



SHAUN•TANNER
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ENERGY STATEMENT

Replacement Dwelling

at

Penguin
Wargrave Road
Henley-on-Thames
RG9 3JD



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Introduction

The Energy Statement provides a clear assessment of the proposed development's overall energy requirements and subsequent CO2 emissions. The proposed development at Penguin is for the demolition of an existing dwelling and outbuildings, and erection of one 2-bed detached dwelling.

Options for the building fabric, services and renewable energy systems have been considered considering the future direction of national Building Regulation standards, best practice, and Government Climate Change targets. As a result, it is proposed that the development will be constructed to outperform the current Part L building regulation standards and the proposal is to be carbon negative.

Energy Strategy

The energy hierarchy sets out the key elements that should form an energy strategy for any new building, in order of their priority. Reducing energy demand is at the top of the hierarchy. Followed by supplying energy efficiently, finally supplying energy from renewable energy sources. In line with best practice, the energy strategy for the proposed development has been set out in accordance with the structure of the energy hierarchy. The Energy hierarchy has three priorities, seeking to reduce energy use before meeting remaining demand by the leanest means:

1. Be Lean – Use less energy: Optimise the building fabric, glazing and structure to minimise energy consumption in the first instance by using low U-values and good air tightness plus ensure that active systems run as energy efficiently as possible.
2. Be Clean – Supply energy efficiency: Further reduce carbon emissions through the use of decentralised energy where feasible, such as combined heat and power (CHP).
3. Be Green – Use renewable energy: When the above design elements have been reasonably exhausted, supply energy through renewable sources where practical.

BE LEAN:

Minimising the requirement for energy is the first step that should be considered. The rate at which energy is lost from a building greatly influences the annual heat load, and therefore the CO2 emissions and energy requirements of that building. Energy requirements for hot water applications are



essentially independent of improvements to the building's fabric efficiency as these are functions of occupancy and usage rather than rate of heat loss. The main areas where the efficiency of the proposed building is improved are detailed below.

Building Element	Proposed Development	Part L Limiting Parameters
Wall	0.17 W/m ² K	0.18 W/m ² K
Roof	0.11 W/m ² K	0.11 W/m ² K
Floors	0.13 W/m ² K	0.13 W/m ² K
Windows	1.2 W/m ² K	1.2 W/m ² K

Thermal Bridging - Accredited Construction Details provide the continuity of insulation and therefore apply a significant improvement factor on the energy performance of a dwelling

Air tightness – Designed air permeability of 4.0 m³/hm² (@50Pa)

BE CLEAN:

The building has been designed to minimise environmental impact where possible with a palette of low maintenance materials eliminating the need for harmful stains and varnishes. The water consumption of the property will be reduced through low-flow fixtures.

BE GREEN:

Heating and Controls – Air Source Heat Pump will be used as a highly efficient heating system in conjunction with underfloor heating systems and radiators. Energy monitoring and management systems can be used to track usage and identify opportunities for optimisation.

Solar Panels: 11.25kWh photovoltaic system is proposed to be installed on the roof with battery storage to retain excess electricity, this will reduce the properties dependency on fossil fuels, minimise its carbon footprint and achieve a zero carbon home.

SUMMARY OF OUTLINE PERFORMANCE

Unit	DER	TER	% Improvement
Detached Dwelling	0.33 kgCO ₂ /year/m ²	5.16 kgCO ₂ /year/m ²	93.60%

Full SAP Calculation Printout



Plot Reference	3993			Issued on Date	27/02/2026
Assessment Reference	01	Plot Type Ref	Replacement Dwelling		
Plot Address	Penguin, Wargrave Street, Henley-on-Thames, Berkshire, RG9 3JD			SAP Version	10.2
SAP Rating	98 A	DER	0.33	TER	5.16
Environmental	100 A	% DER < TER			93.60
CO ₂ Emissions (t/year)	-0.03	DFEE	57.97	TFEE	58.84
Compliance Check	See BREL	% DFEE < TFEE			1.49
% DPER < TPER	80.50	DPER	7.10	TPER	36.40
Assessor Details	Mrs. Chitra Deshpande			Assessor ID	CF77-0001
Client	3993, Penguin				

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	194.5600 (1b)	x 3.3900 (2b)	= 659.5584 (1b) - (3b)
First floor	55.7600 (1c)	x 2.0400 (2c)	= 113.7504 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	250.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 773.3088 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) = 70.0000 / (5) = 0.0905 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2905 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2905 (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	0.3704	0.3632	0.3559	0.3196	0.3123	0.2760	0.2760	0.2687	0.2905	0.3123	0.3268	0.3414 (22b)
Effective ac	0.5686	0.5659	0.5633	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5534	0.5583 (25)

3. Heat losses and heat loss parameter

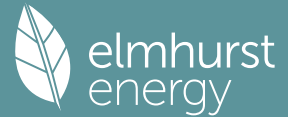
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows			73.3500	1.1450	83.9885		(27)
Roof windows			3.9000	1.0536	4.1092		(27a)
Doors			4.0500	1.4000	5.6700		(26)
Heatloss Floor 1			194.5600	0.1300	25.2928	75.0000	14592.0000 (28)
External Wall 1	301.4300	77.4000	224.0300	0.1700	38.0851	70.0000	15682.1000 (29a)
roof void walls	134.5900		134.5900	0.1300	17.4967	9.0000	1211.3100 (29a)
External Roof 1	314.0600	3.9000	310.1600	0.1100	34.1176	9.0000	2791.4400 (30)
Total net area of external elements Aum(A, m ²)			944.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	208.7599		(33)
Main dwelling							
Internal Wall 1			140.3200			9.0000	1262.8800 (32c)
Internal Ceiling 1			55.7600			9.0000	501.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	36041.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							143.9820 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				41.0400	0.3060	12.5582	
E3 Sill				39.2100	0.0160	0.6274	

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energy

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												3.0673 (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	87.2769	85.9807	84.1554	80.7899	78.2698	75.4755	73.9661	75.7787	77.7522	80.7422	84.1771	86.9819 (42b)
Hot water usage for other uses	46.0427	44.3684	42.6941	41.0199	39.3456	37.6713	37.6713	39.3456	41.0199	42.6941	44.3684	46.0427 (42c)
Average daily hot water use (litres/day)												122.7765 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	133.3196	130.3491	126.8496	121.8098	117.6154	113.1468	111.6374	115.1242	118.7720	123.4364	128.5455	133.0246 (44)
Energy content (annual)	211.1457	185.6154	194.9631	166.7515	158.3330	139.1272	135.0158	142.5478	146.4578	167.5020	183.1366	208.2843 (45)
Distribution loss (46)m = 0.15 x (45)m	31.6719	27.8423	29.2445	25.0127	23.7499	20.8691	20.2524	21.3822	21.9687	25.1253	27.4705	31.2426 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	267.8881	236.8666	251.7055	221.6635	215.0754	194.0392	191.7582	199.2902	201.3698	224.2444	238.0486	265.0267 (62)
WVHRS	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	267.8881	236.8666	251.7055	221.6635	215.0754	194.0392	191.7582	199.2902	201.3698	224.2444	238.0486	265.0267 (64)
12Total per year (kWh/year)												2706.9761 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	115.5999	102.7181	110.2191	99.3745	98.0396	90.1894	90.2867	92.7911	92.6268	101.0883	104.8225	114.6485 (65)

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	7.5800	11.2829	0.6300	0.7000	0.7700	26.1375 (75)
Southeast	5.9400	36.7938	0.6300	0.7000	0.7700	66.7934 (77)
Southwest	46.6100	36.7938	0.6300	0.7000	0.7700	524.1142 (79)

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Northwest			13.2200		11.2829		0.6300		0.7000		0.7700		45.5854 (81)
Southwest			3.9000		26.0000		0.6300		0.7000		1.0000		40.2457 (82)

Solar gains	702.8761	1236.1153	1788.8180	2370.5627	2789.1702	2826.1172	2701.0418	2381.2003	1989.7205	1393.0130	849.0980	596.7724 (83)
Total gains	1554.0860	2111.6441	2626.2239	3181.6547	3557.7307	3567.6534	3413.2783	3092.4794	2722.8295	2149.5350	1651.6206	1428.3191 (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	25.8080	25.8533	25.8979	26.1092	26.1492	26.3367	26.3367	26.3717	26.2641	26.1492	26.0685	25.9847	
alpha	2.7205	2.7236	2.7265	2.7406	2.7433	2.7558	2.7558	2.7581	2.7509	2.7433	2.7379	2.7323	
util living area	0.9843	0.9647	0.9285	0.8522	0.7332	0.5829	0.4524	0.5072	0.7206	0.9058	0.9718	0.9874 (86)	
Living	18.7324	19.0584	19.5067	20.0448	20.4715	20.7337	20.8325	20.8107	20.5957	19.9978	19.2562	18.6776	
Non living	17.6084	17.9312	18.3699	18.8871	19.2688	19.4831	19.5445	19.5366	19.3886	18.8601	18.1374	17.5598	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	4	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	27	0	0	0	0	0	0	0	0	0	0	25	
MIT	19.8814	19.0584	19.5067	20.0448	20.4715	20.7337	20.8325	20.8107	20.5957	19.9978	19.2562	19.4897 (87)	
Th 2	19.6504	19.6524	19.6544	19.6637	19.6655	19.6736	19.6736	19.6751	19.6704	19.6655	19.6619	19.6582 (88)	
util rest of house	0.9807	0.9570	0.9128	0.8195	0.6742	0.4900	0.3304	0.3819	0.6370	0.8773	0.9644	0.9846 (89)	
MIT 2	18.6431	17.9312	18.3699	18.8871	19.2688	19.4831	19.5445	19.5366	19.3886	18.8601	18.1374	18.2936 (90)	
Living area fraction										FLA = Living area / (4) =		0.4033 (91)	
MIT	19.1425	18.3858	18.8284	19.3540	19.7538	19.9875	20.0639	20.0505	19.8754	19.3189	18.5886	18.7760 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.1425	18.3858	18.8284	19.3540	19.7538	19.9875	20.0639	20.0505	19.8754	19.3189	18.5886	18.7760 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9791	0.9476	0.9008	0.8107	0.6785	0.5136	0.3681	0.4197	0.6515	0.8682	0.9564	0.9822 (94)	
Useful gains	1521.6666	2001.0394	2365.7472	2579.4367	2413.9831	1832.1710	1256.4802	1297.9527	1773.9385	1866.1812	1579.6668	1402.8873 (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	5757.7702	5222.2917	4765.8789	4008.5595	3083.5170	2047.9750	1316.7605	1385.8317	2201.4966	3338.1472	4412.1584	5615.9196 (97)	
Space heating kWh	3151.6611	2164.6815	1785.6979	1028.9684	498.1332	0.0000	0.0000	0.0000	0.0000	1095.1427	2039.3940	3134.4960 (98a)	
Space heating requirement - total per year (kWh/year)												14898.1750	
Solar 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	3151.6611	2164.6815	1785.6979	1028.9684	498.1332	0.0000	0.0000	0.0000	0.0000	1095.1427	2039.3940	3134.4960 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												14898.1750	
Space heating per m2										(98c) / (4) =		59.5165 (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 %)													299.3303 (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	3151.6611	2164.6815	1785.6979	1028.9684	498.1332	0.0000	0.0000	0.0000	0.0000	1095.1427	2039.3940	3134.4960 (98)	
Space heating efficiency (main heating system 1)	299.3303	299.3303	299.3303	299.3303	299.3303	0.0000	0.0000	0.0000	0.0000	299.3303	299.3303	299.3303 (210)	
Space heating fuel (main heating system)	1052.9041	723.1749	596.5644	343.7569	166.4159	0.0000	0.0000	0.0000	0.0000	365.8643	681.3189	1047.1696 (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	267.8881	236.8666	251.7055	221.6635	215.0754	194.0392	191.7582	199.2902	201.3698	224.2444	238.0486	265.0267 (64)	
Efficiency of water heater (217)m	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846 (216)	
Fuel for water heating, kWh/month	139.6090	123.4423	131.1755	115.5192	112.0858	101.1229	99.9341	103.8594	104.9432	116.8642	124.0582	138.1178 (219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)	
Lighting	47.1104	37.7937	34.0291	24.9312	19.2575	15.7336	17.5674	22.8347	29.6601	38.9156	43.9551	48.4198 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-196.9274	-332.6748	-568.5346	-730.1331	-713.8896	-489.9906	-482.6586	-487.0501	-495.0434	-418.3376	-233.8209	-163.7360 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-1.4392	-7.3855	-30.7347	-95.8085	-321.5774	-533.0476	-524.8296	-384.0487	-171.9519	-22.2321	-3.3473	-0.9452 (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												4977.1689 (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	191.8846	
Water heating fuel used	1410.7315	(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)	380.2082	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-7410.1444	(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	-642.0356	(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	4977.1689	0.1553	773.0552 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1410.7315	0.1408	198.6937 (264)
Space and water heating			971.7489 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	380.2082	0.1443	54.8758 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5312.7967	0.1350	-717.1641
PV Unit electricity exported	-2097.3476	0.1080	-226.4446
Total			-943.6087 (269)
Total CO2, kg/year			83.0160 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.3300 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4977.1689	1.5750	7839.0061 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1410.7315	1.5208	2145.4248 (278)
Space and water heating			9984.4310 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	380.2082	1.5338	583.1761 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5312.7967	1.4990	-7963.7985
PV Unit electricity exported	-2097.3476	0.3945	-827.4372
Total			-8791.2357 (283)
Total Primary energy kWh/year			1776.3714 (286)
Dwelling Primary energy Rate (DPER)			7.1000 (287)

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

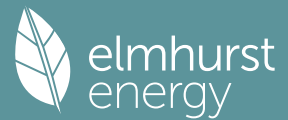
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	194.5600 (1b)	x 3.3900 (2b)	= 659.5584 (1b) - (3b)
First floor	55.7600 (1c)	x 2.0400 (2c)	= 113.7504 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	250.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 773.3088 (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) = 0.0517 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3017 (18)
Number of sides sheltered	0 (19)

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Shelter factor
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 1.0000 \quad (20)$$

$$(21) = (18) \times (20) = 0.3017 \quad (21)$$

	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	0.3847	0.3772	0.3696	0.3319	0.3244	0.2866	0.2866	0.2791	0.3017	0.3244	0.3394	0.3545	(22b)
	0.5740	0.5711	0.5683	0.5551	0.5526	0.5411	0.5411	0.5389	0.5455	0.5526	0.5576	0.5628	(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			4.0500	1.0000	4.0500			(26)
TER Opening Type			55.5900	1.1450	63.6527			(27)
TER Roof Window			2.9500	1.1450	4.6957			(27a)
Heatloss Floor 1			194.5600	0.1300	25.2928			(28)
External Wall 1	301.4300	59.6400	241.7900	0.1800	43.5222			(29a)
roof void walls	134.5900		134.5900	0.1800	24.2262			(29a)
External Roof 1	314.0600	2.9500	311.1100	0.1100	34.2221			(30)
Total net area of external elements Aum(A, m2)			944.6400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	199.6617		(33)

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

143.9820 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate	41.0400	0.0500	2.0520	
E3 Sill	39.2100	0.0500	1.9605	
E5 Ground floor (normal)	75.7600	0.1600	12.1216	
E6 Intermediate floor within a dwelling	55.4900	0.0000	0.0000	
E16 Corner (normal)	23.0000	0.0900	2.0700	
E8 Balcony within a dwelling, wall insulation continuous	29.6900	0.0000	0.0000	
E13 Gable (insulation at rafter level)	36.3300	0.0800	2.9064	
E16 Corner (normal)	23.0000	0.0900	2.0700	
E17 Corner (inverted - internal area greater than external area)	11.5000	-0.0900	-1.0350	
R1 Head of roof window	3.0000	0.0800	0.2400	
R2 Sill of roof window	3.0000	0.0600	0.1800	
R3 Jamb of roof window	4.2000	0.0800	0.3360	
R5 Ridge (inverted)	17.4800	0.0400	0.6992	
E4 Jamb	50.0000	0.0500	2.5000	

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

Point Thermal bridges		(36a) =	26.1007	(36)
Total fabric heat loss	(33) + (36) + (36a) =		225.7624	(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	146.4794	145.7462	145.0274	141.6515	141.0199	138.0795	138.0795	137.5350	139.2121	141.0199	142.2976	143.6335	(38)
Average = Sum(39)m / 12 =	372.2418	371.5085	370.7898	367.4138	366.7822	363.8419	363.8419	363.2974	364.9745	366.7822	368.0600	369.3958	(39)
												367.4108	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.4871	1.4841	1.4813	1.4678	1.4653	1.4535	1.4535	1.4513	1.4580	1.4653	1.4704	1.4757	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0673	(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													
87.2769	85.9807	84.1554	80.7899	78.2698	75.4755	73.9661	75.7787	77.7522	80.7422	84.1771	86.9819	86.9819	(42b)
Hot water usage for other uses													
46.0427	44.3684	42.6941	41.0199	39.3456	37.6713	37.6713	39.3456	41.0199	42.6941	44.3684	46.0427	46.0427	(42c)
Average daily hot water use (litres/day)												122.7765	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.3196	130.3491	126.8496	121.8098	117.6154	113.1468	111.6374	115.1242	118.7720	123.4364	128.5455	133.0246	(44)
Energy conte	211.1457	185.6154	194.9631	166.7515	158.3330	139.1272	135.0158	142.5478	146.4578	167.5020	183.1366	208.2843	(45)
Energy content (annual)										Total = Sum(45)m =		2038.8801	

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

31.6719	27.8423	29.2445	25.0127	23.7499	20.8691	20.2524	21.3822	21.9687	25.1253	27.4705	31.2426	(46)
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

Water storage loss (or HIU loss):

Store volume

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

Temperature factor from Table 2b

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

Total storage loss

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

If cylinder contains dedicated solar storage

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

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

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

Total heat required for water heating calculated for each month

269.7745 238.5705 253.5919 223.4890 216.9618 195.8647 193.6446 201.1767 203.1953 226.1308 239.8741 266.9131 (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 269.7745 238.5705 253.5919 223.4890 216.9618 195.8647 193.6446 201.1767 203.1953 226.1308 239.8741 266.9131 (64)

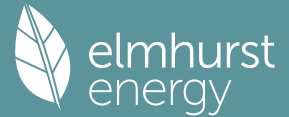
12Total per year (kWh/year)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

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

Heat gains from water heating, kWh/month 117.1090 104.0812 111.7283 100.8349 99.5488 91.6498 91.7958 94.3002 94.0873 102.5975 106.2830 116.1576 (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	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	210.1593	232.6763	210.1593	217.1646	210.1593	217.1646	210.1593	210.1593	217.1646	210.1593	217.1646	210.1593	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	416.6643	420.9879	410.0924	386.8972	357.6173	330.0984	311.7141	307.3904	318.2859	341.4812	370.7610	398.2799	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	(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)	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	(71)
Water heating gains (Table 5)	157.4046	154.8827	150.1724	140.0485	133.8021	127.2914	123.3814	126.7476	130.6768	137.8998	147.6152	156.1258	(72)
Total internal gains	856.2383	880.5572	842.4343	816.1204	773.5889	743.5646	714.2650	713.3074	735.1374	761.5504	807.5510	836.5752	(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					5.7400	11.2829		0.6300	0.7000	0.7700		19.7927 (75)	
Southeast					4.5000	36.7938		0.6300	0.7000	0.7700		50.6010 (77)	
Southwest					35.3300	36.7938		0.6300	0.7000	0.7700		397.2743 (79)	
Northwest					10.0200	11.2829		0.6300	0.7000	0.7700		34.5511 (81)	
Southwest					2.9500	26.0000		0.6300	0.7000	1.0000		30.4422 (82)	

Solar gains	532.6614	936.7421	1355.5309	1796.2903	2113.4344	2141.4095	2046.6454	1804.3290	1507.7442	1055.6251	643.4683	452.2558	(83)
Total gains	1388.8997	1817.2992	2197.9652	2612.4107	2887.0233	2884.9741	2760.9104	2517.6364	2242.8817	1817.1756	1451.0193	1288.8310	(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	26.8953	26.9484	27.0006	27.2487	27.2956	27.5162	27.5162	27.5574	27.4308	27.2956	27.2009	27.1025	
alpha	2.7930	2.7966	2.8000	2.8166	2.8197	2.8344	2.8344	2.8372	2.8287	2.8197	2.8134	2.8068	
util living area	0.9881	0.9748	0.9500	0.8938	0.7963	0.6558	0.5205	0.5757	0.7800	0.9312	0.9792	0.9904	(86)
MIT	18.1433	18.5155	19.0579	19.7491	20.3405	20.7403	20.9026	20.8681	20.5432	19.7415	18.8116	18.0846	(87)
Th 2	19.6972	19.6994	19.7016	19.7118	19.7137	19.7225	19.7225	19.7242	19.7191	19.7137	19.7098	19.7058	(88)
util rest of house	0.9855	0.9693	0.9385	0.8682	0.7448	0.5645	0.3913	0.4467	0.7049	0.9093	0.9736	0.9882	(89)
MIT 2	16.3957	16.8696	17.5552	18.4158	19.1133	19.5430	19.6799	19.6607	19.3610	18.4275	17.2564	16.3254	(90)
Living area fraction	17.1005	17.5334	18.1612	18.9535	19.6082	20.0258	20.1730	20.1476	19.8378	18.9574	17.8836	17.0349	(91)
MIT	17.1005	17.5334	18.1612	18.9535	19.6082	20.0258	20.1730	20.1476	19.8378	18.9574	17.8836	17.0349	(92)
Temperature adjustment	17.1005	17.5334	18.1612	18.9535	19.6082	20.0258	20.1730	20.1476	19.8378	18.9574	17.8836	17.0349	(93)
adjusted MIT	17.1005	17.5334	18.1612	18.9535	19.6082	20.0258	20.1730	20.1476	19.8378	18.9574	17.8836	17.0349	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9771	0.9556	0.9199	0.8495	0.7399	0.5881	0.4397	0.4928	0.7130	0.8921	0.9618	0.9811	(94)
Useful gains	1357.1487	1736.6885	2021.9972	2219.3077	2136.1850	1696.7231	1213.8655	1240.8035	1599.0977	1621.1896	1395.5524	1264.4140	(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	4764.8710	4693.4106	4323.8646	3693.8047	2900.5795	1974.1428	1300.0145	1361.5048	2094.1338	3065.3464	3969.0000	4741.1508	(97)
Space heating kWh	2535.3454	1986.9173	1712.5894	1061.6378	568.7095	0.0000	0.0000	0.0000	0.0000	1074.4526	1852.8822	2586.6922	(98a)
Space heating requirement - total per year (kWh/year)												13379.2264	
Solar 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	2535.3454	1986.9173	1712.5894	1061.6378	568.7095	0.0000	0.0000	0.0000	0.0000	1074.4526	1852.8822	2586.6922	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13379.2264	
Space heating per m2										(98c) / (4) =		53.4485	(99)

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

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

0.0000 (201)

Efficiency of main space heating system 1 (in %)

1.0000 (202)

Efficiency of main space heating system 2 (in %)

92.3000 (206)

Efficiency of secondary/supplementary heating system, %

0.0000 (207)

Efficiency of secondary/supplementary heating system, %

0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2535.3454	1986.9173	1712.5894	1061.6378	568.7095	0.0000	0.0000	0.0000	0.0000	1074.4526	1852.8822	2586.6922	(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)	2746.8531	2152.6731	1855.4598	1150.2035	616.1533	0.0000	0.0000	0.0000	0.0000	1164.0873	2007.4564	2802.4834	(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)

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Water heating													
Water heating requirement	269.7745	238.5705	253.5919	223.4890	216.9618	195.8647	193.6446	201.1767	203.1953	226.1308	239.8741	266.9131	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.8472	87.7392	87.5268	87.0918	86.1179	79.8000	79.8000	79.8000	79.8000	87.0922	87.6667	87.8730	(217)
Fuel for water heating, kWh/month													
307.0953	271.9086	289.7305	256.6131	251.9358	245.4445	242.6624	252.1011	254.6308	259.6453	273.6206	303.7487	(219)	
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	43.6669	35.0312	31.5418	23.1088	17.8499	14.5835	16.2833	21.1657	27.4921	36.0711	40.7422	44.8806	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-196.7777	-221.6330	-254.9929	-227.5356	-204.4857	-177.4903	-174.5591	-182.0015	-194.3452	-216.7315	-194.7057	-177.4522	(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	-372.9706	-724.3352	-1342.8857	-1893.9582	-2398.4721	-2374.0988	-2346.5058	-2032.7842	-1555.3658	-989.0255	-480.1670	-299.9513	(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												14495.3699	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3209.1365	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												352.4173	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-19233.2309	(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												-1090.3073	(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	14495.3699	0.2100	3044.0277	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3209.1365	0.2100	673.9187	(264)
Space and water heating			3717.9463	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	352.4173	0.1443	50.8647	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2422.7105	0.1398	-338.6496	
PV Unit electricity exported	-16810.5205	0.1279	-2149.3058	
Total			-2487.9554	(269)
Total CO2, kg/year			1292.7849	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			5.1600	(273)

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

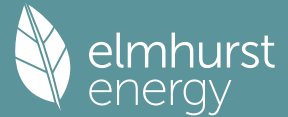
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	14495.3699	1.1300	16379.7679	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3209.1365	1.1300	3626.3243	(278)
Space and water heating			20006.0922	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	352.4173	1.5338	540.5494	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2422.7105	1.5169	-3674.9431	
PV Unit electricity exported	-16810.5205	0.4694	-7890.7301	
Total			-11565.6732	(283)
Total Primary energy kWh/year			9111.0691	(286)
Target Primary Energy Rate (TPER)			36.4000	(287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	194.5600 (1b)	x 3.3900 (2b)	= 659.5584 (1b) - (3b)	
First floor	55.7600 (1c)	x 2.0400 (2c)	= 113.7504 (1c) - (3c)	

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

250.3200

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 773.3088 (4)
(5)

2. Ventilation rate

												m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												4 * 10 = 40.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans												40.0000 / (5) = 0.0517 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												4.0000 (17)
Infiltration rate												0.2517 (18)
Number of sides sheltered												0 (19)
												Shelter factor
Shelter factor												(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.2517 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	0.3210	0.3147	0.3084	0.2769	0.2706	0.2391	0.2391	0.2328	0.2517	0.2706	0.2832	0.2958	(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	0.5515	0.5495	0.5475	0.5383	0.5366	0.5286	0.5286	0.5271	0.5317	0.5366	0.5401	0.5437	(25)

3. Heat losses and heat loss parameter

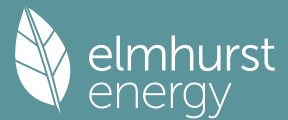
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Windows			73.3500	1.1450	83.9885			(27)
Roof windows			3.9000	1.0536	4.1092			(27a)
Doors			4.0500	1.4000	5.6700			(26)
Heatloss Floor 1			194.5600	0.1300	25.2928	75.0000	14592.0000	(28)
External Wall 1	301.4300	77.4000	224.0300	0.1700	38.0851	70.0000	15682.1000	(29a)
roof void walls	134.5900		134.5900	0.1300	17.4967	9.0000	1211.3100	(29a)
External Roof 1	314.0600	3.9000	310.1600	0.1100	34.1176	9.0000	2791.4400	(30)
Total net area of external elements Aum(A, m2)			944.6400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	208.7599		(33)
Main dwelling								
Internal Wall 1			140.3200			9.0000	1262.8800	(32c)
Internal Ceiling 1			55.7600			9.0000	501.8400	(32e)
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) = 36041.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								143.9820 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E1 Steel lintel with perforated steel base plate				41.0400	0.3060	12.5582		
E3 Sill				39.2100	0.0160	0.6274		
E5 Ground floor (normal)				75.7600	0.0660	5.0002		
E6 Intermediate floor within a dwelling				55.4900	0.0050	0.2775		
E16 Corner (normal)				23.0000	0.1800	4.1400		
E8 Balcony within a dwelling, wall insulation continuous				29.6900	0.1000	2.9690		
E13 Gable (insulation at rafter level)				36.3300	0.0630	2.2888		
E16 Corner (normal)				23.0000	0.0350	0.8050		
E17 Corner (inverted - internal area greater than external area)				11.5000	0.0000	0.0000		
R1 Head of roof window				3.0000	0.2400	0.7200		
R2 Sill of roof window				3.0000	0.2400	0.7200		
R3 Jamb of roof window				4.2000	0.2400	1.0080		
R5 Ridge (inverted)				17.4800	0.1200	2.0976		
E4 Jamb				50.0000	0.0170	0.8500		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							34.0616 (36)	
Point Thermal bridges							(36a) =	0.0000
Total fabric heat loss							(33) + (36) + (36a) =	242.8215 (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	140.7395	140.2291	139.7288	137.3791	136.9394	134.8929	134.8929	134.5139	135.6812	136.9394	137.8288	138.7586 (38)
Average = Sum(39)m / 12 =	383.5610	383.0507	382.5504	380.2006	379.7610	377.7144	377.7144	377.3354	378.5027	379.7610	380.6504	381.5802 (39)
												380.1985
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.5323	1.5302	1.5282	1.5189	1.5171	1.5089	1.5089	1.5074	1.5121	1.5171	1.5207	1.5244 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0673 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths													32.6548 (42b)
Hot water usage for other uses													46.0427 (42c)
Average daily hot water use (litres/day)													72.1332 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.6975	76.5383	74.1811	71.2476	68.6304	65.9106	65.3459	67.6983	70.1110	72.9040	75.8634	78.5871	(44)
Energy content (annual)	124.6377	108.9895	114.0135	97.5344	92.3897	81.0448	79.0302	83.8247	86.4539	98.9300	108.0814	123.0485	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):	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	105.9420	92.6411	96.9115	82.9042	78.5313	68.8881	67.1756	71.2510	73.4858	84.0905	91.8692	104.5912	(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	105.9420	92.6411	96.9115	82.9042	78.5313	68.8881	67.1756	71.2510	73.4858	84.0905	91.8692	104.5912	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 1018.2814 (64)												1018 (64)
Electric shower(s)	60.5824	53.9794	58.9434	56.2490	57.3045	54.6629	56.4850	57.3045	56.2490	58.9434	57.8351	60.5824	(64a)
Heat gains from water heating, kWh/month	41.6311	36.6551	38.9637	34.7883	33.9589	30.8878	30.9152	32.1389	32.4337	35.7585	37.4261	41.2934	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	210.1593	232.6763	210.1593	217.1646	210.1593	217.1646	210.1593	210.1593	217.1646	210.1593	217.1646	210.1593	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	416.6643	420.9879	410.0924	386.8972	357.6173	330.0984	311.7141	307.3904	318.2859	341.4812	370.7610	398.2799	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	(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)	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	(71)
Water heating gains (Table 5)	55.9558	54.5463	52.3706	48.3171	45.6437	42.8997	41.5526	43.1974	45.0468	48.0625	51.9806	55.5019	(72)
Total internal gains	751.7895	777.2208	741.6325	721.3890	682.4305	659.1728	632.4362	629.7572	649.5075	668.7131	708.9164	732.9513	(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	7.5800				11.2829		0.6300		0.7000		0.7700		26.1375 (75)	
Southeast	5.9400				36.7938		0.6300		0.7000		0.7700		66.7934 (77)	
Southwest	46.6100				36.7938		0.6300		0.7000		0.7700		524.1142 (79)	
Northwest	13.2200				11.2829		0.6300		0.7000		0.7700		45.5854 (81)	
Southwest	3.9000				26.0000		0.6300		0.7000		1.0000		40.2457 (82)	
Solar gains	702.8761	1236.1153	1788.8180	2370.5627	2789.1702	2826.1172	2701.0418	2381.2003	1989.7205	1393.0130	849.0980	596.7724	(83)	
Total gains	1454.6656	2013.3361	2530.4505	3091.9517	3471.6007	3485.2900	3333.4779	3010.9576	2639.2280	2061.7261	1558.0144	1329.7236	(84)	

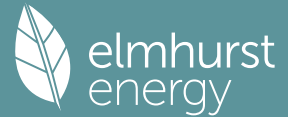
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	26.1016	26.1364	26.1705	26.3323	26.3628	26.5056	26.5056	26.5322	26.4504	26.3628	26.3012	26.2371	
alpha	2.7401	2.7424	2.7447	2.7555	2.7575	2.7670	2.7670	2.7688	2.7634	2.7575	2.7534	2.7491	
util living area	0.9866	0.9683	0.9334	0.8585	0.7401	0.5904	0.4593	0.5157	0.7304	0.9128	0.9754	0.9895	(86)
MIT	18.1017	18.5393	19.1408	19.8614	20.4367	20.7890	20.9232	20.8927	20.5992	19.7898	18.7945	18.0232	(87)
Th 2	19.6634	19.6649	19.6664	19.6734	19.6747	19.6808	19.6808	19.6819	19.6785	19.6747	19.6720	19.6693	(88)
util rest of house	0.9836	0.9613	0.9186	0.8268	0.6820	0.4976	0.3365	0.3899	0.6480	0.8860	0.9688	0.9871	(89)
MIT 2	17.0615	17.4944	18.0832	18.7726	19.2878	19.5723	19.6562	19.6441	19.4433	18.7268	17.7561	16.9873	(90)
Living area fraction	17.4810	17.9158	18.5097	19.2117	19.7512	20.0630	20.1672	20.1476	19.9095	19.1555	18.1749	17.4051	(91)
MIT	17.4810	17.9158	18.5097	19.2117	19.7512	20.0630	20.1672	20.1476	19.9095	19.1555	18.1749	17.4051	(92)
Temperature adjustment	17.4810	17.9158	18.5097	19.2117	19.7512	20.0630	20.1672	20.1476	19.9095	19.1555	18.1749	17.4051	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9763	0.9487	0.9021	0.8138	0.6857	0.5263	0.3839	0.4370	0.6642	0.8727	0.9583	0.9810	(94)
Useful gains	1420.2231	1910.0274	2282.7401	2516.2010	2380.5134	1834.2471	1279.6688	1315.8921	1753.0377	1799.2382	1493.0909	1304.4251	(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	5055.7134	4985.6998	4594.3148	3920.5163	3057.5219	2063.4414	1347.3643	1414.1069	2198.8972	3249.0358	4215.6562	5038.7972	(97)
Space heating kWh	2704.8048	2066.8519	1719.8116	1011.1070	503.6944	0.0000	0.0000	0.0000	0.0000	1078.6494	1960.2470	2778.3728	(98a)
Space heating requirement - total per year (kWh/year)	13823.5389												
Solar 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
 2704.8048 2066.8519 1719.8116 1011.1070 503.6944 0.0000 0.0000 0.0000 0.0000 1078.6494 1960.2470 2778.3728 (98c)
 Space heating requirement after solar contribution - total per year (kWh/year) 13823.5389
 Space heating per m2 (98c) / (4) = 55.2235 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	3550.5155	2795.0867	2867.7492	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7700	0.8315	0.7925	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2733.9111	2324.1216	2272.7453	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh													
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	855.9835	1062.4563	829.6196	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh													
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	213.9959	265.6141	207.4049	0.0000	0.0000	0.0000	0.0000	(107)
Energy for space heating													687.0148 (107)
Energy for space cooling													55.2235 (99)
Total													2.7445 (108)
Fabric Energy Efficiency (DFEE)													57.9680 (109)
													58.0 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	194.5600 (1b)	x 3.3900 (2b)	= 659.5584 (1b) - (3b)	
First floor	55.7600 (1c)	x 2.0400 (2c)	= 113.7504 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	250.3200			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 773.3088 (5)	

2. Ventilation rate

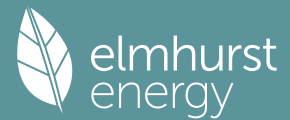
	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
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) = 0.0517 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3017 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3017 (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	0.3847	0.3772	0.3696	0.3319	0.3244	0.2866	0.2866	0.2791	0.3017	0.3244	0.3394	0.3545	(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	0.5740	0.5711	0.5683	0.5551	0.5526	0.5411	0.5411	0.5389	0.5455	0.5526	0.5576	0.5628	(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			4.0500	1.0000	4.0500			(26)
TER Opening Type			55.5900	1.1450	63.6527			(27)
TER Roof Window			2.9500	1.1450	4.6957			(27a)
Heatloss Floor 1			194.5600	0.1300	25.2928			(28)
External Wall 1	301.4300	59.6400	241.7900	0.1800	43.5222			(29a)
roof void walls	134.5900		134.5900	0.1800	24.2262			(29a)
External Roof 1	314.0600	2.9500	311.1100	0.1100	34.2221			(30)
Total net area of external elements Aum(A, m2)			944.6400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	199.6617		(33)

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

143.9820 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	41.0400	0.0500	2.0520
E3 Sill	39.2100	0.0500	1.9605
E5 Ground floor (normal)	75.7600	0.1600	12.1216
E6 Intermediate floor within a dwelling	55.4900	0.0000	0.0000
E16 Corner (normal)	23.0000	0.0900	2.0700
E8 Balcony within a dwelling, wall insulation continuous	29.6900	0.0000	0.0000
E13 Gable (insulation at rafter level)	36.3300	0.0800	2.9064
E16 Corner (normal)	23.0000	0.0900	2.0700
E17 Corner (inverted - internal area greater than external area)	11.5000	-0.0900	-1.0350
R1 Head of roof window	3.0000	0.0800	0.2400
R2 Sill of roof window	3.0000	0.0600	0.1800
R3 Jamb of roof window	4.2000	0.0800	0.3360
R5 Ridge (inverted)	17.4800	0.0400	0.6992
E4 Jamb	50.0000	0.0500	2.5000

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

26.1007 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 225.7624 (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	146.4794	145.7462	145.0274	141.6515	141.0199	138.0795	138.0795	137.5350	139.2121	141.0199	142.2976	143.6335 (38)
Heat transfer coeff	372.2418	371.5085	370.7898	367.4138	366.7822	363.8419	363.8419	363.2974	364.9745	366.7822	368.0600	369.3958 (39)
Average = Sum(39)m / 12 =												367.4108

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4871	1.4841	1.4813	1.4678	1.4653	1.4535	1.4535	1.4513	1.4580	1.4653	1.4704	1.4757 (40)
HLP (average)												1.4678
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0673 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
32.6548	32.1699	31.4869	30.2277	29.2848	28.2393	27.6746	28.3527	29.0911	30.2099	31.4950	32.5445	32.5445 (42b)
Hot water usage for other uses												
46.0427	44.3684	42.6941	41.0199	39.3456	37.6713	37.6713	39.3456	41.0199	42.6941	44.3684	46.0427	46.0427 (42c)
Average daily hot water use (litres/day)												72.1332 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	78.6975	76.5383	74.1811	71.2476	68.6304	65.9106	65.3459	67.6983	70.1110	72.9040	75.8634	78.5871 (44)
Energy conte	124.6377	108.9895	114.0135	97.5344	92.3897	81.0448	79.0302	83.8247	86.4539	98.9300	108.0814	123.0485 (45)
Energy content (annual)										Total =	Sum(45)m =	1197.9782
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	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
105.9420	92.6411	96.9115	82.9042	78.5313	68.8881	67.1756	71.2510	73.4858	84.0905	91.8692	104.5912	104.5912 (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	105.9420	92.6411	96.9115	82.9042	78.5313	68.8881	67.1756	71.2510	73.4858	84.0905	91.8692	104.5912 (64)
12Total per year (kWh/year)												1018.2814 (64)
Electric shower(s)	60.5824	53.9794	58.9434	56.2490	57.3045	54.6629	56.4850	57.3045	56.2490	58.9434	57.8351	60.5824 (64a)
												689.1212 (64a)
Heat gains from water heating, kWh/month	41.6311	36.6551	38.9637	34.7883	33.9589	30.8878	30.9152	32.1389	32.4337	35.7585	37.4261	41.2934 (65)

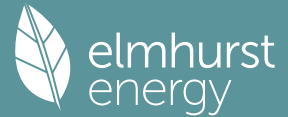
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673	153.3673 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
210.1593	232.6763	210.1593	217.1646	210.1593	217.1646	210.1593	217.1646	210.1593	217.1646	210.1593	217.1646	210.1593 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
416.6643	420.9879	410.0924	386.8972	357.6173	330.0984	311.7141	307.3904	318.2859	341.4812	370.7610	398.2799	398.2799 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367	38.3367 (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)												
-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938 (71)
Water heating gains (Table 5)												
55.9558	54.5463	52.3706	48.3171	45.6437	42.8997	41.5526	43.1974	45.0468	48.0625	51.9806	55.5019	55.5019 (72)
Total internal gains	751.7895	777.2208	741.6325	721.3890	682.4305	659.1728	632.4362	629.7572	649.5075	668.7131	708.9164	732.9513 (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	5.7400	11.2829	0.6300	0.7000	0.7700	19.7927 (75)

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Southeast	4.5000	36.7938	0.6300	0.7000	0.7700	50.6010 (77)
Southwest	35.3300	36.7938	0.6300	0.7000	0.7700	397.2743 (79)
Northwest	10.0200	11.2829	0.6300	0.7000	0.7700	34.5511 (81)
Southwest	2.9500	26.0000	0.6300	0.7000	1.0000	30.4422 (82)

Solar gains	532.6614	936.7421	1355.5309	1796.2903	2113.4344	2141.4095	2046.6454	1804.3290	1507.7442	1055.6251	643.4683	452.2558 (83)
Total gains	1284.4509	1713.9628	2097.1634	2517.6793	2795.8649	2800.5823	2679.0816	2434.0862	2157.2517	1724.3382	1352.3847	1185.2071 (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	26.8953	26.9484	27.0006	27.2487	27.2956	27.5162	27.5162	27.5574	27.4308	27.2956	27.2009	27.1025
alpha	2.7930	2.7966	2.8000	2.8166	2.8197	2.8344	2.8344	2.8372	2.8287	2.8197	2.8134	2.8068
util living area	0.9903	0.9782	0.9550	0.9013	0.8066	0.6677	0.5327	0.5896	0.7930	0.9386	0.9825	0.9922 (86)
MIT	18.0840	18.4594	19.0076	19.7102	20.3145	20.7273	20.8966	20.8596	20.5202	19.6978	18.7570	18.0252 (87)
Th 2	19.6972	19.6994	19.7016	19.7118	19.7137	19.7225	19.7225	19.7242	19.7191	19.7137	19.7098	19.7058 (88)
util rest of house	0.9881	0.9732	0.9445	0.8771	0.7564	0.5767	0.4018	0.4594	0.7199	0.9186	0.9777	0.9905 (89)
MIT 2	17.0656	17.4390	17.9805	18.6663	19.2247	19.5746	19.6870	19.6710	19.4233	18.6708	17.7443	17.0125 (90)
Living area fraction	FLA = Living area / (4) =											0.4033 (91)
MIT	17.4763	17.8506	18.3947	19.0873	19.6642	20.0395	20.1748	20.1503	19.8657	19.0850	18.1527	17.4209 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4763	17.8506	18.3947	19.0873	19.6642	20.0395	20.1748	20.1503	19.8657	19.0850	18.1527	17.4209 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9824	0.9634	0.9304	0.8626	0.7542	0.6014	0.4511	0.5065	0.7296	0.9057	0.9694	0.9857 (94)
Useful gains	1261.8415	1651.1762	1951.3007	2171.7715	2108.5152	1684.2156	1208.5940	1232.8792	1573.8697	1561.8164	1311.0279	1168.2649 (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	4904.7675	4811.2410	4410.4267	3742.9392	2921.1293	1979.0998	1300.6712	1362.4907	2104.3240	3112.1302	4068.0582	4883.7424 (97)
Space heating kWh	2710.3369	2123.5636	1829.5897	1131.2407	604.5849	0.0000	0.0000	0.0000	0.0000	1153.4334	1985.0618	2764.3153 (98a)
Space heating requirement - total per year (kWh/year)												14302.1264
Solar 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	2710.3369	2123.5636	1829.5897	1131.2407	604.5849	0.0000	0.0000	0.0000	0.0000	1153.4334	1985.0618	2764.3153 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												14302.1264
Space heating per m2												(98c) / (4) = 57.1354 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	3420.1137	2692.4299	2761.0600	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7063	0.7777	0.7343	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2415.4917	2093.8429	2027.4839	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	3135.2010	2999.3069	2723.5545	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	518.1907	673.6653	517.8766	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	fc = cooled area / (4) =											1.0000 (105)
0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	129.5477	168.4163	129.4691	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												427.4331 (107)
Energy for space heating												57.1354 (99)
Energy for space cooling												1.7075 (108)
Total												58.8429 (109)
Fabric Energy Efficiency (TFEE)												58.8 (109)

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

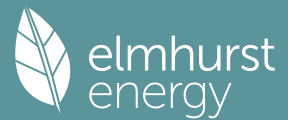
1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	194.5600 (1b)	x 3.3900 (2b)	= 659.5584 (1b) - (3b)
First floor	55.7600 (1c)	x 2.0400 (2c)	= 113.7504 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	250.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 773.3088 (5)

2. Ventilation rate

m3 per hour

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Number of open chimneys													0 * 80 =	0.0000 (6a)
Number of open flues													1 * 20 =	20.0000 (6b)
Number of chimneys / flues attached to closed fire													1 * 10 =	10.0000 (6c)
Number of flues attached to solid fuel boiler													0 * 20 =	0.0000 (6d)
Number of flues attached to other heater													0 * 35 =	0.0000 (6e)
Number of blocked chimneys													0 * 20 =	0.0000 (6f)
Number of intermittent extract fans													4 * 10 =	40.0000 (7a)
Number of passive vents													0 * 10 =	0.0000 (7b)
Number of flueless gas fires													0 * 40 =	0.0000 (7c)
														Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =										70.0000	/ (5) =	0.0905 (8)	
Pressure test	Yes													
Pressure Test Method	Blower Door													
Measured/design AP50	4.0000 (17)													
Infiltration rate	0.2905 (18)													
Number of sides sheltered	0 (19)													
Shelter factor	(20) = 1 - [0.075 x (19)] =										1.0000 (20)			
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =										0.2905 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750		
Adj infilt rate														
Effective ac	0.3704	0.3632	0.3559	0.3196	0.3123	0.2760	0.2760	0.2687	0.2905	0.3123	0.3268	0.3414	(22b)	
	0.5686	0.5659	0.5633	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5534	0.5583	(25)	

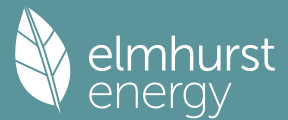
3. Heat losses and heat loss parameter														

Element	Gross		Openings		NetArea		U-value		A x U		K-value		A x K	
	m2		m2		m2		W/m2K		W/K		kJ/m2K		kJ/K	
Main dwelling														
Windows					73.3500		1.1450		83.9885				(27)	
Roof windows					3.9000		1.0536		4.1092				(27a)	
Doors					4.0500		1.4000		5.6700				(26)	
Heatloss Floor 1					194.5600		0.1300		25.2928		75.0000		14592.0000 (28)	
External Wall 1	301.4300		77.4000		224.0300		0.1700		38.0851		70.0000		15682.1000 (29a)	
roof void walls	134.5900				134.5900		0.1300		17.4967		9.0000		1211.3100 (29a)	
External Roof 1	314.0600		3.9000		310.1600		0.1100		34.1176		9.0000		2791.4400 (30)	
Total net area of external elements Aum(A, m2)					944.6400								(31)	
Fabric heat loss, W/K = Sum (A x U)							(26)...(30) + (32) =		208.7599				(33)	
Main dwelling														
Internal Wall 1					140.3200						9.0000		1262.8800 (32c)	
Internal Ceiling 1					55.7600						9.0000		501.8400 (32e)	
Heat capacity Cm = Sum(A x k)											(28)...(30) + (32) + (32a)...(32e) =		36041.5700 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													143.9820 (35)	
List of Thermal Bridges														
K1 Element							Length		Psi-value		Total			
E1 Steel lintel with perforated steel base plate							41.0400		0.3060		12.5582			
E3 Sill							39.2100		0.0160		0.6274			
E5 Ground floor (normal)							75.7600		0.0660		5.0002			
E6 Intermediate floor within a dwelling							55.4900		0.0050		0.2775			
E16 Corner (normal)							23.0000		0.1800		4.1400			
E8 Balcony within a dwelling, wall insulation continuous							29.6900		0.1000		2.9690			
E13 Gable (insulation at rafter level)							36.3300		0.0630		2.2888			
E16 Corner (normal)							23.0000		0.0350		0.8050			
E17 Corner (inverted - internal area greater than external area)							11.5000		0.0000		0.0000			
R1 Head of roof window							3.0000		0.2400		0.7200			
R2 Sill of roof window							3.0000		0.2400		0.7200			
R3 Jamb of roof window							4.2000		0.2400		1.0080			
R5 Ridge (inverted)							17.4800		0.1200		2.0976			
E4 Jamb							50.0000		0.0170		0.8500			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											(36a) =		34.0616 (36)	
Point Thermal bridges											(33) + (36) + (36a) =		0.0000	
Total fabric heat loss											(33) + (36) + (36a) =		242.8215 (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	145.1029	144.4231	143.7567	140.6269	140.0413	137.3153	137.3153	136.8105	138.3653	140.0413	141.2259	142.4644	(38)	
Average = Sum(39)m / 12 =	387.9244	387.2446	386.5782	383.4484	382.8628	380.1368	380.1368	379.6320	381.1868	382.8628	384.0474	385.2859	(39)	
	383.4456												(39)	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
HLP (average)	1.5497	1.5470	1.5443	1.5318	1.5295	1.5186	1.5186	1.5166	1.5228	1.5295	1.5342	1.5392	(40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)	

4. Water heating energy requirements (kWh/year)														

Assumed occupancy													3.0673 (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													87.2769	
	87.2769	85.9807	84.1554	80.7899	78.2698	75.4755	73.9661	75.7787	77.7522	80.7422	84.1771	86.9819	(42b)	
Hot water usage for other uses													46.0427	
	46.0427	44.3684	42.6941	41.0199	39.3456	37.6713	37.6713	39.3456	41.0199	42.6941	44.3684	46.0427	(42c)	
Average daily hot water use (litres/day)													122.7765 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	133.3196	130.3491	126.8496	121.8098	117.6154	113.1468	111.6374	115.1242	118.7720	123.4364	128.5455	133.0246	(44)	
Energy content (annual)	211.1457	185.6154	194.9631	166.7515	158.3330	139.1272	135.0158	142.5478	146.4578	167.5020	183.1366	208.2843	(45)	
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m =	
	31.6719	27.8423	29.2445	25.0127	23.7499	20.8691	20.2524	21.3822	21.9687	25.1253	27.4705	31.2426	(46)	
Water storage loss (or HIU loss):													300.0000 (47)	
Store volume													2.0000 (48)	
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)	
Temperature factor from Table 2b													1.0800 (55)	
Enter (49) or (54) in (55)														

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Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	267.8881	236.8666	251.7055	221.6635	215.0754	194.0392	191.7582	199.2902	201.3698	224.2444	238.0486	265.0267 (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	267.8881	236.8666	251.7055	221.6635	215.0754	194.0392	191.7582	199.2902	201.3698	224.2444	238.0486	265.0267 (64)
	Total per year (kWh/year) = Sum(64)m =											2706.9761 (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	115.5999	102.7181	110.2191	99.3745	98.0396	90.1894	90.2867	92.7911	92.6268	101.0883	104.8225	114.6485 (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	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.8224	47.8046	38.8773	29.4326	22.0012	18.5744	20.0703	26.0881	35.0154	44.4600	51.8914	55.3183	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	621.8869	628.3402	612.0782	577.4584	533.7572	492.6842	465.2449	458.7916	475.0536	509.6734	553.3746	594.4476	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	(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)	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	(71)
Water heating gains (Table 5)	155.3762	152.8543	148.1440	138.0201	131.7737	125.2630	121.3530	124.7192	128.6484	135.8714	145.5868	154.0974	(72)
Total internal gains	948.9039	946.8174	916.9179	862.7295	805.3505	754.3399	724.4865	727.4172	756.5356	807.8232	868.6712	921.6817	(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				7.5800	11.2829		0.6300		0.7000		0.7700		26.1375 (75)
Southeast				5.9400	36.7938		0.6300		0.7000		0.7700		66.7934 (77)
Southwest				46.6100	36.7938		0.6300		0.7000		0.7700		524.1142 (79)
Northwest				13.2200	11.2829		0.6300		0.7000		0.7700		45.5854 (81)
Southwest				3.9000	26.0000		0.6300		0.7000		1.0000		40.2457 (82)
Solar gains	702.8761	1236.1153	1788.8180	2370.5627	2789.1702	2826.1172	2701.0418	2381.2003	1989.7205	1393.0130	849.0980	596.7724	(83)
Total gains	1651.7799	2182.9327	2705.7359	3233.2922	3594.5206	3580.4571	3425.5283	3108.6176	2746.2561	2200.8361	1717.7693	1518.4540	(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	25.8080	25.8533	25.8979	26.1092	26.1492	26.3367	26.3367	26.3717	26.2641	26.1492	26.0685	25.9847
alpha	2.7205	2.7236	2.7265	2.7406	2.7433	2.7558	2.7558	2.7581	2.7509	2.7433	2.7379	2.7323
util living area	0.9818	0.9620	0.9240	0.8480	0.7294	0.5814	0.4511	0.5051	0.7174	0.9013	0.9691	0.9854 (86)
Living	18.7725	19.0858	19.5335	20.0580	20.4774	20.7347	20.8329	20.8115	20.5992	20.0138	19.2823	18.7151
Non living	17.6480	17.9578	18.3953	18.8988	19.2733	19.4837	19.5446	19.5369	19.3909	18.8745	18.1628	17.5969
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	4	0	0	0	0	0	0	0	0	0	0	0
16 / 9	27	0	0	0	0	0	0	0	0	0	0	25
MIT	19.9012	19.0858	19.5335	20.0580	20.4774	20.7347	20.8329	20.8115	20.5992	20.0138	19.2823	19.5141 (87)
Th 2	19.6504	19.6524	19.6544	19.6637	19.6655	19.6736	19.6736	19.6751	19.6704	19.6655	19.6619	19.6582 (88)
util rest of house	0.9777	0.9537	0.9074	0.8147	0.6701	0.4886	0.3293	0.3802	0.6336	0.8718	0.9611	0.9821 (89)
MIT 2	18.6626	17.9578	18.3953	18.8988	19.2733	19.4837	19.5446	19.5369	19.3909	18.8745	18.1628	18.3177 (90)
Living area fraction	fLA = Living area / (4) =											0.4033 (91)
MIT	19.1621	18.4127	18.8543	19.3663	19.7589	19.9882	20.0642	20.0510	19.8782	19.3340	18.6142	18.8002 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1621	18.4127	18.8543	19.3663	19.7589	19.9882	20.0642	20.0510	19.8782	19.3340	18.6142	18.8002 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9760	0.9440	0.8953	0.8061	0.6747	0.5122	0.3670	0.4179	0.6483	0.8628	0.9527	0.9795	(94)
Ext temp.	1612.0969	2060.5930	2422.5349	2606.4253	2425.3323	1833.8612	1257.0442	1299.0812	1780.3337	1898.9657	1636.5019	1487.2601	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Space heating kWh	5765.3808	5232.7082	4775.9060	4013.2823	3085.4471	2048.2543	1316.8577	1386.0241	2202.5834	3343.9143	4422.0153	5625.2573	(97)
Space heating requirement - total per year (kWh/year)	3090.0432	2131.6614	1750.9081	1012.9371	491.1254	0.0000	0.0000	0.0000	0.0000	1075.0418	2005.5696	3078.6699	(98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	3090.0432	2131.6614	1750.9081	1012.9371	491.1254	0.0000	0.0000	0.0000	0.0000	1075.0418	2005.5696	3078.6699	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												14635.9566	

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Space heating per m2

(98c) / (4) = 58.4690 (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 %)												299.3303 (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	3090.0432	2131.6614	1750.9081	1012.9371	491.1254	0.0000	0.0000	0.0000	0.0000	1075.0418	2005.5696	3078.6699 (98)
Space heating efficiency (main heating system 1)	299.3303	299.3303	299.3303	299.3303	299.3303	0.0000	0.0000	0.0000	0.0000	299.3303	299.3303	299.3303 (210)
Space heating fuel (main heating system)	1032.3189	712.1435	584.9418	338.4011	164.0747	0.0000	0.0000	0.0000	0.0000	359.1490	670.0189	1028.5193 (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	267.8881	236.8666	251.7055	221.6635	215.0754	194.0392	191.7582	199.2902	201.3698	224.2444	238.0486	265.0267 (64)
Efficiency of water heater	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846 (216)
Fuel for water heating, kWh/month	139.6090	123.4423	131.1755	115.5192	112.0858	101.1229	99.9341	103.8594	104.9432	116.8642	124.0582	138.1178 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	47.1104	37.7937	34.0291	24.9312	19.2575	15.7336	17.5674	22.8347	29.6601	38.9156	43.9551	48.4198 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-196.9035	-332.5902	-568.1428	-729.4055	-711.5484	-489.9906	-482.6586	-487.0501	-495.0434	-418.1180	-233.7796	-163.7216 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.4631	-7.4702	-31.1264	-96.5361	-323.9185	-533.0476	-524.8296	-384.0487	-171.9519	-22.4517	-3.3886	-0.9597 (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												4889.5673 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												191.8846
Water heating fuel used												1410.7315 (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)												380.2082 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-7410.1444 (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												-729.6373 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4889.5673	16.4900	806.2896 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1410.7315	16.4900	232.6296 (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	380.2082	16.4900	62.6963 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5308.9523	16.4900	-875.4462
PV Unit electricity exported	-2101.1921	5.5900	-117.4566
Total			-992.9029 (252)
Total energy cost			108.7127 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.1325 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	97.8518
SAP rating (Section 12)		98 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4889.5673	0.1553	759.4220 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1410.7315	0.1408	198.6937 (264)
Space and water heating			958.1157 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	380.2082	0.1443	54.8758 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5308.9523	0.1350	-716.6352
PV Unit electricity exported	-2101.1921	0.1080	-226.9874
Total			-943.6226 (269)
Total CO2, kg/year			69.3689 (272)
CO2 emissions per m2			0.2800 (273)
EI value			99.6852
EI rating			100 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	194.5600 (1b)	x 3.3900 (2b)	= 659.5584 (1b) - (3b)
First floor	55.7600 (1c)	x 2.0400 (2c)	= 113.7504 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	250.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 773.3088 (5)

2. Ventilation rate

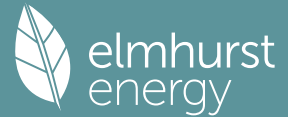
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) =	70.0000 / (5) = 0.0905 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2905 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2905 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000 (22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750 (22a)
Adj infilt rate	0.3341	0.3196	0.3196	0.2905	0.2978	0.2542	0.2542	0.2542	0.2687	0.2978	0.2905	0.3123 (22b)
Effective ac	0.5558	0.5511	0.5511	0.5422	0.5443	0.5323	0.5323	0.5323	0.5361	0.5443	0.5422	0.5488 (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			73.3500	1.1450	83.9885		(27)
Roof windows			3.9000	1.0536	4.1092		(27a)
Doors			4.0500	1.4000	5.6700		(26)
Heatloss Floor 1			194.5600	0.1300	25.2928	75.0000	14592.0000 (28)
External Wall 1	301.4300	77.4000	224.0300	0.1700	38.0851	70.0000	15682.1000 (29a)
roof void walls	134.5900		134.5900	0.1300	17.4967	9.0000	1211.3100 (29a)
External Roof 1	314.0600	3.9000	310.1600	0.1100	34.1176	9.0000	2791.4400 (30)
Total net area of external elements Aum(A, m2)			944.6400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		208.7599		(33)
Main dwelling							
Internal Wall 1			140.3200			9.0000	1262.8800 (32c)
Internal Ceiling 1			55.7600			9.0000	501.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	36041.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							143.9820 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E1 Steel lintel with perforated steel base plate				41.0400	0.3060		12.5582
E3 Sill				39.2100	0.0160		0.6274
E5 Ground floor (normal)				75.7600	0.0660		5.0002
E6 Intermediate floor within a dwelling				55.4900	0.0050		0.2775
E16 Corner (normal)				23.0000	0.1800		4.1400

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E8 Balcony within a dwelling, wall insulation continuous	29.6900	0.1000	2.9690
E13 Gable (insulation at rafter level)	36.3300	0.0630	2.2888
E16 Corner (normal)	23.0000	0.0350	0.8050
E17 Corner (inverted - internal area greater than external area)	11.5000	0.0000	0.0000
R1 Head of roof window	3.0000	0.2400	0.7200
R2 Sill of roof window	3.0000	0.2400	0.7200
R3 Jamb of roof window	4.2000	0.2400	1.0080
R5 Ridge (inverted)	17.4800	0.1200	2.0976
E4 Jamb	50.0000	0.0170	0.8500

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal Bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 242.8215 (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	141.8384	140.6269	140.6269	138.3653	138.9105	135.8412	135.8412	135.8412	136.8105	138.9105	138.3653	140.0413	(38)
Heat transfer coeff	384.6600	383.4484	383.4484	381.1868	381.7320	378.6628	378.6628	378.6628	379.6320	381.7320	381.1868	382.8628	(39)
Average = Sum(39)m / 12 =												381.3231	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.5367	1.5318	1.5318	1.5228	1.5250	1.5127	1.5127	1.5127	1.5166	1.5250	1.5228	1.5295	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0673 (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	87.2769	85.9807	84.1554	80.7899	78.2698	75.4755	73.9661	75.7787	77.7522	80.7422	84.1771	86.9819	(42b)
Hot water usage for other uses	46.0427	44.3684	42.6941	41.0199	39.3456	37.6713	37.6713	39.3456	41.0199	42.6941	44.3684	46.0427	(42c)
Average daily hot water use (litres/day)													122.7765 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	133.3196	130.3491	126.8496	121.8098	117.6154	113.1468	111.6374	115.1242	118.7720	123.4364	128.5455	133.0246	(44)
Distribution loss (46)m = 0.15 x (45)m	211.1457	185.6154	194.9631	166.7515	158.3330	139.1272	135.0158	142.5478	146.4578	167.5020	183.1366	208.2843	(45)
Store volume										Total = Sum(45)m =		2038.8801	
a) If manufacturer declared loss factor is known (kWh/day):	31.6719	27.8423	29.2445	25.0127	23.7499	20.8691	20.2524	21.3822	21.9687	25.1253	27.4705	31.2426	(46)
Temperature factor from Table 2b													300.0000 (47)
Enter (49) or (54) in (55)													2.0000 (48)
Total storage loss													0.5400 (49)
If cylinder contains dedicated solar storage													1.0800 (55)
Primary loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
Combi loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
Total heat required for water heating calculated for each month	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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	(61)
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	(62)
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	(63a)
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	(63b)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
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	(63d)
Heat gains from water heating, kWh/month	267.8881	236.8666	251.7055	221.6635	215.0754	194.0392	191.7582	199.2902	201.3698	224.2444	238.0486	265.0267	(64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													2706.9761 (64)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	115.5999	102.7181	110.2191	99.3745	98.0396	90.1894	90.2867	92.7911	92.6268	101.0883	104.8225	114.6485	(65)

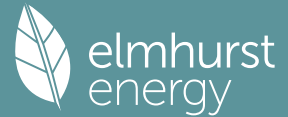
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.8224	47.8046	38.8773	29.4326	22.0012	18.5744	20.0703	26.0881	35.0154	44.4600	51.8914	55.3183	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	621.8869	628.3402	612.0782	577.4584	533.7572	492.6842	465.2449	458.7916	475.0536	509.6734	553.3746	594.4476	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	(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)	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	(71)
Water heating gains (Table 5)	155.3762	152.8543	148.1440	138.0201	131.7737	125.2630	121.3530	124.7192	128.6484	135.8714	145.5868	154.0974	(72)
Total internal gains	948.9039	946.8174	916.9179	862.7295	805.3505	754.3399	724.4865	727.4172	756.5356	807.8232	868.6712	921.6817	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	7.5800	13.3543	0.6300	0.7000	0.7700	30.9360 (75)
Southeast	5.9400	41.8189	0.6300	0.7000	0.7700	75.9156 (77)
Southwest	46.6100	41.8189	0.6300	0.7000	0.7700	595.6946 (79)
Northwest	13.2200	13.3543	0.6300	0.7000	0.7700	53.9543 (81)
Southwest	3.9000	31.0000	0.6300	0.7000	1.0000	47.9852 (82)

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Solar gains	804.4856	1277.9517	1824.3218	2476.1874	2838.7662	3049.9853	2882.6395	2593.4133	2155.2625	1527.0442	963.8491	681.7152 (83)
Total gains	1753.3895	2224.7691	2741.2397	3338.9169	3644.1166	3804.3252	3607.1260	3320.8306	2911.7982	2334.8674	1832.5204	1603.3969 (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	26.0270	26.1092	26.1092	26.2641	26.2266	26.4392	26.4392	26.4392	26.3717	26.2266	26.2641	26.1492	
alpha	2.7351	2.7406	2.7406	2.7509	2.7484	2.7626	2.7626	2.7626	2.7581	2.7484	2.7509	2.7433	
util living area	0.9787	0.9601	0.9192	0.8337	0.7113	0.5296	0.4055	0.4441	0.6883	0.8849	0.9635	0.9828 (86)	
Living	18.8481	19.1222	19.5919	20.1204	20.5189	20.7760	20.8495	20.8382	20.6354	20.0878	19.3566	18.7965	
Non living	17.7297	18.0017	18.4587	18.9608	19.3105	19.5137	19.5560	19.5520	19.4205	18.9449	18.2416	17.6828	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	4	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	27	0	0	0	0	0	0	0	0	0	0	24	
MIT	19.9385	19.1222	19.5919	20.1204	20.5189	20.7760	20.8495	20.8382	20.6354	20.0878	19.3566	19.5362 (87)	
Th 2	19.6601	19.6637	19.6637	19.6704	19.6688	19.6780	19.6780	19.6780	19.6751	19.6688	19.6704	19.6655 (88)	
util rest of house	0.9740	0.9516	0.9016	0.7980	0.6488	0.4337	0.2847	0.3179	0.6016	0.8513	0.9541	0.9790 (89)	
MIT 2	18.7079	18.0017	18.4587	18.9608	19.3105	19.5137	19.5560	19.5520	19.4205	18.9449	18.2416	18.3484 (90)	
Living area fraction									fLA = Living area / (4) =				0.4033 (91)
MIT	19.2042	18.4536	18.9157	19.4284	19.7978	20.0227	20.0777	20.0707	19.9105	19.4058	18.6913	18.8274 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.2042	18.4536	18.9157	19.4284	19.7978	20.0227	20.0777	20.0707	19.9105	19.4058	18.6913	18.8274 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9721	0.9416	0.8896	0.7906	0.6554	0.4602	0.3227	0.3572	0.6187	0.8432	0.9450	0.9759 (94)
Useful gains	1704.3931	2094.9516	2438.5788	2639.6751	2388.4817	1750.6888	1164.0157	1186.3074	1801.5013	1968.8574	1731.7239	1564.7849 (95)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000 (96)
Heat loss rate W	5694.5641	5197.1100	4684.0839	3937.0583	2976.6853	1901.9269	1203.2749	1238.4961	2167.8722	3285.1003	4380.3177	5523.7297 (97)
Space heating kWh	2968.6873	2084.6504	1670.6558	934.1160	437.6235	0.0000	0.0000	0.0000	0.0000	979.2848	1906.9876	2945.4549 (98a)
Space heating requirement - total per year (kWh/year)												13927.4602
Solar 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	2968.6873	2084.6504	1670.6558	934.1160	437.6235	0.0000	0.0000	0.0000	0.0000	979.2848	1906.9876	2945.4549 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13927.4602
Space heating per m2										(98c) / (4) =		55.6386 (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 %)												298.9552 (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	2968.6873	2084.6504	1670.6558	934.1160	437.6235	0.0000	0.0000	0.0000	0.0000	979.2848	1906.9876	2945.4549 (98)
Space heating efficiency (main heating system 1)	298.9552	298.9552	298.9552	298.9552	298.9552	0.0000	0.0000	0.0000	0.0000	298.9552	298.9552	298.9552 (210)
Space heating fuel (main heating system)	993.0207	697.3120	558.8315	312.4602	146.3843	0.0000	0.0000	0.0000	0.0000	327.5691	637.8840	985.2496 (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	267.8881	236.8666	251.7055	221.6635	215.0754	194.0392	191.7582	199.2902	201.3698	224.2444	238.0486	265.0267 (64)
Efficiency of water heater (217)m	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482 (216)
Fuel for water heating, kWh/month	139.5627	123.4013	131.1320	115.4809	112.0486	101.0893	99.9010	103.8250	104.9084	116.8255	124.0171	138.0720 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	47.1104	37.7937	34.0291	24.9312	19.2575	15.7336	17.5674	22.8347	29.6601	38.9156	43.9551	48.4198 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-229.1195	-349.2904	-585.1977	-757.1087	-693.8208	-489.9571	-482.6255	-487.0157	-495.0086	-460.7558	-269.2816	-190.2185 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-2.1746	-8.5575	-34.6759	-112.8296	-364.1129	-616.4724	-595.6567	-467.6818	-236.1498	-30.3338	-4.9501	-1.4255 (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												4658.7113 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												191.9482
Water heating fuel used												1410.2637 (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)	380.2082 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-7964.4206 (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	-1515.2373 (238)

10a. Fuel costs - using BEDF prices (590)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4658.7113	28.4300	1324.4716 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1410.2637	28.4300	400.9380 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	380.2082	28.4300	108.0932 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5489.4000	28.4300	-1560.6364
PV Unit electricity exported	-2475.0206	5.8100	-143.7987
Total			-1704.4351 (252)
Total energy cost			129.0677 (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	4658.7113	0.1555	724.4036 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1410.2637	0.1408	198.6278 (264)
Space and water heating			923.0314 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	380.2082	0.1443	54.8758 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5489.4000	0.1356	-744.2521
PV Unit electricity exported	-2475.0206	0.1080	-267.2748
Total			-1011.5269 (269)
Total CO2, kg/year			-33.6196 (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	4658.7113	1.5756	7340.4500 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1410.2637	1.5208	2144.7134 (278)
Space and water heating			9485.1634 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	380.2082	1.5338	583.1761 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5489.4000	1.5012	-8240.7257
PV Unit electricity exported	-2475.0206	0.3946	-976.7306
Total			-9217.4564 (283)
Total Primary energy kWh/year			850.8831 (286)

SAP 10 EPC IMPROVEMENTS

01	
Current energy efficiency rating:	A 98
Current environmental impact rating:	A 100
N Solar water heating	SAP increase too small
U Solar photovoltaic panels	Already installed
V2 Wind turbine	Not applicable
Recommended measures:	SAP change Cost change CO2 change
(none)	
Measures omitted - SAP change or cost saving too small:	
N Solar water heating	+ 0.4 -£ 30 -35 kg (104.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0 0.00 kg/m²		
Potential energy efficiency rating:	A 98		
Potential environmental impact rating:	A 100		

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Fuel prices for cost data on this page from database revision number 590 TEST (30 Jan 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £1834	Potential £1834	Saving £0
Electricity			
Space heating	£1324	£1324	£0
Water heating	£401	£401	£0
Lighting	£108	£108	£0
Generated (PV)	-£1704	-£1704	£0
Total cost of fuels	£130	£130	£0
Total cost of uses	£129	£129	£0
Delivered energy	-6 kWh/m ²	-6 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	-0.0 tonnes	-0.0 tonnes	0.0 tonnes
CO2 emissions per m ²	-0 kg/m ²	-0 kg/m ²	0 kg/m ²
Primary energy	3 kWh/m ²	3 kWh/m ²	0 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	194.5600 (1b)	x 3.3900 (2b)	= 659.5584 (1b) - (3b)
First floor	55.7600 (1c)	x 2.0400 (2c)	= 113.7504 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	250.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 773.3088 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) =	70.0000 / (5) = 0.0905 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2905 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2905 (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	0.3704	0.3632	0.3559	0.3196	0.3123	0.2760	0.2760	0.2687	0.2905	0.3123	0.3268	0.3414 (22b)
Effective ac	0.5686	0.5659	0.5633	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5534	0.5583 (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			73.3500	1.1450	83.9885		(27)
Roof windows			3.9000	1.0536	4.1092		(27a)
Doors			4.0500	1.4000	5.6700		(26)
Heatloss Floor 1			194.5600	0.1300	25.2928	75.0000	14592.0000 (28)
External Wall 1	301.4300	77.4000	224.0300	0.1700	38.0851	70.0000	15682.1000 (29a)
roof void walls	134.5900		134.5900	0.1300	17.4967	9.0000	1211.3100 (29a)
External Roof 1	314.0600	3.9000	310.1600	0.1100	34.1176	9.0000	2791.4400 (30)
Total net area of external elements Aum(A, m ²)			944.6400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	208.7599			(33)
Main dwelling							
Internal Wall 1			140.3200			9.0000	1262.8800 (32c)
Internal Ceiling 1			55.7600			9.0000	501.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	36041.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							143.9820 (35)

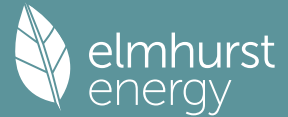
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	41.0400	0.3060	12.5582
E3 Sill	39.2100	0.0160	0.6274
E5 Ground floor (normal)	75.7600	0.0660	5.0002
E6 Intermediate floor within a dwelling	55.4900	0.0050	0.2775
E16 Corner (normal)	23.0000	0.1800	4.1400
E8 Balcony within a dwelling, wall insulation continuous	29.6900	0.1000	2.9690

elmhurst
energy

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Total gains 1651.7799 2182.9327 2705.7359 3233.2922 3594.5206 3580.4571 3425.5283 3108.6176 2746.2561 2200.8361 1717.7693 1518.4540 (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	25.8080	25.8533	25.8979	26.1092	26.1492	26.3367	26.3367	26.3717	26.2641	26.1492	26.0685	25.9847
alpha	2.7205	2.7236	2.7265	2.7406	2.7433	2.7558	2.7558	2.7581	2.7509	2.7433	2.7379	2.7323
util living area	0.9818	0.9620	0.9240	0.8480	0.7294	0.5814	0.4511	0.5051	0.7174	0.9013	0.9691	0.9854 (86)
Living	18.7725	19.0858	19.5335	20.0580	20.4774	20.7347	20.8329	20.8115	20.5992	20.0138	19.2823	18.7151
Non living	17.6480	17.9578	18.3953	18.8988	19.2733	19.4837	19.5446	19.5369	19.3909	18.8745	18.1628	17.5969
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	4	0	0	0	0	0	0	0	0	0	0	0
16 / 9	27	0	0	0	0	0	0	0	0	0	0	25
MIT	19.9012	19.0858	19.5335	20.0580	20.4774	20.7347	20.8329	20.8115	20.5992	20.0138	19.2823	19.5141 (87)
Th 2	19.6504	19.6524	19.6544	19.6637	19.6655	19.6736	19.6736	19.6751	19.6704	19.6655	19.6619	19.6582 (88)
util rest of house	0.9777	0.9537	0.9074	0.8147	0.6701	0.4886	0.3293	0.3802	0.6336	0.8718	0.9611	0.9821 (89)
MIT 2	18.6626	17.9578	18.3953	18.8988	19.2733	19.4837	19.5446	19.5369	19.3909	18.8745	18.1628	18.3177 (90)
Living area fraction									fLA = Living area / (4) =			0.4033 (91)
MIT	19.1621	18.4127	18.8543	19.3663	19.7589	19.9882	20.0642	20.0510	19.8782	19.3340	18.6142	18.8002 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1621	18.4127	18.8543	19.3663	19.7589	19.9882	20.0642	20.0510	19.8782	19.3340	18.6142	18.8002 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9760	0.9440	0.8953	0.8061	0.6747	0.5122	0.3670	0.4179	0.6483	0.8628	0.9527	0.9795 (94)
Useful gains	1612.0969	2060.5930	2422.5349	2606.4253	2425.3323	1833.8612	1257.0442	1299.0812	1780.3337	1898.9657	1636.5019	1487.2601 (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	5765.3808	5232.7082	4775.9060	4013.2823	3085.4471	2048.2543	1316.8577	1386.0241	2202.5834	3343.9143	4422.0153	5625.2573 (97)
Space heating kWh	3090.0432	2131.6614	1750.9081	1012.9371	491.1254	0.0000	0.0000	0.0000	0.0000	1075.0418	2005.5696	3078.6699 (98a)
Space heating requirement - total per year (kWh/year)												14635.9566
Solar 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	3090.0432	2131.6614	1750.9081	1012.9371	491.1254	0.0000	0.0000	0.0000	0.0000	1075.0418	2005.5696	3078.6699 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												14635.9566
Space heating per m2										(98c) / (4) =		58.4690 (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 %)

299.3303 (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	3090.0432	2131.6614	1750.9081	1012.9371	491.1254	0.0000	0.0000	0.0000	0.0000	1075.0418	2005.5696	3078.6699 (98)
Space heating efficiency (main heating system 1)	299.3303	299.3303	299.3303	299.3303	299.3303	0.0000	0.0000	0.0000	0.0000	299.3303	299.3303	299.3303 (210)
Space heating fuel (main heating system)	1032.3189	712.1435	584.9418	338.4011	164.0747	0.0000	0.0000	0.0000	0.0000	359.1490	670.0189	1028.5193 (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	267.8881	236.8666	251.7055	221.6635	215.0754	194.0392	191.7582	199.2902	201.3698	224.2444	238.0486	265.0267 (64)
Efficiency of water heater (217)m	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846	191.8846 (216)
Fuel for water heating, kWh/month	139.6090	123.4423	131.1755	115.5192	112.0858	101.1229	99.9341	103.8594	104.9432	116.8642	124.0582	138.1178 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	47.1104	37.7937	34.0291	24.9312	19.2575	15.7336	17.5674	22.8347	29.6601	38.9156	43.9551	48.4198 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-196.9035	-332.5902	-568.1428	-729.4055	-711.5484	-489.9906	-482.6586	-487.0501	-495.0434	-418.1180	-233.7796	-163.7216 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.4631	-7.4702	-31.1264	-96.5361	-323.9185	-533.0476	-524.8296	-384.0487	-171.9519	-22.4517	-3.3886	-0.9597 (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												4889.5673 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												191.8846
Water heating fuel used												1410.7315 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	380.2082 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-7410.1444 (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	-729.6373 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4889.5673	16.4900	806.2896 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1410.7315	16.4900	232.6296 (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	380.2082	16.4900	62.6963 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5308.9523	16.4900	-875.4462
PV Unit electricity exported	-2101.1921	5.5900	-117.4566
Total			-992.9029 (252)
Total energy cost			108.7127 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.1325 (257)
SAP value		97.8518
SAP rating (Section 12)		98 (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	4889.5673	0.1553	759.4220 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1410.7315	0.1408	198.6937 (264)
Space and water heating			958.1157 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	380.2082	0.1443	54.8758 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5308.9523	0.1350	-716.6352
PV Unit electricity exported	-2101.1921	0.1080	-226.9874
Total			-943.6226 (269)
Total CO2, kg/year			69.3689 (272)
CO2 emissions per m2			0.2800 (273)
EI value			99.6852
EI rating			100 (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

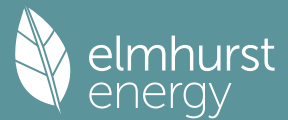
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	194.5600 (1b)	x 3.3900 (2b)	= 659.5584 (1b) - (3b)
First floor	55.7600 (1c)	x 2.0400 (2c)	= 113.7504 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	250.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	773.3088 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)

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Number of flueless gas fires

0 * 40 = 0.0000 (7c)

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

Air changes per hour
70.0000 / (5) = 0.0905 (8)
Yes
Blower Door
4.0000 (17)
0.2905 (18)
0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2905 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.4000	4.4000	4.0000	4.1000	3.5000	3.5000	3.5000	3.7000	4.1000	4.0000	4.3000 (22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0250	0.8750	0.8750	0.8750	0.9250	1.0250	1.0000	1.0750 (22a)
Adj infilt rate												
Effective ac	0.3341	0.3196	0.3196	0.2905	0.2978	0.2542	0.2542	0.2542	0.2687	0.2978	0.2905	0.3123 (22b)
	0.5558	0.5511	0.5511	0.5422	0.5443	0.5323	0.5323	0.5323	0.5361	0.5443	0.5422	0.5488 (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			73.3500	1.1450	83.9885		(27)
Roof windows			3.9000	1.0536	4.1092		(27a)
Doors			4.0500	1.4000	5.6700		(26)
Heatloss Floor 1			194.5600	0.1300	25.2928	75.0000	14592.0000 (28)
External Wall 1	301.4300	77.4000	224.0300	0.1700	38.0851	70.0000	15682.1000 (29a)
roof void walls	134.5900		134.5900	0.1300	17.4967	9.0000	1211.3100 (29a)
External Roof 1	314.0600	3.9000	310.1600	0.1100	34.1176	9.0000	2791.4400 (30)
Total net area of external elements Aum(A, m2)			944.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	208.7599		(33)
Main dwelling							
Internal Wall 1			140.3200			9.0000	1262.8800 (32c)
Internal Ceiling 1			55.7600			9.0000	501.8400 (32e)

Heat capacity Cm = Sum(A x K)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 36041.5700 (34)
List of Thermal Bridges 143.9820 (35)

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	41.0400	0.3060	12.5582
E3 Sill	39.2100	0.0160	0.6274
E5 Ground floor (normal)	75.7600	0.0660	5.0002
E6 Intermediate floor within a dwelling	55.4900	0.0050	0.2775
E16 Corner (normal)	23.0000	0.1800	4.1400
E8 Balcony within a dwelling, wall insulation continuous	29.6900	0.1000	2.9690
E13 Gable (insulation at rafter level)	36.3300	0.0630	2.2888
E16 Corner (normal)	23.0000	0.0350	0.8050
E17 Corner (inverted - internal area greater than external area)	11.5000	0.0000	0.0000
R1 Head of roof window	3.0000	0.2400	0.7200
R2 Sill of roof window	3.0000	0.2400	0.7200
R3 Jamb of roof window	4.2000	0.2400	1.0080
R5 Ridge (inverted)	17.4800	0.1200	2.0976
E4 Jamb	50.0000	0.0170	0.8500

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 242.8215 (37)

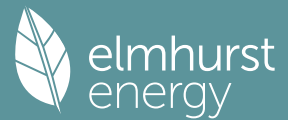
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
(38)m 141.8384 140.6269 140.6269 138.3653 138.9105 135.8412 135.8412 135.8412 136.8105 138.9105 138.3653 140.0413 (38)
Heat transfer coeff 384.6600 383.4484 383.4484 381.1868 381.7320 378.6628 378.6628 378.6628 379.6320 381.7320 381.1868 382.8628 (39)
Average = Sum(39)m / 12 = 381.3231

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5367	1.5318	1.5318	1.5228	1.5250	1.5127	1.5127	1.5127	1.5166	1.5250	1.5228	1.5295 (40)
HLP (average)												1.5233
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0673 (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	87.2769	85.9807	84.1554	80.7899	78.2698	75.4755	73.9661	75.7787	77.7522	80.7422	84.1771	86.9819 (42b)
Hot water usage for other uses	46.0427	44.3684	42.6941	41.0199	39.3456	37.6713	37.6713	39.3456	41.0199	42.6941	44.3684	46.0427 (42c)
Average daily hot water use (litres/day)												122.7765 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	133.3196	130.3491	126.8496	121.8098	117.6154	113.1468	111.6374	115.1242	118.7720	123.4364	128.5455	133.0246 (44)
Energy conte	211.1457	185.6154	194.9631	166.7515	158.3330	139.1272	135.0158	142.5478	146.4578	167.5020	183.1366	208.2843 (45)
Energy content (annual)										Total = Sum(45)m =		2038.8801
Distribution loss (46)m = 0.15 x (45)m	31.6719	27.8423	29.2445	25.0127	23.7499	20.8691	20.2524	21.3822	21.9687	25.1253	27.4705	31.2426 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0800 (55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	267.8881	236.8666	251.7055	221.6635	215.0754	194.0392	191.7582	199.2902	201.3698	224.2444	238.0486	265.0267 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)

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PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	267.8881	236.8666	251.7055	221.6635	215.0754	194.0392	191.7582	199.2902	201.3698	224.2444	238.0486	265.0267	(64)
Total per year (kWh/year) = Sum(64)m =													2706.9761 (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	115.5999	102.7181	110.2191	99.3745	98.0396	90.1894	90.2867	92.7911	92.6268	101.0883	104.8225	114.6485	(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	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	184.0408	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.8224	47.8046	38.8773	29.4326	22.0012	18.5744	20.0703	26.0881	35.0154	44.4600	51.8914	55.3183	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	621.8869	628.3402	612.0782	577.4584	533.7572	492.6842	465.2449	458.7916	475.0536	509.6734	553.3746	594.4476	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	56.4714	(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)	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	-122.6938	(71)
Water heating gains (Table 5)	155.3762	152.8543	148.1440	138.0201	131.7737	125.2630	121.3530	124.7192	128.6484	135.8714	145.5868	154.0974	(72)
Total internal gains	948.9039	946.8174	916.9179	862.7295	805.3505	754.3399	724.4865	727.4172	756.5356	807.8232	868.6712	921.6817	(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					7.5800	13.3543		0.6300	0.7000		0.7700	30.9360 (75)	
Southeast					5.9400	41.8189		0.6300	0.7000		0.7700	75.9156 (77)	
Southwest					46.6100	41.8189		0.6300	0.7000		0.7700	595.6946 (79)	
Northwest					13.2200	13.3543		0.6300	0.7000		0.7700	53.9543 (81)	
Southwest					3.9000	31.0000		0.6300	0.7000		1.0000	47.9852 (82)	
Solar gains	804.4856	1277.9517	1824.3218	2476.1874	2838.7662	3049.9853	2882.6395	2593.4133	2155.2625	1527.0442	963.8491	681.7152	(83)
Total gains	1753.3895	2224.7691	2741.2397	3338.9169	3644.1166	3804.3252	3607.1260	3320.8306	2911.7982	2334.8674	1832.5204	1603.3969	(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	26.0270	26.1092	26.1092	26.2641	26.2266	26.4392	26.4392	26.4392	26.3717	26.2266	26.2641	26.1492	
alpha	2.7351	2.7406	2.7406	2.7509	2.7484	2.7626	2.7626	2.7626	2.7581	2.7484	2.7509	2.7433	
util living area	0.9787	0.9601	0.9192	0.8337	0.7113	0.5296	0.4055	0.4441	0.6883	0.8849	0.9635	0.9828	(86)
Living	18.8481	19.1222	19.5919	20.1204	20.5189	20.7760	20.8495	20.8382	20.6354	20.0878	19.3566	18.7965	
Non living	17.7297	18.0017	18.4587	18.9608	19.3105	19.5137	19.5560	19.5520	19.4205	18.9449	18.2416	17.6828	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	4	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	27	0	0	0	0	0	0	0	0	0	0	24	
MIT	19.9385	19.1222	19.5919	20.1204	20.5189	20.7760	20.8495	20.8382	20.6354	20.0878	19.3566	19.5362	(87)
Th 2	19.6601	19.6637	19.6637	19.6704	19.6688	19.6780	19.6780	19.6780	19.6751	19.6688	19.6704	19.6655	(88)
util rest of house	0.9740	0.9516	0.9016	0.7980	0.6488	0.4337	0.2847	0.3179	0.6016	0.8513	0.9541	0.9790	(89)
MIT 2	18.7079	18.0017	18.4587	18.9608	19.3105	19.5137	19.5560	19.5520	19.4205	18.9449	18.2416	18.3484	(90)
Living area fraction	19.2042	18.4536	18.9157	19.4284	19.7978	20.0227	20.0777	20.0707	19.9105	19.4058	18.6913	18.274	(91)
MIT	19.2042	18.4536	18.9157	19.4284	19.7978	20.0227	20.0777	20.0707	19.9105	19.4058	18.6913	18.274	(92)
Temperature adjustment	19.2042	18.4536	18.9157	19.4284	19.7978	20.0227	20.0777	20.0707	19.9105	19.4058	18.6913	18.274	(93)
adjusted MIT	19.2042	18.4536	18.9157	19.4284	19.7978	20.0227	20.0777	20.0707	19.9105	19.4058	18.6913	18.274	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1704.3931	2094.9516	2438.5788	2639.6751	2388.4817	1750.6888	1164.0157	1186.3074	1801.5013	1968.8574	1731.7239	1564.7849	(94)
Ext temp.	4.4000	4.9000	6.7000	9.1000	12.0000	15.0000	16.9000	16.8000	14.2000	10.8000	7.2000	4.4000	(96)
Heat loss rate W	5694.5641	5197.1100	4684.0839	3937.0583	2976.6853	1901.9269	1203.2749	1238.4961	2167.8722	3285.1003	4380.3177	5523.7297	(97)
Space heating kWh	2968.6873	2084.6504	1670.6558	934.1160	437.6235	0.0000	0.0000	0.0000	0.0000	979.2848	1906.9876	2945.4549	(98a)
Space heating requirement - total per year (kWh/year)													13927.4602
Solar 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	2968.6873	2084.6504	1670.6558	934.1160	437.6235	0.0000	0.0000	0.0000	0.0000	979.2848	1906.9876	2945.4549	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													13927.4602
Space heating per m2													(98c) / (4) = 55.6386 (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)

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Efficiency of main space heating system 1 (in %)												298.9552 (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	2968.6873	2084.6504	1670.6558	934.1160	437.6235	0.0000	0.0000	0.0000	0.0000	979.2848	1906.9876	2945.4549 (98)
Space heating efficiency (main heating system 1)	298.9552	298.9552	298.9552	298.9552	298.9552	0.0000	0.0000	0.0000	0.0000	298.9552	298.9552	298.9552 (210)
Space heating fuel (main heating system)	993.0207	697.3120	558.8315	312.4602	146.3843	0.0000	0.0000	0.0000	0.0000	327.5691	637.8840	985.2496 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	267.8881	236.8666	251.7055	221.6635	215.0754	194.0392	191.7582	199.2902	201.3698	224.2444	238.0486	265.0267 (64)
Efficiency of water heater	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482	191.9482 (216)
Fuel for water heating, kWh/month	139.5627	123.4013	131.1320	115.4809	112.0486	101.0893	99.9010	103.8250	104.9084	116.8255	124.0171	138.0720 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Lighting	47.1104	37.7937	34.0291	24.9312	19.2575	15.7336	17.5674	22.8347	29.6601	38.9156	43.9551	48.4198 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-229.1195	-349.2904	-585.1977	-757.1087	-693.8208	-489.9571	-482.6255	-487.0157	-495.0086	-460.7558	-269.2816	-190.2185 (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)	-2.1746	-8.5575	-34.6759	-112.8296	-364.1129	-616.4724	-595.6567	-467.6818	-236.1498	-30.3338	-4.9501	-1.4255 (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												4658.7113 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												191.9482
Water heating fuel used												1410.2637 (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)												380.2082 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-7964.4206 (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												-1515.2373 (238)

10a. Fuel costs - using BEDF prices (590)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4658.7113	28.4300	1324.4716 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1410.2637	28.4300	400.9380 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	380.2082	28.4300	108.0932 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5489.4000	28.4300	-1560.6364
PV Unit electricity exported	-2475.0206	5.8100	-143.7987
Total			-1704.4351 (252)
Total energy cost			129.0677 (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	4658.7113	0.1555	724.4036 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1410.2637	0.1408	198.6278 (264)
Space and water heating			923.0314 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	380.2082	0.1443	54.8758 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5489.4000	0.1356	-744.2521
PV Unit electricity exported	-2475.0206	0.1080	-267.2748
Total			-1011.5269 (269)
Total CO2, kg/year			-33.6196 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4658.7113	1.5756	7340.4500 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1410.2637	1.5208	2144.7134 (278)
Space and water heating			9485.1634 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	380.2082	1.5338	583.1761 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5489.4000	1.5012	-8240.7257
PV Unit electricity exported	-2475.0206	0.3946	-976.7306
Total			-9217.4564 (283)
Total Primary energy kWh/year			850.8831 (286)