1.1202	1.1261	1.1323	(40)
HLP (average)												1.1231	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8381	(42)
Hot water usage for mixer showers														
71.8049	70.7259	69.1534	66.1448	63.9246	61.4485	60.0412	61.6017	63.3124	65.9709	69.0441	71.5298	(42a)		
Hot water usage for baths														
31.0017	30.5413	29.8929	28.6974	27.8023	26.8097	26.2736	26.9174	27.6184	28.6805	29.9006	30.8969	(42b)		
Hot water usage for other uses														
43.6947	42.1058	40.5169	38.9280	37.3391	35.7502	35.7502	37.3391	38.9280	40.5169	42.1058	43.6947	(42c)		
Average daily hot water use (litres/day)													134.6676	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use														
146.5013	143.3729	139.5632	133.7703	129.0659	124.0084	122.0649	125.8582	129.8588	135.1682	141.0504	146.1214	(44)		
Energy content (annual)	232.0223	204.1611	214.5035	183.1248	173.7476	152.4829	147.6270	155.8387	160.1288	183.4220	200.9522	228.7908	(45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2236.8017		
34.8033	30.6242	32.1755	27.4687	26.0621	22.8724	22.1440	23.3758	24.0193	27.5133	30.1428	34.3186	(46)		
Water storage loss (or HIU loss):														
Store volume													210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7016	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.9188	(55)
Total storage loss														
28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)		
If cylinder contains dedicated solar storage														
28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(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														
283.7689	250.9000	266.2500	233.2021	225.4942	202.5602	199.3735	207.5853	210.2062	235.1686	251.0296	280.5374	(62)		
WWHRS	-32.8262	-29.0318	-30.4004	-25.1727	-23.4601	-20.0750	-18.8171	-20.0101	-20.7703	-24.4859	-27.7396	-32.2183	(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														
250.9427	221.8682	235.8496	208.0294	202.0341	182.4852	180.5565	187.5753	189.4359	210.6827	223.2900	248.3191	(64)		
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2541.0685	(64)	
Electric shower(s)												2541	(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														
118.5447	105.2747	112.7197	100.9509	99.1683	90.7624	90.4832	93.2137	93.3047	102.3851	106.8785	117.4702	(65)		

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	140.7591	155.8405	140.7591	145.4511	140.7591	145.4511	140.7591	140.7591	145.4511	140.7591	145.4511	140.7591 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.5263	280.4061	273.1490	257.6994	238.1970	219.8676	207.6224	204.7426	211.9997	227.4493	246.9516	265.2811 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229 (71)
Water heating gains (Table 5)	159.3343	156.6587	151.5049	140.2095	133.2908	126.0589	121.6173	125.2872	129.5899	137.6144	148.4423	157.8901 (72)
Total internal gains	646.1907	661.4764	633.9841	611.9311	580.8180	556.9487	535.5699	536.3599	552.6117	574.3939	609.4161	632.5013 (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				0.8800	11.2829	0.6300	0.7000	0.7700	3.0344 (75)			
Southeast				5.4600	36.7938	0.6300	0.7000	0.7700	61.3959 (77)			
Southwest				6.8900	36.7938	0.6300	0.7000	0.7700	77.4758 (79)			
Northwest				9.9600	11.2829	0.6300	0.7000	0.7700	34.3442 (81)			

Solar gains	176.2504	312.6352	460.7394	626.1550	751.7997	768.5561	731.7344	634.6049	517.4890	354.4203	213.3683	149.3705 (83)
Total gains	822.4411	974.1116	1094.7235	1238.0861	1332.6177	1325.5048	1267.3042	1170.9648	1070.1008	928.8142	822.7844	781.8719 (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	64.8519	65.0449	65.2352	66.1442	66.3171	67.1340	67.1340	67.2874	66.8169	66.3171	65.9683	65.6075
alpha	5.3235	5.3263	5.3490	5.4096	5.4211	5.4756	5.4756	5.4858	5.4545	5.4211	5.3979	5.3738
util living area	0.9966	0.9911	0.9764	0.9223	0.7929	0.5938	0.4362	0.4902	0.7502	0.9523	0.9918	0.9974 (86)
MIT	19.7844	19.9890	20.2715	20.6330	20.8806	20.9803	20.9969	20.9944	20.9340	20.6009	20.1318	19.7570 (87)
Th 2	19.9638	19.9666	19.9693	19.9820	19.9844	19.9955	19.9955	19.9975	19.9912	19.9844	19.9796	19.9745 (88)
util rest of house	0.9954	0.9880	0.9681	0.8961	0.7344	0.5080	0.3381	0.3862	0.6661	0.9304	0.9884	0.9964 (89)
MIT 2	18.5577	18.8199	19.1774	19.6237	19.8909	19.9853	19.9946	19.9958	19.9504	19.5980	19.0127	18.5305 (90)
Living area fraction	18.7477	19.0010	19.3469	19.7800	20.0442	20.1395	20.1499	20.1505	20.1028	19.7533	19.1860	18.7206 (92)
MIT	18.7477	19.0010	19.3469	19.7800	20.0442	20.1395	20.1499	20.1505	20.1028	19.7533	19.1860	18.7206 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7477	19.0010	19.3469	19.7800	20.0442	20.1395	20.1499	20.1505	20.1028	19.7533	19.1860	18.7206 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9932	0.9839	0.9615	0.8899	0.7382	0.5207	0.3534	0.4023	0.6762	0.9240	0.9846	0.9947 (94)
Useful gains	816.8854	958.4399	1052.5818	1101.8136	983.7472	690.1263	447.8101	471.1156	723.6302	858.2508	810.0946	777.7476 (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	1890.8419	1839.9868	1671.4580	1396.1004	1067.9168	700.3306	448.7967	473.0748	762.5074	1171.4733	1554.9898	1878.4860 (97)
Space heating kWh	799.0236	592.3995	460.4439	211.8865	62.6222	0.0000	0.0000	0.0000	0.0000	233.0375	536.3245	818.9493 (98a)
Space heating requirement - total per year (kWh/year)												3714.6870
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	799.0236	592.3995	460.4439	211.8865	62.6222	0.0000	0.0000	0.0000	0.0000	233.0375	536.3245	818.9493 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3714.6870
Space heating per m ²										(98c) / (4) =		32.5137 (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	799.0236	592.3995	460.4439	211.8865	62.6222	0.0000	0.0000	0.0000	0.0000	233.0375	536.3245	818.9493 (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)	865.6811	641.8196	498.8558	229.5628	67.8463	0.0000	0.0000	0.0000	0.0000	252.4784	581.0666	887.2690 (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)

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

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	57.0000 (1b)	x 2.4000 (2b)	= 136.8000 (1b) - (3b)
First floor	57.2500 (1c)	x 2.6500 (2c)	= 151.7125 (1c) - (3c)

$$(3a) + (3b) + (3c) + (3d) + (3e) \dots (3n) = 288.5125 \quad (5)$$

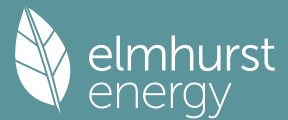
m3 per hour

Air changes per hour

	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	0.4643	0.4551	0.4460	0.4005	0.3914	0.3459	0.3459	0.3368	0.3641	0.3914	0.4096	0.4278 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23b)
Effective ac	0.6078	0.6036	0.5995	0.5802	0.5766	0.5598	0.5598	0.5567	0.5663	0.5766	0.5839	0.5915 (23c)

Assumed occupancy												2.8381	(42)	
Hot water usage	for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage	for baths	31.0017	30.5413	29.8929	28.6974	27.8023	26.8097	26.2736	26.9174	27.6184	28.6805	29.9006	30.8969	(42b)
Hot water usage	for other uses	43.6947	42.1058	40.5169	38.9280	37.3391	35.7502	35.7502	37.3391	38.9280	40.5169	42.1058	43.6947	(42c)
Average daily hot water use (litres/day)												68.4659	(43)	

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.6964	72.6471	70.4098	67.6254	65.1414	62.5599	62.0238	64.2565	66.5464	69.1974	72.0064	74.5916	(44)
Energy conte	118.3008	103.4485	108.2172	92.5758	87.6928	76.9247	75.0124	79.5630	82.0584	93.9002	102.5863	116.7924	(45)
Energy content (annual)	Total = Sum(45)m = 1137.0724												
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):	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)
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	(57)
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	(59)
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	(61)
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	(62)
Total heat required for water heating calculated for each month	100.5557	87.9312	91.9847	78.6895	74.5389	65.3860	63.7605	67.6285	69.7496	79.8152	87.1983	99.2735	(63a)
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	(63b)
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	(63c)
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	(63d)
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	(64)
Output from w/h	100.5557	87.9312	91.9847	78.6895	74.5389	65.3860	63.7605	67.6285	69.7496	79.8152	87.1983	99.2735	(64a)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 966.5116												(64)
Electric shower(s)	57.5038	51.2364	55.9481	53.3906	54.3925	51.8851	53.6146	54.3925	53.3906	55.9481	54.8961	57.5038	(64a)
Heat gains from water heating, kWh/month	39.5149	34.7919	36.9832	33.0200	32.2328	29.3178	29.3438	30.5052	30.7851	33.9408	35.5236	39.1943	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	140.7591	155.8405	140.7591	145.4511	140.7591	145.4511	140.7591	140.7591	145.4511	140.7591	145.4511	140.7591	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.5263	280.4061	273.1490	257.6994	238.1970	219.8676	207.6224	204.7426	211.9997	227.4493	246.9516	265.2811	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	(71)
Water heating gains (Table 5)	53.1114	51.7736	49.7086	45.8611	43.3237	40.7191	39.4406	41.0017	42.7570	45.6194	49.3383	52.6805	(72)
Total internal gains	536.9678	553.5913	529.1878	514.5827	487.8510	471.6089	453.3932	452.0744	465.7789	479.3989	507.3121	524.2918	(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				0.8800	11.2829		0.6300		0.7000		0.7700		3.0344 (75)
Southeast				5.4600	36.7938		0.6300		0.7000		0.7700		61.3959 (77)
Southwest				6.8900	36.7938		0.6300		0.7000		0.7700		77.4758 (79)
Northwest				9.9600	11.2829		0.6300		0.7000		0.7700		34.3442 (81)
Solar gains	176.2504	312.6352	460.7394	626.1550	751.7997	768.5561	731.7344	634.6049	517.4890	354.4203	213.3683	149.3705	(83)
Total gains	713.2182	866.2265	989.9272	1140.7377	1239.6507	1240.1650	1185.1276	1086.6793	983.2679	833.8192	720.6804	673.6623	(84)

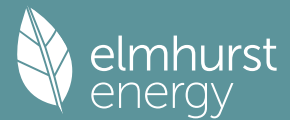
7. Mean internal temperature (heating season)

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	68.5033	68.7243	68.9423	69.9850	70.1837	71.1232	71.1232	71.3000	70.7584	70.1837	69.7830	69.3691
alpha	5.5669	5.5816	5.5962	5.6657	5.6789	5.7415	5.7415	5.7533	5.7172	5.6789	5.6522	5.6246
util living area	0.9983	0.9945	0.9832	0.9343	0.8060	0.6006	0.4407	0.4990	0.7692	0.9651	0.9954	0.9987 (86)
MIT	19.7794	19.9859	20.2690	20.6373	20.8866	20.9829	20.9975	20.9952	20.9354	20.5907	20.1216	19.7534 (87)
Th 2	20.0136	20.0164	20.0192	20.0324	20.0349	20.0464	20.0464	20.0486	20.0420	20.0349	20.0299	20.0247 (88)
util rest of house	0.9976	0.9926	0.9771	0.9115	0.7504	0.5179	0.3465	0.3984	0.6891	0.9483	0.9934	0.9983 (89)
MIT 2	18.9025	19.1101	19.3915	19.7522	19.9647	20.0395	20.0459	20.0473	20.0101	19.7184	19.2567	18.8854 (90)
Living area fraction	19.0383	19.2458	19.5275	19.8893	20.1075	20.1856	20.1933	20.1942	20.1535	19.8535	19.3907	19.0199 (91)
MIT	19.0383	19.2458	19.5275	19.8893	20.1075	20.1856	20.1933	20.1942	20.1535	19.8535	19.3907	19.0199 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0383	19.2458	19.5275	19.8893	20.1075	20.1856	20.1933	20.1942	20.1535	19.8535	19.3907	19.0199 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9905	0.9732	0.9075	0.7550	0.5303	0.3611	0.4141	0.6992	0.9442	0.9916	0.9976	(94)
Useful gains	710.8948	857.9945	963.3650	1035.2719	935.9229	657.6980	428.0044	449.9610	687.5228	787.3297	714.5931	672.0454	(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	1826.0580	1771.7050	1603.8069	1332.7377	1016.7392	666.5588	428.8038	451.6551	726.1129	1119.0517	1494.8704	1813.2471	(97)
Space heating kWh	829.6814	614.0135	476.4888	214.1754	60.1273	0.0000	0.0000	0.0000	0.0000	246.8012	561.7996	849.0540	(98a)
Space heating requirement - total per year (kWh/year)	3852.1412												
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)

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Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh												
	829.6814	614.0135	476.4888	214.1754	60.1273	0.0000	0.0000	0.0000	0.0000	246.8012	561.7996	849.0540 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3852.1412
Space heating per m2												(98c) / (4) = 33.7168 (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	1121.7459	883.0766	904.6950	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9265	0.9658	0.9462	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1039.2989	852.8604	856.0054	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1391.1358	1329.5344	1217.2594	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	253.3226	354.6455	268.7730	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	63.3306	88.6614	67.1932	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												219.1853 (107)
Energy for space heating												33.7168 (99)
Energy for space cooling												1.9185 (108)
Total												35.6352 (109)
Fabric Energy Efficiency (DFEE)												35.6 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	57.0000 (1b)	x 2.4000 (2b)	= 136.8000 (1b) - (3b)
First floor	57.2500 (1c)	x 2.6500 (2c)	= 151.7125 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.2500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	288.5125 (5)

2. Ventilation rate

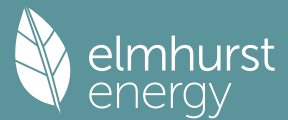
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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) = 0.1386 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3886 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3595 (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	0.4584	0.4494	0.4404	0.3954	0.3865	0.3415	0.3415	0.3325	0.3595	0.3865	0.4044	0.4224 (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	0.6050	0.6010	0.5970	0.5782	0.5747	0.5583	0.5583	0.5553	0.5646	0.5747	0.5818	0.5892 (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			2.1100	1.0000	2.1100		(26)
TER Opening Type			23.1900	1.1450	26.5534		(27)
Heatloss Floor 1			56.0000	0.1300	7.2800		(28a)
Heatloss Floor 2			1.7500	0.1300	0.2275		(28b)
External Wall 1	118.3000	25.3000	93.0000	0.1800	16.7400		(29a)
External Roof 1	57.2500		57.2500	0.1100	6.2975		(30)
Total net area of external elements Aum(A, m2)			233.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2084		(33)
Main dwelling							

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Party Wall 1	68.6800	0.0000	0.0000	(32)									
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				267.4389 (35)									
List of Thermal Bridges													
K1 Element	Length	Psi-value	Total										
E12 Gable (insulation at ceiling level)	8.4500	0.0600	0.5070										
E10 Eaves (insulation at ceiling level)	12.0500	0.0600	0.7230										
E21 Exposed floor (inverted)	3.5000	0.3200	1.1200										
P1 Party wall - Ground floor	12.4000	0.0800	0.9920										
P2 Party wall - Intermediate floor within a dwelling	12.4000	0.0000	0.0000										
P4 Party wall - Roof (insulation at ceiling level)	12.4000	0.1200	1.4880										
E2 Other lintels (including other steel lintels)	17.9300	0.0500	0.8965										
E3 Sill	16.9300	0.0500	0.8465										
E4 Jamb	42.2000	0.0500	2.1100										
E5 Ground floor (normal)	24.0000	0.1600	3.8400										
E6 Intermediate floor within a dwelling	22.0000	0.0000	0.0000										
E16 Corner (normal)	19.9500	0.0900	1.7955										
E18 Party wall between dwellings	10.1000	0.0600	0.6060										
E17 Corner (inverted - internal area greater than external area)	9.6000	-0.0900	-0.8640										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				14.0605 (36)									
Point Thermal bridges				0.0000									
Total fabric heat loss	(33) + (36) + (36a) =			73.2689 (37)									
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	57.6058	57.2174	56.8367	55.0487	54.7142	53.1569	53.1569	52.8686	53.7568	54.7142	55.3910	56.0985	(39)
Average = Sum(39)m / 12 =	130.8747	130.4863	130.1057	128.3177	127.9832	126.4259	126.4259	126.1375	127.0257	127.9832	128.6599	129.3674	(39)
												128.3161	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	1.1455	1.1421	1.1388	1.1231	1.1202	1.1066	1.1066	1.1040	1.1118	1.1202	1.1261	1.1323	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8381 (42)
Hot water usage for mixer showers													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
31.0017	30.5413	29.8929	28.6974	27.8023	26.8097	26.2736	26.9174	27.6184	28.6805	29.9006	30.8969	30.8969	(42b)
Hot water usage for other uses													
43.6947	42.1058	40.5169	38.9280	37.3391	35.7502	35.7502	37.3391	38.9280	40.5169	42.1058	43.6947	43.6947	(42c)
Average daily hot water use (litres/day)													68.4659 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.6964	72.6471	70.4098	67.6254	65.1414	62.5599	62.0238	64.2565	66.5464	69.1974	72.0064	74.5916	(44)
Energy conte	118.3008	103.4485	108.2172	92.5758	87.6928	76.9247	75.0124	79.5630	82.0584	93.9002	102.5863	116.7924	(45)
Energy content (annual)										Total = Sum(45)m =		1137.0724	
Distribution loss (46)m = 0.15 x (45)m													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (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													
100.5557	87.9312	91.9847	78.6895	74.5389	65.3860	63.7605	67.6285	69.7496	79.8152	87.1983	99.2735	99.2735	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
100.5557	87.9312	91.9847	78.6895	74.5389	65.3860	63.7605	67.6285	69.7496	79.8152	87.1983	99.2735	99.2735	(64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		966.5116	(64)
Electric shower(s)												967	(64)
57.5038	51.2364	55.9481	53.3906	54.3925	51.8851	53.6146	54.3925	53.3906	55.9481	54.8961	57.5038	57.5038	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												654.1023	(64a)
Heat gains from water heating, kWh/month													
39.5149	34.7919	36.9832	33.0200	32.2328	29.3178	29.3438	30.5052	30.7851	33.9408	35.5236	39.1943	39.1943	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	141.9036	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
140.7591	155.8405	140.7591	145.4511	140.7591	145.4511	140.7591	140.7591	140.7591	145.4511	140.7591	145.4511	140.7591	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
277.5263	280.4061	273.1490	257.6994	238.1970	219.8676	207.6224	204.7426	211.9997	227.4493	246.9516	265.2811	265.2811	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	37.1904	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	(71)
Water heating gains (Table 5)													
53.1114	51.7736	49.7086	45.8611	43.3237	40.7191	39.4406	41.0017	42.7570	45.6194	49.3383	52.6805	52.6805	(72)
Total internal gains	536.9678	553.5913	529.1878	514.5827	487.8510	471.6089	453.3932	452.0744	465.7789	479.3989	507.3121	524.2918	(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
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Northeast			0.8800		11.2829		0.6300		0.7000		0.7700		3.0344 (75)
Southeast			5.4600		36.7938		0.6300		0.7000		0.7700		61.3959 (77)
Southwest			6.8900		36.7938		0.6300		0.7000		0.7700		77.4758 (79)
Northwest			9.9600		11.2829		0.6300		0.7000		0.7700		34.3442 (81)

Solar gains	176.2504	312.6352	460.7394	626.1550	751.7997	768.5561	731.7344	634.6049	517.4890	354.4203	213.3683	149.3705	(83)
Total gains	713.2182	866.2265	989.9272	1140.7377	1239.6507	1240.1650	1185.1276	1086.6793	983.2679	833.8192	720.6804	673.6623	(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	64.8519	65.0449	65.2352	66.1442	66.3171	67.1340	67.1340	67.2874	66.8169	66.3171	65.9683	65.6075	
alpha	5.3235	5.3363	5.3490	5.4096	5.4211	5.4756	5.4756	5.4858	5.4545	5.4211	5.3979	5.3738	
util living area	0.9983	0.9948	0.9846	0.9419	0.8266	0.6291	0.4654	0.5258	0.7927	0.9689	0.9956	0.9987	(86)
MIT	19.6886	19.8966	20.1876	20.5728	20.8520	20.9741	20.9958	20.9921	20.9131	20.5324	20.0438	19.6616	(87)
Th 2	19.9638	19.9666	19.9693	19.9820	19.9844	19.9955	19.9955	19.9975	19.9912	19.9844	19.9796	19.9745	(88)
util rest of house	0.9976	0.9929	0.9789	0.9206	0.7716	0.5405	0.3613	0.4156	0.7116	0.9532	0.9937	0.9983	(89)
MIT 2	18.7727	18.9818	19.2714	19.6498	19.8916	19.9848	19.9945	19.9956	19.9476	19.6213	19.1393	18.7541	(90)
Living area fraction										FLA = Living area / (4) =		0.1549	(91)
MIT	18.9146	19.1236	19.4133	19.7928	20.0404	20.1381	20.1496	20.1499	20.0972	19.7624	19.2795	18.8947	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9146	19.1236	19.4133	19.7928	20.0404	20.1381	20.1496	20.1499	20.0972	19.7624	19.2795	18.8947	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9908	0.9749	0.9159	0.7749	0.5536	0.3775	0.4327	0.7210	0.9488	0.9918	0.9975	(94)
Useful gains	710.8700	858.2455	965.0517	1044.7626	960.6503	686.4967	447.3959	470.2094	708.9702	791.1002	714.7597	672.0109	(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	1912.6812	1855.9815	1680.0940	1397.7404	1067.4296	700.1571	448.7664	473.0085	761.7976	1172.6358	1567.0091	1901.0180	(97)
Space heating kWh	894.1475	670.4786	531.9914	254.1440	79.4438	0.0000	0.0000	0.0000	0.0000	283.8625	613.6196	914.3813	(98a)
Space heating requirement - total per year (kWh/year)												4242.0687	
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	894.1475	670.4786	531.9914	254.1440	79.4438	0.0000	0.0000	0.0000	0.0000	283.8625	613.6196	914.3813	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4242.0687	
Space heating per m2										(98c) / (4) =		37.1297	(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	1188.4032	935.5515	958.6449	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9038	0.9518	0.9272	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1074.0663	890.4529	888.8813	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1391.1358	1329.5344	1217.2594	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	228.2901	326.6766	244.3133	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	57.0725	81.6691	61.0783	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												199.8200	(107)
Energy for space heating												37.1297	(99)
Energy for space cooling												1.7490	(108)
Total												38.8787	(109)
Fabric Energy Efficiency (TFEE)												38.9	(109)

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

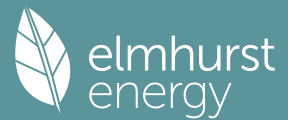
1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	57.0000 (1b)	x 2.4000 (2b)	= 136.8000 (1b) - (3b)	
First floor	57.2500 (1c)	x 2.6500 (2c)	= 151.7125 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.2500		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	288.5125 (5)	

2. Ventilation rate

m3 per hour

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

0 * 80 = 0.0000 (6a)
0 * 20 = 0.0000 (6b)
0 * 10 = 0.0000 (6c)
0 * 20 = 0.0000 (6d)
0 * 35 = 0.0000 (6e)
0 * 20 = 0.0000 (6f)
5 * 10 = 50.0000 (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) = 50.0000 / (5) = 0.1733 (8)
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered
Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3962 (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	0.5051	0.4952	0.4853	0.4358	0.4259	0.3764	0.3764	0.3665	0.3962	0.4259	0.4457	0.4655 (22b)
Effective ac	0.6276	0.6226	0.6178	0.5950	0.5907	0.5708	0.5708	0.5671	0.5785	0.5907	0.5993	0.6084 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
windows			23.1900	1.1450	26.5534		(27)
doors			2.1100	1.4000	2.9540		(26)
Heatloss Floor 1			56.0000	0.1000	5.6000	75.0000	4200.0000 (28a)
Heatloss Floor 2			1.7500	0.1800	0.3150	20.0000	35.0000 (28b)
External Wall 1	118.3000	25.3000	93.0000	0.1800	16.7400	140.0000	13020.0000 (29a)
External Roof 1	57.2500		57.2500	0.1200	6.8700	9.0000	515.2500 (30)
Total net area of external elements Aum(A, m2)			233.3000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 59.0324		(33)
Main dwelling							
Party Wall 1			68.6800	0.0000	0.0000	140.0000	9615.2000 (32)
Internal Wall 1			181.1600			9.0000	1630.4400 (32c)
Internal Floor 1			57.0000			18.0000	1026.0000 (32d)
Internal Ceiling 1			57.0000			9.0000	513.0000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 30554.8900 (34)
List of Thermal Bridges
267.4389 (35)

K1 Element	Length	Psi-value	Total
E12 Gable (insulation at ceiling level)	8.4500	0.0430	0.3633
E10 Eaves (insulation at ceiling level)	12.0500	0.0570	0.6869
E21 Exposed floor (inverted)	3.5000	0.3200	1.1200
P1 Party wall - Ground floor	12.4000	0.0500	0.6200
P2 Party wall - Intermediate floor within a dwelling	12.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	12.4000	0.0400	0.4960
E2 Other lintels (including other steel lintels)	17.9300	0.0250	0.4483
E3 Sill	16.9300	0.0220	0.3725
E4 Jamb	42.2000	0.0170	0.7174
E5 Ground floor (normal)	24.0000	0.0750	1.8000
E6 Intermediate floor within a dwelling	22.0000	0.0010	0.0220
E16 Corner (normal)	19.9500	0.0420	0.8379
E18 Party wall between dwellings	10.1000	0.0330	0.3333
E17 Corner (inverted - internal area greater than external area)	9.6000	-0.0850	-0.8160

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 66.0339 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m
Heat transfer coeff
Average = Sum(39)m / 12 =
HLP
HLP (average)
Days in mont

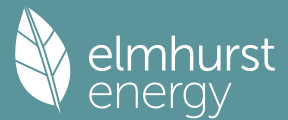
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	59.7511	59.2795	58.8172	56.6456	56.2393	54.3480	54.3480	53.9977	55.0765	56.2393	57.0612	57.9205 (38)
Feb	125.7851	125.3134	124.8511	122.6796	122.2733	120.3819	120.3819	120.0317	121.1105	122.2733	123.0952	123.9545 (39)
Mar												122.6776
Apr	1.1010	1.0968	1.0928	1.0738	1.0702	1.0537	1.0537	1.0506	1.0600	1.0702	1.0774	1.0849 (40)
May												1.0738
Jun	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Hot water usage for mixer showers
Hot water usage for baths
Hot water usage for other uses
Average daily hot water use (litres/day)
Daily hot water use
Energy conte
Energy content (annual)
Distribution loss (46)m = 0.15 x (45)m
Water storage loss (or HIU loss):
Store volume
a) If manufacturer declared loss factor is known (kWh/day):
Temperature factor from Table 2b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	173.4282	169.8951	165.4957	158.5746	153.0376	147.0516	144.5804	148.9588	153.6009	159.9073	166.9420	172.9451 (44)
Feb	274.6678	241.9284	254.3608	217.0807	206.0181	180.8172	174.8574	184.4422	189.4053	216.9927	237.8394	270.7902 (45)
Mar												2649.2001
Apr	41.2002	36.2893	38.1541	32.5621	30.9027	27.1226	26.2286	27.6663	28.4108	32.5489	35.6759	40.6185 (46)
May												210.0000 (47)
Jun												2.5800 (48)
Jul												0.7800 (49)

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Enter (49) or (54) in (55)												2.0124 (55)
Total storage loss	62.3844	56.3472	62.3844	60.3720	62.3844	60.3720	62.3844	62.3844	60.3720	62.3844	60.3720	62.3844 (56)
If cylinder contains dedicated solar storage	62.3844	56.3472	62.3844	60.3720	62.3844	60.3720	62.3844	62.3844	60.3720	62.3844	60.3720	62.3844 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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	391.9098	347.8244	371.6028	330.5407	323.2601	263.7012	260.5042	270.0890	272.2893	334.2347	351.2994	388.0322 (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	391.9098	347.8244	371.6028	330.5407	323.2601	263.7012	260.5042	270.0890	272.2893	334.2347	351.2994	388.0322 (64)
	Total per year (kWh/year) = Sum(64)m =											3905.2877 (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	135.2131	120.0802	128.4610	114.6497	112.3871	78.1313	76.7500	79.9369	80.9869	116.0362	121.5520	133.9238 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.5807	28.0497	22.8115	17.2698	12.9094	10.8986	11.7764	15.3074	20.5455	26.0872	30.4476	32.4584 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	414.2183	418.5166	407.6850	384.6259	355.5180	328.1606	309.8842	305.5859	316.4175	339.4765	368.5845	395.9419 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229 (71)
Water heating gains (Table 5)	181.7381	178.6908	172.6627	159.2357	151.0579	108.5157	103.1586	107.4421	112.4817	155.9626	168.8222	180.0051 (72)
Total internal gains	739.1650	736.8850	714.7872	672.7594	631.1132	559.2029	536.4471	539.9633	561.0726	633.1543	679.4823	720.0333 (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				0.8800	11.2829		0.6300		0.7000		0.7700		3.0344 (75)
Southeast				5.4600	36.7938		0.6300		0.7000		0.7700		61.3959 (77)
Southwest				6.8900	36.7938		0.6300		0.7000		0.7700		77.4758 (79)
Northwest				9.9600	11.2829		0.6300		0.7000		0.7700		34.3442 (81)
Solar gains	176.2504	312.6352	460.7394	626.1550	751.7997	768.5561	731.7344	634.6049	517.4890	354.4203	213.3683		149.3705 (83)
Total gains	915.4153	1049.5202	1175.5266	1298.9144	1382.9129	1327.7589	1268.1815	1174.5682	1078.5616	987.5746	892.8506		869.4039 (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	67.4760	67.7299	67.9807	69.1841	69.4139	70.5045	70.5045	70.7102	70.0804	69.4139	68.9505	68.4725
alpha	5.4984	5.5153	5.5320	5.6123	5.6276	5.7003	5.7003	5.7140	5.6720	5.6276	5.5967	5.5648
util living area	0.9941	0.9868	0.9658	0.8992	0.7554	0.5690	0.4160	0.4667	0.7246	0.9337	0.9873	0.9955 (86)
Living	20.1428	20.2828	20.4893	20.7309	20.8823	20.9355	20.9441	20.9430	20.9086	20.7085	20.3843	20.1234
Non living	19.0071	19.1871	19.4471	19.7468	19.9066	19.9638	19.9686	19.9709	19.9411	19.7311	19.3300	18.9931
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.0000	20.0034	20.0067	20.0223	20.0252	20.0388	20.0388	20.0414	20.0336	20.0252	20.0193	20.0132 (88)
util rest of house	0.9921	0.9824	0.9545	0.8689	0.6962	0.4886	0.3261	0.3713	0.6425	0.9063	0.9823	0.9939 (89)
MIT 2	20.0000	20.0034	20.0067	20.0223	20.0252	20.0388	20.0388	20.0414	20.0336	20.0252	20.0193	20.0132 (90)
Living area fraction	fLA = Living area / (4) = 0.1549 (91)											
MIT	20.1550	20.1578	20.1606	20.1738	20.1762	20.1878	20.1878	20.1899	20.1833	20.1762	20.1712	20.1660 (92)
Temperature adjustment	0.0000											
adjusted MIT	20.1550	20.1578	20.1606	20.1738	20.1762	20.1878	20.1878	20.1899	20.1833	20.1762	20.1712	20.1660 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9925	0.9832	0.9565	0.8741	0.7060	0.5014	0.3401	0.3862	0.6560	0.9112	0.9832	0.9942 (94)
Useful gains	908.5265	1031.8466	1124.4180	1135.3493	976.2988	665.7118	431.2864	453.6708	707.5800	899.9089	877.8287	864.3694 (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	1994.3179	1912.0087	1705.5419	1383.0612	1036.4175	672.6645	431.9006	454.9068	736.7528	1170.9181	1609.0077	1979.0615 (97)
Space heating kWh	807.8288	591.4690	432.3562	178.3526	44.7283	0.0000	0.0000	0.0000	0.0000	201.6308	526.4488	829.3309 (98a)
Space heating requirement - total per year (kWh/year)	3612.1454											
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	807.8288	591.4690	432.3562	178.3526	44.7283	0.0000	0.0000	0.0000	0.0000	201.6308	526.4488	829.3309 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3612.1454											

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Space heating per m2

(98c) / (4) = 31.6162 (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 %)												370.9193 (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	807.8288	591.4690	432.3562	178.3526	44.7283	0.0000	0.0000	0.0000	0.0000	201.6308	526.4488	829.3309 (98)
Space heating efficiency (main heating system 1)	370.9193	370.9193	370.9193	370.9193	370.9193	0.0000	0.0000	0.0000	0.0000	370.9193	370.9193	370.9193 (210)
Space heating fuel (main heating system)	217.7910	159.4603	116.5634	48.0839	12.0588	0.0000	0.0000	0.0000	0.0000	54.3597	141.9308	223.5880 (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	391.9098	347.8244	371.6028	330.5407	323.2601	263.7012	260.5042	270.0890	272.2893	334.2347	351.2994	388.0322 (64)
Efficiency of water heater (217)m	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600 (216)
Fuel for water heating, kWh/month	323.9995	287.5532	307.2113	273.2644	267.2454	218.0069	215.3639	223.2878	225.1069	276.3184	290.4261	320.7938 (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	27.6424	22.1757	19.9668	14.6285	11.2995	9.2318	10.3078	13.3984	17.4032	22.8340	25.7909	28.4106 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-89.8995	-149.2780	-251.8008	-331.1690	-400.5212	-387.7254	-382.5721	-339.2730	-270.7138	-189.3919	-106.4153	-75.2781 (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												973.8359 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												120.9600
Water heating fuel used												3228.5778 (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)												223.0897 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2974.0381 (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												1451.4653 (238)

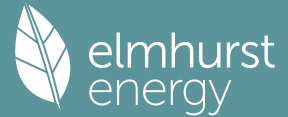
10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	973.8359	16.4900	160.5855 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3228.5778	16.4900	532.3925 (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	223.0897	16.4900	36.7875 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2974.0381	16.4900	-490.4189
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-490.4189 (252)
Total energy cost			239.3466 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.5411 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	91.2293
SAP rating (Section 12)		91 (258)
SAP band		B

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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	973.8359	0.1567	152.5849 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	3228.5778	0.1414	456.4375 (264)
Space and water heating			609.0224 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	223.0897	0.1443	32.1987 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2974.0381	0.1316	-391.4041
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-391.4041 (269)
Total CO ₂ , kg/year			249.8170 (272)
CO ₂ emissions per m ²			2.1900 (273)
EI value			97.8979
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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	57.0000 (1b)	x 2.4000 (2b)	= 136.8000 (1b) - (3b)
First floor	57.2500 (1c)	x 2.6500 (2c)	= 151.7125 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.2500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.5125 (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	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	50.0000 / (5) = 0.1733 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.1000 (17)
Infiltration rate	0.4283 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3962 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.4160	0.3962	0.3962	0.3665	0.3665	0.3268	0.3368	0.3169	0.3268	0.3467	0.3467	0.3764 (22b)
Effective ac	0.5865	0.5785	0.5785	0.5671	0.5671	0.5534	0.5567	0.5502	0.5534	0.5601	0.5601	0.5708 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
windows			23.1900	1.1450	26.5534		(27)
doors			2.1100	1.4000	2.9540		(26)
Heatloss Floor 1			56.0000	0.1000	5.6000	75.0000	4200.0000 (28a)
Heatloss Floor 2			1.7500	0.1800	0.3150	20.0000	35.0000 (28b)
External Wall 1	118.3000	25.3000	93.0000	0.1800	16.7400	140.0000	13020.0000 (29a)
External Roof 1	57.2500		57.2500	0.1200	6.8700	9.0000	515.2500 (30)
Total net area of external elements Aum(A, m ²)			233.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.0324		(33)
Main dwelling							
Party Wall 1			68.6800	0.0000	0.0000	140.0000	9615.2000 (32)
Internal Wall 1			181.1600			9.0000	1630.4400 (32c)
Internal Floor 1			57.0000			18.0000	1026.0000 (32d)
Internal Ceiling 1			57.0000			9.0000	513.0000 (32e)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 30554.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							267.4389 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E12 Gable (insulation at ceiling level)				8.4500	0.0430		0.3633
E10 Eaves (insulation at ceiling level)				12.0500	0.0570		0.6869
E21 Exposed floor (inverted)				3.5000	0.3200		1.1200
P1 Party wall - Ground floor				12.4000	0.0500		0.6200

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P2 Party wall - Intermediate floor within a dwelling	12.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	12.4000	0.0400	0.4960
E2 Other lintels (including other steel lintels)	17.9300	0.0250	0.4483
E3 Sill	16.9300	0.0220	0.3725
E4 Jamb	42.2000	0.0170	0.7174
E5 Ground floor (normal)	24.0000	0.0750	1.8000
E6 Intermediate floor within a dwelling	22.0000	0.0010	0.0220
E16 Corner (normal)	19.9500	0.0420	0.8379
E18 Party wall between dwellings	10.1000	0.0330	0.3333
E17 Corner (inverted - internal area greater than external area)	9.6000	-0.0850	-0.8160

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.0015 (36)
 Point Thermal bridges 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 66.0339 (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	55.8424	55.0765	55.0765	53.9977	53.9977	52.6902	53.0030	52.3866	52.6902	53.3253	53.3253	54.3480	(38)
Average = Sum(39)m / 12 =	121.8763	121.1105	121.1105	120.0317	120.0317	118.7241	119.0370	118.4206	118.7241	119.3592	119.3592	120.3819	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0668	1.0600	1.0600	1.0506	1.0506	1.0392	1.0419	1.0365	1.0392	1.0447	1.0447	1.0537	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8381 (42)
Hot water usage for mixer showers													
98.7318	97.2480	95.0859	90.9491	87.8963	84.4917	82.5566	84.7024	87.0545	90.7099	94.9356	98.3535	(42a)	
Hot water usage for baths													
31.0017	30.5413	29.8929	28.6974	27.8023	26.8097	26.2736	26.9174	27.6184	28.6805	29.9006	30.8969	(42b)	
Hot water usage for other uses													
43.6947	42.1058	40.5169	38.9280	37.3391	35.7502	35.7502	37.3391	38.9280	40.5169	42.1058	43.6947	(42c)	
Average daily hot water use (litres/day)													159.4933 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	173.4282	169.8951	165.4957	158.5746	153.0376	147.0516	144.5804	148.9588	153.6009	159.9073	166.9420	172.9451	(44)
Energy conte	274.6678	241.9284	254.3608	217.0807	206.0181	180.8172	174.8574	184.4422	189.4053	216.9927	237.8394	270.7902	(45)
Energy content (annual)										Total =	Sum(45)m =	2649.2001	
Distribution loss (46)m = 0.15 x (45)m													
41.2002	36.2893	38.1541	32.5621	30.9027	27.1226	26.2286	27.6663	28.4108	32.5489	35.6759	40.6185	(46)	
Water storage loss (or HIU loss):													
Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.5800 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													2.0124 (55)
Total storage loss													
62.3844	56.3472	62.3844	60.3720	62.3844	60.3720	62.3844	62.3844	60.3720	62.3844	60.3720	62.3844	(56)	
If cylinder contains dedicated solar storage													
62.3844	56.3472	62.3844	60.3720	62.3844	60.3720	62.3844	62.3844	60.3720	62.3844	60.3720	62.3844	(57)	
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(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													
391.9098	347.8244	371.6028	330.5407	323.2601	263.7012	260.5042	270.0890	272.2893	334.2347	351.2994	388.0322	(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	391.9098	347.8244	371.6028	330.5407	323.2601	263.7012	260.5042	270.0890	272.2893	334.2347	351.2994	388.0322	(64)
													3905.2877 (64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													0.0000 (64a)
Heat gains from water heating, kWh/month													
135.2131	120.0802	128.4610	114.6497	112.3871	78.1313	76.7500	79.9369	80.9869	116.0362	121.5520	133.9238	(65)	

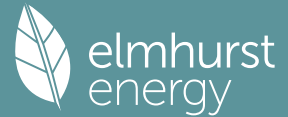
5. Internal gains (see Table 5 and 5a)

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	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	31.5807	28.0497	22.8115	17.2698	12.9094	10.8986	11.7764	15.3074	20.5455	26.0872	30.4476	32.4584	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	414.2183	418.5166	407.6850	384.6259	355.5180	328.1606	309.8842	305.5859	316.4175	339.4765	368.5845	395.9419	(68)
Pumps, fans	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	(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)	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	(71)
Total internal gains	181.7381	178.6908	172.6627	159.2357	151.0579	108.5157	103.1586	107.4421	112.4817	155.9626	168.8222	180.0051	(72)
	739.1650	736.8850	714.7872	672.7594	631.1132	559.2029	536.4471	539.9633	561.0726	633.1543	679.4823	720.0333	(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	0.8800	12.9236	0.6300	0.7000	0.7700	3.4757 (75)
Southeast	5.4600	40.4699	0.6300	0.7000	0.7700	67.5300 (77)
Southwest	6.8900	40.4699	0.6300	0.7000	0.7700	85.2164 (79)
Northwest	9.9600	12.9236	0.6300	0.7000	0.7700	39.3381 (81)

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Solar gains	195.5602	312.8924	457.6699	644.5940	756.6099	828.6556	780.0844	690.1441	558.4820	379.3373	242.6843	164.0508 (83)
Total gains	934.7251	1049.7774	1172.4571	1317.3534	1387.7231	1387.8584	1316.5315	1230.1074	1119.5546	1012.4915	922.1666	884.0841 (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	69.6400	70.0804	70.0804	70.7102	70.7102	71.4890	71.3011	71.6723	71.4890	71.1086	71.1086	70.5045
alpha	5.6427	5.6720	5.6720	5.7140	5.7140	5.7659	5.7534	5.7782	5.7659	5.7406	5.7406	5.7003
util living area	0.9915	0.9828	0.9532	0.8558	0.6636	0.4259	0.2802	0.3078	0.6001	0.8916	0.9789	0.9934 (86)
Living	20.2609	20.3808	20.5866	20.8066	20.9190	20.9445	20.9459	20.9461	20.9348	20.7971	20.5051	20.2431
Non living	19.1801	19.3355	19.5892	19.8472	19.9541	19.9812	19.9793	19.9841	19.9764	19.8481	19.5037	19.1665
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.0281	20.0336	20.0336	20.0414	20.0414	20.0508	20.0486	20.0530	20.0508	20.0462	20.0462	20.0388 (88)
util rest of house	0.9885	0.9771	0.9378	0.8155	0.5945	0.3460	0.1943	0.2169	0.5089	0.8498	0.9705	0.9910 (89)
MIT 2	20.0281	20.0336	20.0336	20.0414	20.0414	20.0508	20.0486	20.0530	20.0508	20.0462	20.0462	20.0388 (90)
Living area fraction									fLA = Living area / (4) =			0.1549 (91)
MIT	20.1787	20.1833	20.1833	20.1899	20.1899	20.1979	20.1960	20.1997	20.1979	20.1940	20.1940	20.1878 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1787	20.1833	20.1833	20.1899	20.1899	20.1979	20.1960	20.1997	20.1979	20.1940	20.1940	20.1878 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9890	0.9781	0.9405	0.8223	0.6056	0.3585	0.2076	0.2310	0.5235	0.8571	0.9720	0.9915 (94)
Useful gains	924.4848	1026.7950	1102.7474	1083.2570	840.4620	497.5177	273.2790	284.1318	586.0974	867.8433	896.3705	876.5352 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1837.7307	1766.1916	1548.1928	1235.1128	863.0145	498.3891	273.3046	284.1777	593.3684	1025.7724	1455.4656	1816.2929 (97)
Space heating kWh	679.4550	496.8746	331.4114	109.3361	16.7791	0.0000	0.0000	0.0000	0.0000	117.4993	402.5485	699.1797 (98a)
Space heating requirement - total per year (kWh/year)												2853.0837
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	679.4550	496.8746	331.4114	109.3361	16.7791	0.0000	0.0000	0.0000	0.0000	117.4993	402.5485	699.1797 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2853.0837
Space heating per m2										(98c) / (4) =		24.9723 (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 %)												370.3597 (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	679.4550	496.8746	331.4114	109.3361	16.7791	0.0000	0.0000	0.0000	0.0000	117.4993	402.5485	699.1797 (98)
Space heating efficiency (main heating system 1)	370.3597	370.3597	370.3597	370.3597	370.3597	0.0000	0.0000	0.0000	0.0000	370.3597	370.3597	370.3597 (210)
Space heating fuel (main heating system)	183.4581	134.1600	89.4837	29.5216	4.5305	0.0000	0.0000	0.0000	0.0000	31.7257	108.6912	188.7839 (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	391.9098	347.8244	371.6028	330.5407	323.2601	263.7012	260.5042	270.0890	272.2893	334.2347	351.2994	388.0322 (64)
Efficiency of water heater (217)m	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600 (216)
Fuel for water heating, kWh/month	323.9995	287.5532	307.2113	273.2644	267.2454	218.0069	215.3639	223.2878	225.1069	276.3184	290.4261	320.7938 (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	27.6424	22.1757	19.9668	14.6285	11.2995	9.2318	10.3078	13.3984	17.4032	22.8340	25.7909	28.4106 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-100.7024	-150.6431	-251.1690	-339.8817	-401.4726	-413.1942	-403.7784	-365.7333	-291.6109	-203.6797	-122.0542	-83.5022 (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												770.3547 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												120.9600
Water heating fuel used												3228.5778 (219)

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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)	223.0897 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3127.4218 (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	1094.6004 (238)

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	770.3547	27.6700	213.1571 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3228.5778	27.6700	893.3475 (247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	223.0897	27.6700	61.7289 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3127.4218	27.6700	-865.3576
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-865.3576 (252)
Total energy cost			302.8759 (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	770.3547	0.1576	121.3787 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3228.5778	0.1414	456.4375 (264)
Space and water heating			577.8163 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	223.0897	0.1443	32.1987 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3127.4218	0.1315	-411.2266
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-411.2266 (269)
Total CO2, kg/year			198.7884 (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	770.3547	1.5833	1219.6978 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3228.5778	1.5228	4916.4321 (278)
Space and water heating			6136.1299 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	223.0897	1.5338	342.1825 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3127.4218	1.4858	-4646.6396
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-4646.6396 (283)
Total Primary energy kWh/year			1831.6728 (286)

SAP 10 EPC IMPROVEMENTS

design rev 2

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

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

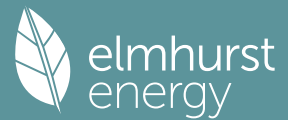
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.7	-£ 129	-59 kg (29.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£129	0.52 kg/m ²	A 94 A 98
Total Savings	£129	0.52 kg/m ²	

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£1168	£1023	£146
Space heating	£213	£235	-£22
Water heating	£893	£725	£168
Lighting	£62	£62	£0
Generated (PV)	-£865	-£849	-£17
Total cost of fuels	£303	£174	£129
Total cost of uses	£303	£173	£129
Delivered energy	10 kWh/m ²	5 kWh/m ²	4 kWh/m ²
Carbon dioxide emissions	0.2 tonnes	0.1 tonnes	0.1 tonnes
CO2 emissions per m ²	2 kg/m ²	1 kg/m ²	1 kg/m ²
Primary energy	16 kWh/m ²	10 kWh/m ²	6 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	57.0000 (1b)	x 2.4000 (2b)	= 136.8000 (1b) - (3b)
First floor	57.2500 (1c)	x 2.6500 (2c)	= 151.7125 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.2500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.5125 (5)

2. Ventilation rate

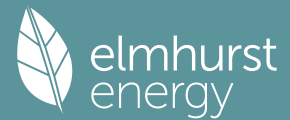
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	50.0000 / (5) = 0.1733 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.1000 (17)
Infiltration rate	0.4283 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3962 (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	0.5051	0.4952	0.4853	0.4358	0.4259	0.3764	0.3764	0.3665	0.3962	0.4259	0.4457	0.4655 (22b)
Effective ac	0.6276	0.6226	0.6178	0.5950	0.5907	0.5708	0.5708	0.5671	0.5785	0.5907	0.5993	0.6084 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
windows			23.1900	1.1450	26.5534		(27)
doors			2.1100	1.4000	2.9540		(26)
Heatloss Floor 1			56.0000	0.1000	5.6000	75.0000	4200.0000 (28a)
Heatloss Floor 2			1.7500	0.1800	0.3150	20.0000	35.0000 (28b)
External Wall 1	118.3000	25.3000	93.0000	0.1800	16.7400	140.0000	13020.0000 (29a)
External Roof 1	57.2500		57.2500	0.1200	6.8700	9.0000	515.2500 (30)
Total net area of external elements Aum(A, m ²)			233.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.0324		(33)
Main dwelling							
Party Wall 1			68.6800	0.0000	0.0000	140.0000	9615.2000 (32)
Internal Wall 1			181.1600			9.0000	1630.4400 (32c)
Internal Floor 1			57.0000			18.0000	1026.0000 (32d)
Internal Ceiling 1			57.0000			9.0000	513.0000 (32e)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 30554.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							267.4389 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E12 Gable (insulation at ceiling level)				8.4500	0.0430		0.3633
E10 Eaves (insulation at ceiling level)				12.0500	0.0570		0.6869
E21 Exposed floor (inverted)				3.5000	0.3200		1.1200
P1 Party wall - Ground floor				12.4000	0.0500		0.6200
P2 Party wall - Intermediate floor within a dwelling				12.4000	0.0000		0.0000
P4 Party wall - Roof (insulation at ceiling level)				12.4000	0.0400		0.4960
E2 Other lintels (including other steel lintels)				17.9300	0.0250		0.4483
E3 Sill				16.9300	0.0220		0.3725

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E4 Jamb						42.2000	0.0170	0.7174					
E5 Ground floor (normal)						24.0000	0.0750	1.8000					
E6 Intermediate floor within a dwelling						22.0000	0.0010	0.0220					
E16 Corner (normal)						19.9500	0.0420	0.8379					
E18 Party wall between dwellings						10.1000	0.0330	0.3333					
E17 Corner (inverted - internal area greater than external area)						9.6000	-0.0850	-0.8160					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											7.0015	(36)	
Point Thermal bridges											0.0000		
Total fabric heat loss									(33) + (36) + (36a) =		66.0339	(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	59.7511	59.2795	58.8172	56.6456	56.2393	54.3480	54.3480	53.9977	55.0765	56.2393	57.0612	57.9205	(38)
Average = Sum(39)m / 12 =	125.7851	125.3134	124.8511	122.6796	122.2733	120.3819	120.3819	120.0317	121.1105	122.2733	123.0952	123.9545	(39)
												122.6776	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1010	1.0968	1.0928	1.0738	1.0702	1.0537	1.0537	1.0506	1.0600	1.0702	1.0774	1.0849	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													

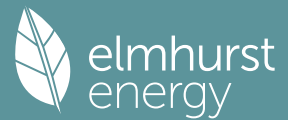
Assumed occupancy												2.8381	(42)
Hot water usage for mixer showers													
	98.7318	97.2480	95.0859	90.9491	87.8963	84.4917	82.5566	84.7024	87.0545	90.7099	94.9356	98.3535	(42a)
Hot water usage for baths													
	31.0017	30.5413	29.8929	28.6974	27.8023	26.8097	26.2736	26.9174	27.6184	28.6805	29.9006	30.8969	(42b)
Hot water usage for other uses													
	43.6947	42.1058	40.5169	38.9280	37.3391	35.7502	35.7502	37.3391	38.9280	40.5169	42.1058	43.6947	(42c)
Average daily hot water use (litres/day)												159.4933	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	173.4282	169.8951	165.4957	158.5746	153.0376	147.0516	144.5804	148.9588	153.6009	159.9073	166.9420	172.9451	(44)
Energy conte	274.6678	241.9284	254.3608	217.0807	206.0181	180.8172	174.8574	184.4422	189.4053	216.9927	237.8394	270.7902	(45)
Energy content (annual)										Total = Sum(45)m =		2649.2001	
Distribution loss (46)m = 0.15 x (45)m													
	41.2002	36.2893	38.1541	32.5621	30.9027	27.1226	26.2286	27.6663	28.4108	32.5489	35.6759	40.6185	(46)
Water storage loss (or HIU loss):													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.5800	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												2.0124	(55)
Total storage loss													
	62.3844	56.3472	62.3844	60.3720	62.3844	60.3720	62.3844	62.3844	60.3720	62.3844	60.3720	62.3844	(56)
If cylinder contains dedicated solar storage													
	62.3844	56.3472	62.3844	60.3720	62.3844	60.3720	62.3844	62.3844	60.3720	62.3844	60.3720	62.3844	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(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													
	391.9098	347.8244	371.6028	330.5407	323.2601	263.7012	260.5042	270.0890	272.2893	334.2347	351.2994	388.0322	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												669.9114	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												669.9114	
Solar input	-0.0000	-16.1469	-60.6842	-85.8783	-116.0245	-105.7420	-105.4402	-90.4409	-60.5052	-29.0491	-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													
	391.9098	331.6775	310.9186	244.6623	207.2356	157.9591	155.0640	179.6481	211.7841	305.1856	351.2994	388.0322	(64)
Electric shower(s)												3235.3764	(64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month													
	135.2131	120.0802	128.4610	114.6497	112.3871	78.1313	76.7500	79.9369	80.9869	116.0362	121.5520	133.9238	(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	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	(66)
	31.5807	28.0497	22.8115	17.2698	12.9094	10.8986	11.7764	15.3074	20.5455	26.0872	30.4476	32.4584	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	414.2183	418.5166	407.6850	384.6259	355.5180	328.1606	309.8842	305.5859	316.4175	339.4765	368.5845	395.9419	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	(71)
Water heating gains (Table 5)													
	181.7381	178.6908	172.6627	159.2357	151.0579	108.5157	103.1586	107.4421	112.4817	155.9626	168.8222	180.0051	(72)
Total internal gains													
	739.1650	736.8850	714.7872	672.7594	631.1132	559.2029	536.4471	539.9633	561.0726	633.1543	679.4823	720.0333	(73)

6. Solar gains													

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[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	0.8800				11.2829		0.6300		0.7000	0.7700	3.0344 (75)
Southeast	5.4600				36.7938		0.6300		0.7000	0.7700	61.3959 (77)
Southwest	6.8900				36.7938		0.6300		0.7000	0.7700	77.4758 (79)
Northwest	9.9600				11.2829		0.6300		0.7000	0.7700	34.3442 (81)

Solar gains	176.2504	312.6352	460.7394	626.1550	751.7997	768.5561	731.7344	634.6049	517.4890	354.4203	213.3683	149.3705 (83)
Total gains	915.4153	1049.5202	1175.5266	1298.9144	1382.9129	1327.7589	1268.1815	1174.5682	1078.5616	987.5746	892.8506	869.4039 (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	67.4760	67.7299	67.9807	69.1841	69.4139	70.5045	70.5045	70.7102	70.0804	69.4139	68.9505	68.4725
alpha	5.4984	5.5153	5.5320	5.6123	5.6276	5.7003	5.7003	5.7140	5.6720	5.6276	5.5967	5.5648
util living area	0.9941	0.9868	0.9658	0.8992	0.7554	0.5690	0.4160	0.4667	0.7246	0.9337	0.9873	0.9955 (86)
Living	20.1428	20.2828	20.4893	20.7309	20.8823	20.9355	20.9441	20.9430	20.9086	20.7085	20.3843	20.1234
Non living	19.0071	19.1871	19.4471	19.7468	19.9066	19.9638	19.9686	19.9709	19.9411	19.7311	19.3300	18.9931
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.0000	20.0034	20.0067	20.0223	20.0252	20.0388	20.0388	20.0414	20.0336	20.0252	20.0193	20.0132 (88)
util rest of house	0.9921	0.9824	0.9545	0.8689	0.6962	0.4886	0.3261	0.3713	0.6425	0.9063	0.9823	0.9939 (89)
MIT 2	20.0000	20.0034	20.0067	20.0223	20.0252	20.0388	20.0388	20.0414	20.0336	20.0252	20.0193	20.0132 (90)
Living area fraction									fLA = Living area / (4) =			0.1549 (91)
MIT	20.1550	20.1578	20.1606	20.1738	20.1762	20.1878	20.1878	20.1899	20.1833	20.1762	20.1712	20.1660 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1550	20.1578	20.1606	20.1738	20.1762	20.1878	20.1878	20.1899	20.1833	20.1762	20.1712	20.1660 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9925	0.9832	0.9565	0.8741	0.7060	0.5014	0.3401	0.3862	0.6560	0.9112	0.9832	0.9942 (94)
Useful gains	908.5265	1031.8466	1124.4180	1135.3493	976.2988	665.7118	431.2864	453.6708	707.5800	899.9089	877.8287	864.3694 (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	1994.3179	1912.0087	1705.5419	1383.0612	1036.4175	672.6645	431.9006	454.9068	736.7528	1170.9181	1609.0077	1979.0615 (97)
Space heating kWh	807.8288	591.4690	432.3562	178.3526	44.7283	0.0000	0.0000	0.0000	0.0000	201.6308	526.4488	829.3309 (98a)
Space heating requirement - total per year (kWh/year)												3612.1454
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	807.8288	591.4690	432.3562	178.3526	44.7283	0.0000	0.0000	0.0000	0.0000	201.6308	526.4488	829.3309 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3612.1454
Space heating per m2										(98c) / (4) =		31.6162 (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 %)												370.9193 (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	807.8288	591.4690	432.3562	178.3526	44.7283	0.0000	0.0000	0.0000	0.0000	201.6308	526.4488	829.3309 (98)
Space heating efficiency (main heating system 1)	370.9193	370.9193	370.9193	370.9193	370.9193	0.0000	0.0000	0.0000	0.0000	370.9193	370.9193	370.9193 (210)
Space heating fuel (main heating system)	217.7910	159.4603	116.5634	48.0839	12.0588	0.0000	0.0000	0.0000	0.0000	54.3597	141.9308	223.5880 (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	391.9098	331.6775	310.9186	244.6623	207.2356	157.9591	155.0640	179.6481	211.7841	305.1856	351.2994	388.0322 (64)
Efficiency of water heater	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600 (216)
Fuel for water heating, kWh/month	323.9995	274.2043	257.0425	202.2671	171.3257	130.5879	128.1944	148.5186	175.0860	252.3029	290.4261	320.7938 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	27.6424	22.1757	19.9668	14.6285	11.2995	9.2318	10.3078	13.3984	17.4032	22.8340	25.7909	28.4106 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-89.9024	-149.2613	-251.3984	-329.0606	-393.9020	-378.7956	-373.6616	-334.2368	-269.1044	-189.2668	-106.4221	-75.2800 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)

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Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													973.8359	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													120.9600	
Water heating fuel used													2674.7490	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													80.0000	(231)
Electricity for lighting (calculated in Appendix L)													223.0897	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-2940.2920	(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													1011.3826	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	973.8359	16.4900	160.5855	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2674.7490	16.4900	441.0661	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	223.0897	16.4900	36.7875	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2940.2920	16.4900	-484.8541	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-484.8541	(252)
Total energy cost			166.7770	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.3770	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	93.8886	
SAP rating (Section 12)		94	(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	
Space heating - main system 1	973.8359	0.1567	152.5849	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2674.7490	0.1443	385.9030	(264)
Space and water heating			538.4878	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	223.0897	0.1443	32.1987	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2940.2920	0.1317	-387.3284	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-387.3284	(269)
Total CO2, kg/year			194.4551	(272)
CO2 emissions per m2			1.7000	(273)
EI value			98.3638	
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	57.0000 (1b)	x 2.4000 (2b)	= 136.8000	(1b) - (3b)
First floor	57.2500 (1c)	x 2.6500 (2c)	= 151.7125	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.2500			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	288.5125	(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												5 * 10 = 50.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											Air changes per hour	
Pressure test											50.0000 / (5) =	
Pressure Test Method											Yes	
Measured/design AP50											Blower Door	
Infiltration rate											5.1000 (17)	
Number of sides sheltered											0.4283 (18)	
Shelter factor											1 (19)	
Infiltration rate adjusted to include shelter factor											(20) = 1 - [0.075 x (19)] = 0.9250 (20)	
											(21) = (18) x (20) = 0.3962 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Adj infilt rate	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Effective ac	0.4160	0.3962	0.3962	0.3665	0.3665	0.3268	0.3368	0.3169	0.3268	0.3467	0.3467	0.3764 (22b)
	0.5865	0.5785	0.5785	0.5671	0.5671	0.5534	0.5567	0.5502	0.5534	0.5601	0.5601	0.5708 (25)

3. Heat losses and heat loss parameter

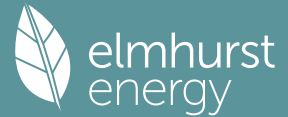
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
windows			23.1900	1.1450	26.5534			(27)
doors			2.1100	1.4000	2.9540			(26)
Heatloss Floor 1			56.0000	0.1000	5.6000	75.0000	4200.0000	(28a)
Heatloss Floor 2			1.7500	0.1800	0.3150	20.0000	35.0000	(28b)
External Wall 1	118.3000	25.3000	93.0000	0.1800	16.7400	140.0000	13020.0000	(29a)
External Roof 1	57.2500		57.2500	0.1200	6.8700	9.0000	515.2500	(30)
Total net area of external elements Aum (A, m2)			233.3000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 59.0324			(33)
Main dwelling								
Party Wall 1			68.6800	0.0000	0.0000	140.0000	9615.2000	(32)
Internal Wall 1			181.1600			9.0000	1630.4400	(32c)
Internal Floor 1			57.0000			18.0000	1026.0000	(32d)
Internal Ceiling 1			57.0000			9.0000	513.0000	(32e)
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) = 30554.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								267.4389 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E12 Gable (insulation at ceiling level)				8.4500	0.0430	0.3633		
E10 Eaves (insulation at ceiling level)				12.0500	0.0570	0.6869		
E21 Exposed floor (inverted)				3.5000	0.3200	1.1200		
P1 Party wall - Ground floor				12.4000	0.0500	0.6200		
P2 Party wall - Intermediate floor within a dwelling				12.4000	0.0000	0.0000		
P4 Party wall - Roof (insulation at ceiling level)				12.4000	0.0400	0.4960		
E2 Other lintels (including other steel lintels)				17.9300	0.0250	0.4483		
E3 Sill				16.9300	0.0220	0.3725		
E4 Jamb				42.2000	0.0170	0.7174		
E5 Ground floor (normal)				24.0000	0.0750	1.8000		
E6 Intermediate floor within a dwelling				22.0000	0.0010	0.0220		
E16 Corner (normal)				19.9500	0.0420	0.8379		
E18 Party wall between dwellings				10.1000	0.0330	0.3333		
E17 Corner (inverted - internal area greater than external area)				9.6000	-0.0850	-0.8160		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0015 (36)	
Point Thermal bridges							(36a) = 0.0000	
Total fabric heat loss							(33) + (36) + (36a) = 66.0339 (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	55.8424	55.0765	55.0765	53.9977	53.9977	52.6902	53.0030	52.3866	52.6902	53.3253	53.3253	54.3480 (38)
Average = Sum(39)m / 12 =	121.8763	121.1105	121.1105	120.0317	120.0317	118.7241	119.0370	118.4206	118.7241	119.3592	119.3592	120.3819 (39)
												119.8472
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0668	1.0600	1.0600	1.0506	1.0506	1.0392	1.0419	1.0365	1.0392	1.0447	1.0447	1.0537 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8381 (42)											
Hot water usage for mixer showers												
Hot water usage for baths												
Hot water usage for other uses												
Average daily hot water use (litres/day)												
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	173.4282	169.8951	165.4957	158.5746	153.0376	147.0516	144.5804	148.9588	153.6009	159.9073	166.9420	172.9451 (44)
Energy content (annual)	274.6678	241.9284	254.3608	217.0807	206.0181	180.8172	174.8574	184.4422	189.4053	216.9927	237.8394	270.7902 (45)
	Total = Sum(45)m = 2649.2001											

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Distribution loss (46)m = 0.15 x (45)m	41.2002	36.2893	38.1541	32.5621	30.9027	27.1226	26.2286	27.6663	28.4108	32.5489	35.6759	40.6185 (46)
Water storage loss (or HIU loss):												210.0000 (47)
Store volume												2.5800 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.7800 (49)
Temperature factor from Table 2b												2.0124 (55)
Enter (49) or (54) in (55)												
Total storage loss												
62.3844	56.3472	62.3844	60.3720	62.3844	60.3720	62.3844	62.3844	60.3720	62.3844	60.3720	62.3844	(56)
If cylinder contains dedicated solar storage												
62.3844	56.3472	62.3844	60.3720	62.3844	60.3720	62.3844	62.3844	60.3720	62.3844	60.3720	62.3844	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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												
391.9098	347.8244	371.6028	330.5407	323.2601	263.7012	260.5042	270.0890	272.2893	334.2347	351.2994	388.0322	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												733.8006 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												733.8006
Solar input	-0.0000	-17.5890	-61.7809	-90.8145	-118.3359	-117.1048	-115.2661	-102.6556	-70.0850	-36.4824	-3.6865	-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												
391.9098	330.2354	309.8219	239.7261	204.9242	146.5964	145.2382	167.4334	202.2042	297.7523	347.6130	388.0322	(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												
135.2131	120.0802	128.4610	114.6497	112.3871	78.1313	76.7500	79.9369	80.9869	116.0362	121.5520	133.9238	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	170.2843	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
31.5807	28.0497	22.8115	17.2698	12.9094	10.8986	11.7764	15.3074	20.5455	26.0872	30.4476	32.4584	32.4584	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
414.2183	418.5166	407.6850	384.6259	355.5180	328.1606	309.8842	305.5859	316.4175	339.4765	368.5845	395.9419	395.9419	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	54.8665	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	-113.5229	(71)
Water heating gains (Table 5)													
181.7381	178.6908	172.6627	159.2357	151.0579	108.5157	103.1586	107.4421	112.4817	155.9626	168.8222	180.0051	180.0051	(72)
Total internal gains													
739.1650	736.8850	714.7872	672.7594	631.1132	559.2029	536.4471	539.9633	561.0726	633.1543	679.4823	720.0333	720.0333	(73)

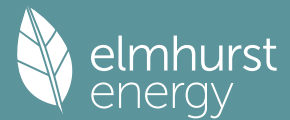
6. Solar gains

[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						0.8800	12.9236	0.6300	0.7000	0.7700	3.4757 (75)		
Southeast						5.4600	40.4699	0.6300	0.7000	0.7700	67.5300 (77)		
Southwest						6.8900	40.4699	0.6300	0.7000	0.7700	85.2164 (79)		
Northwest						9.9600	12.9236	0.6300	0.7000	0.7700	39.3381 (81)		
Solar gains	195.5602	312.8924	457.6699	644.5940	756.6099	828.6556	780.0844	690.1441	558.4820	379.3373	242.6843	164.0508	(83)
Total gains	934.7251	1049.7774	1172.4571	1317.3534	1387.7231	1387.8584	1316.5315	1230.1074	1119.5546	1012.4915	922.1666	884.0841	(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	69.6400	70.0804	70.0804	70.7102	70.7102	71.4890	71.3011	71.6723	71.4890	71.1086	71.1086	70.5045
alpha	5.6427	5.6720	5.6720	5.7140	5.7140	5.7659	5.7534	5.7782	5.7659	5.7406	5.7406	5.7003
util living area												
	0.9915	0.9828	0.9532	0.8558	0.6636	0.4259	0.2802	0.3078	0.6001	0.8916	0.9789	0.9934 (86)
Living	20.2609	20.3808	20.5866	20.8066	20.9190	20.9445	20.9459	20.9461	20.9348	20.7971	20.5051	20.2431
Non living	19.1801	19.3355	19.5892	19.8472	19.9541	19.9812	19.9793	19.9841	19.9764	19.8481	19.5037	19.1665
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.0281	20.0336	20.0336	20.0414	20.0414	20.0508	20.0486	20.0530	20.0508	20.0462	20.0462	20.0388 (88)
util rest of house												
	0.9885	0.9771	0.9378	0.8155	0.5945	0.3460	0.1943	0.2169	0.5089	0.8498	0.9705	0.9910 (89)
MIT 2	20.0281	20.0336	20.0336	20.0414	20.0414	20.0508	20.0486	20.0530	20.0508	20.0462	20.0462	20.0388 (90)
Living area fraction									fLA =	Living area / (4) =		
MIT	20.1787	20.1833	20.1833	20.1899	20.1899	20.1979	20.1960	20.1997	20.1979	20.1940	20.1940	20.1878 (91)
Temperature adjustment												0.0000
adjusted MIT	20.1787	20.1833	20.1833	20.1899	20.1899	20.1979	20.1960	20.1997	20.1979	20.1940	20.1940	20.1878 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9890	0.9781	0.9405	0.8223	0.6056	0.3585	0.2076	0.2310	0.5235	0.8571	0.9720	0.9915	(94)
Useful gains	924.4848	1026.7950	1102.7474	1083.2570	840.4620	497.5177	273.2790	284.1318	586.0974	867.8433	896.3705	876.5352	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1837.7307	1766.1916	1548.1928	1235.1128	863.0145	498.3891	273.3046	284.1777	593.3684	1025.7724	1455.4656	1816.2929	(97)
Space heating kWh	679.4550	496.8746	331.4114	109.3361	16.7791	0.0000	0.0000	0.0000	0.0000	117.4993	402.5485	699.1797	(98a)
Space heating requirement - total per year (kWh/year)												2853.0837	
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	679.4550	496.8746	331.4114	109.3361	16.7791	0.0000	0.0000	0.0000	0.0000	117.4993	402.5485	699.1797	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2853.0837	
Space heating per m2												24.9723	(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 %)													370.3597	(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	679.4550	496.8746	331.4114	109.3361	16.7791	0.0000	0.0000	0.0000	0.0000	117.4993	402.5485	699.1797	(98)	
Space heating efficiency (main heating system 1)	370.3597	370.3597	370.3597	370.3597	370.3597	0.0000	0.0000	0.0000	0.0000	370.3597	370.3597	370.3597	(210)	
Space heating fuel (main heating system)	183.4581	134.1600	89.4837	29.5216	4.5305	0.0000	0.0000	0.0000	0.0000	31.7257	108.6912	188.7839	(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	391.9098	330.2354	309.8219	239.7261	204.9242	146.5964	145.2382	167.4334	202.2042	297.7523	347.6130	388.0322	(64)	
Efficiency of water heater	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	120.9600	(216)	
Fuel for water heating, kWh/month	323.9995	273.0121	256.1358	198.1863	169.4149	121.1941	120.0712	138.4204	167.1662	246.1576	287.3784	320.7938	(219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)	
Lighting	27.6424	22.1757	19.9668	14.6285	11.2995	9.2318	10.3078	13.3984	17.4032	22.8340	25.7909	28.4106	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-100.7067	-150.6214	-250.7196	-337.2554	-394.3722	-391.1508	-386.1971	-358.4626	-289.2502	-203.4521	-122.0601	-83.5049	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1												770.3547	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												120.9600		
Water heating fuel used												2621.9305	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:												80.0000	(230g)	
pump for solar water heating												80.0000	(231)	
Total electricity for the above, kWh/year												223.0897	(232)	
Electricity for lighting (calculated in Appendix L)														
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation												-3067.7529	(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												627.6220	(238)	

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	770.3547	27.6700	213.1571	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2621.9305	27.6700	725.4882	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	27.6700	22.1360	(249)

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Energy for lighting	223.0897	27.6700	61.7289 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3067.7529	27.6700	-848.8472
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-848.8472 (252)
Total energy cost			173.6630 (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	770.3547	0.1576	121.3787 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2621.9305	0.1447	379.3156 (264)
Space and water heating			500.6943 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	223.0897	0.1443	32.1987 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3067.7529	0.1317	-404.1135
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-404.1135 (269)
Total CO2, kg/year			139.8765 (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	770.3547	1.5833	1219.6978 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2621.9305	1.5351	4024.9845 (278)
Space and water heating			5244.6823 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	223.0897	1.5338	342.1825 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3067.7529	1.4867	-4560.7531
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-4560.7531 (283)
Total Primary energy kWh/year			1147.1356 (286)

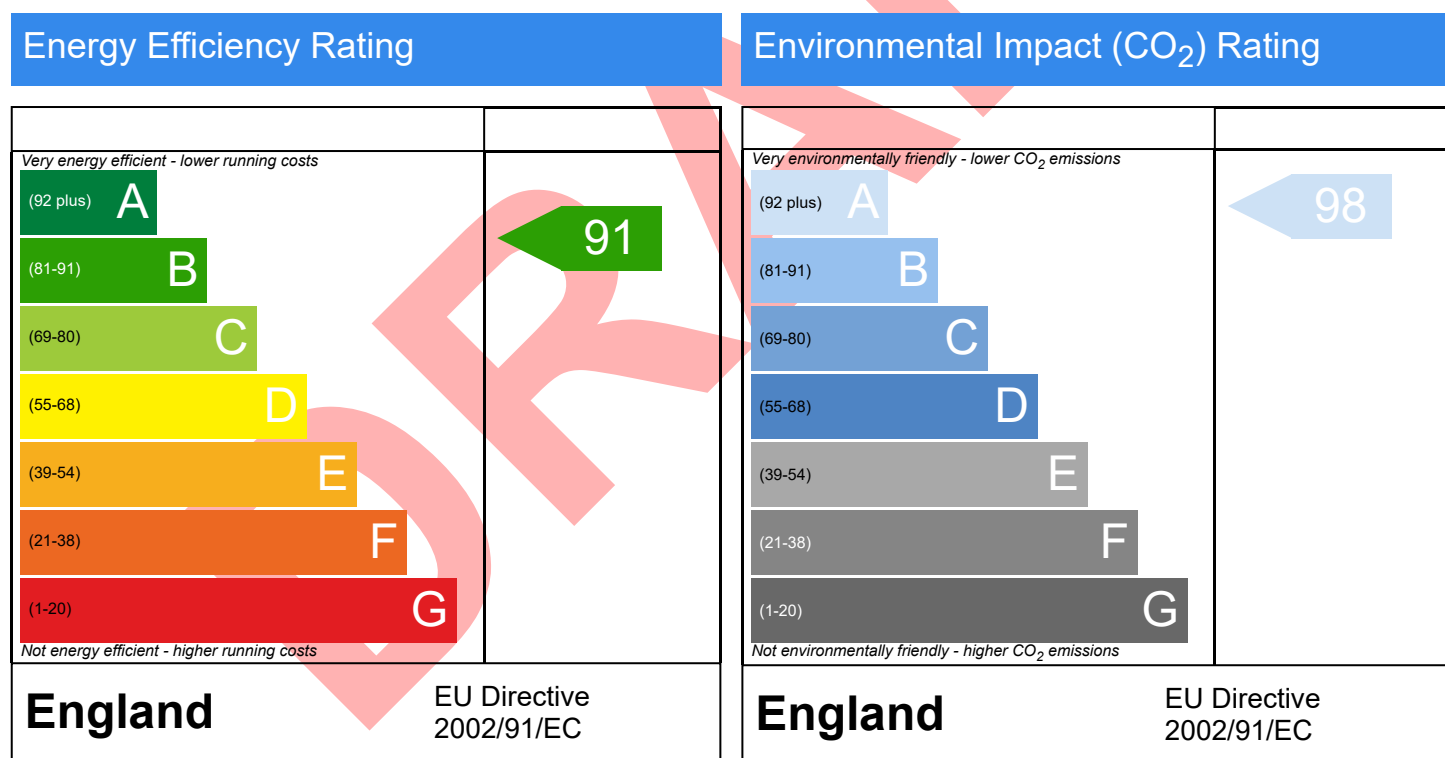
Predicted Energy Assessment



Dwelling type: House, Semi-Detached
Date of assessment: 04/08/2026
SAP Version: 10.2
Produced by: Mike Ovenden
Total floor area: 114.25 m²
DRRN:

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data

Plot Reference	Plot 1 134 High Street Kimpton		Issued on Date	04/08/2026
Assessment Reference	design rev 2	Plot Type Ref	Design	
Plot Address			SAP Version	10.2

SAP Rating	91 B	DER	2.28	TER	10.20
Environmental	98 A	% DER < TER			77.65
CO ₂ Emissions (t/year)	0.2	DFEE	35.64	TFEE	38.88
Compliance Check	See BREL	% DFEE < TFEE			8.34
% DPER < TPER	59.14	DPER	21.73	TPER	53.19

Assessor Details	Mr. Mike Ovenden	Assessor ID	H824-0001
Client	11, Alison Swarbrick		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	Southwest	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	House, Semi-Detached	
2.0 Number of Storeys	2	
3.0 Date Built	2026	
4.0 Sheltered Sides	1	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	267.44	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	No	
Smart gas meter fitted	No	

7.0 Measurements	Ground floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	1st Storey:	25.00 m	57.00 m ²	2.40 m
		22.00 m	57.25 m ²	2.65 m

8.0 Living Area	17.70	m ²
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9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	External Wall 1	Cavity Wall	Cavity wall; dense plaster, lightweight aggregate block, filled cavity, any outside structure	0.18	140.00	118.30	93.00	0.00	None	25.30	Calculate Wall Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Party Wall 1	Filled Cavity with Edge Sealing	Dense plaster both sides. lightweight aggregate blocks, cavity or cavity fill	0.00	140.00	68.68		None

9.2 Internal Walls	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Internal Wall 1	Plasterboard on timber frame	9.00	181.16

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	External Roof 1	External Plane Roof	Plasterboard, insulated at ceiling level	0.12	9.00	57.25	57.25	None	0.00	Calculate Wall Area	0.00

10.2 Internal Ceilings	Description	Storey	Construction	Kappa	Area (m ²)
	Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	9.00	57.00

11.0 Heat Loss Floors	Description	Type	Storey Index	Construction	U-Value (W/m ² K)	Shelter Code	Shelter Factor	Kappa (kJ/m ² K)	Area (m ²)
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Summary for Input Data



Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Suspended concrete floor, carpeted	0.10	None	0.00	75.00	56.00
Heatloss Floor 2	Exposed Floor -	+1	Timber exposed floor, insulation between joists	0.18	None	0.00	20.00	1.75
	Timber							

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	+1	Plasterboard ceiling, carpeted chipboard floor	18.00	57.00

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.20
doors	Manufacturer	Solid Door				0.00			1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
windows front	windows	External Wall 1	South East	5.46	
windows side	windows	External Wall 1	South West	6.89	
windows rear	windows	External Wall 1	North West	9.96	
front door	doors	External Wall 1	South West	2.11	
windows side	windows	External Wall 1	North East	0.88	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E12 Gable (insulation at ceiling level)	Independently assessed	8.45	0.04	0.04 cert supplied	No
E10 Eaves (insulation at ceiling level)	Independently assessed	12.05	0.06	0.06 cert supplied	No
E21 Exposed floor (inverted)	Table K1 - Default	3.50	0.32	0.32	No
P1 Party wall - Ground floor	Independently assessed	12.40	0.05	0.05 cert supplied	No
P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	12.40	0.00	0.00	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	12.40	0.04	0.04 cert supplied	No
E2 Other lintels (including other steel lintels)	Independently assessed	17.93	0.03	0.03 cert supplied	No
E3 Sill	Independently assessed	16.93	0.02	0.02 cert supplied	No
E4 Jamb	Independently assessed	42.20	0.02	0.02 cert supplied	No
E5 Ground floor (normal)	Independently assessed	24.00	0.07	0.07 cert supplied	Yes
E6 Intermediate floor within a dwelling	Independently assessed	22.00	0.00	0.00 cert supplied	Yes
E16 Corner (normal)	Independently assessed	19.95	0.04	0.04 cert supplied	No
E18 Party wall between dwellings	Independently assessed	10.10	0.03	0.03 cert supplied	Yes
E17 Corner (inverted – internal area greater than external area)	Independently assessed	9.60	-0.09	-0.09 cert supplied	No

Y-value W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

Number of open chimneys

Number of open flues

Number of chimneys/flues attached to closed fire

Number of flues attached to solid fuel boiler

Number of flues attached to other heater

Number of blocked chimneys

Number of intermittent extract fans

Number of passive vents

Number of flueless gas fires

21.0 Fixed Cooling System

22.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Test Method

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
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Summary for Input Data

Lighting 1 95.00 11.00 1045.00 30

24.0 Main Heating 1

Database		
Percentage of Heat	100.00	%
Database Ref. No.	100612	
Fuel Type	Electricity	
In Winter	370.92	
In Summer	120.96	
Model Name	geoTHERM air 4kW	
Manufacturer	Vaillant Group UK Ltd	
System Type	Heat Pump	
Controls SAP Code	2207	
Controls description	Time and temperature zone control by arrangement	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	Enter value	
Flow Temperature Value	45.00	

25.0 Main Heating 2

None

26.0 Heat Networks

None

27.0 Secondary Heating

None

28.0 Water Heating

Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From mains
Bath Count	1
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
ensuite	Combi boiler or unvented hot water system	11.00		No	

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

Hot Water Cylinder		
Cylinder Stat	No	
Cylinder In Heated Space	No	
Independent Time Control	No	
Insulation Type	Measured Loss	
Cylinder Volume	210.00	L
Loss	2.58	kWh/day
Pipes insulation	Fully insulated primary pipework	

31.0 Thermal Store

None

Summary for Input Data

32.0 Photovoltaic Unit

Export Capable Meter?	One Dwelling
Connected To Dwelling	No
Diverter	Yes
Battery Capacity [kWh]	No
	11.50

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
4.50	South	30°	Modest		No	0.80		

34.0 Small-scale Hydro

None

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £7,000	£129	A 94	A 98
Photovoltaic			0	0
Wind turbine			0	0

Thermal Bridging

Plot Reference	Plot 1 134 High Street Kimpton		Issued on Date	04/08/2026
Assessment Reference	design rev 2	Plot Type Ref	Semi-Detached House	
Plot Address			SAP Version	10.2

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Compliance Check	See BREL	% DFEE < TFEE			8.34
% DPER < TPER	59.14	DPER	21.73	TPER	53.19

Assessor Details	Mr. Mike Ovenden	Assessor ID	H824-0001
Client	11, Alison Swarbrick		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.043	8.45	0.36	cert supplied
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.057	12.05	0.69	cert supplied
External wall	E21 Exposed floor (inverted)	Table K1 - Default	0.320	3.50	1.12	
Party wall	P1 Party wall - Ground floor	Independently assessed	0.050	12.40	0.62	cert supplied
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	12.40	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.040	12.40	0.50	cert supplied
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.025	17.93	0.45	cert supplied
External wall	E3 Sill	Independently assessed	0.022	16.93	0.37	cert supplied
External wall	E4 Jamb	Independently assessed	0.017	42.20	0.72	cert supplied
External wall	E5 Ground floor (normal)	Independently assessed	0.075	24.00	1.80	cert supplied
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.001	22.00	0.02	cert supplied
External wall	E16 Corner (normal)	Independently assessed	0.042	19.95	0.84	cert supplied
External wall	E18 Party wall between dwellings	Independently assessed	0.033	10.10	0.33	cert supplied
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.085	9.60	-0.82	cert supplied

Total: 223.91 W/mK:
Y-Value: 0.03 W/m²K: