

OAKLAND ENERGY



ENERGY STATEMENT

Client: DAN MITCHELL

Project: North House, Perran Round Lane
PERRANPORTH, TR4 9PG

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EXCELLENCE
IN ENERGY
ASSESSMENT

INTRODUCTION

This report has been prepared by Oakland Energy LTD, under instruction from Dan Mitchell to accompany the planning application for 2no. New dwellings at Perran Round, Perranporth.

Cornwall Council has set an ambitious target of becoming net zero by 2030. Policy SEC1 of the Climate Emergency Development Plan Document requires the highest standards of sustainable construction with energy hierarchy as its core principle. This means improving fabric standards, energy efficiency and minimising space heating requirements, before installing renewable energy and then offsetting residual energy if required.

Policy extract showing requirement

2b) New Development – Residential

Residential development proposals will be required to achieve Net Zero Carbon and submit an 'Energy Statement' that demonstrates how the proposal will achieve:

- Space heating demand less than 30kWh/m²/annum;
- Total energy consumption less than 40kWh/m²/annum; and
- On-site renewable generation to match the total energy consumption, with a preference for roof-mounted solar PV.

Where the use of onsite renewables to match total energy consumption is demonstrated to be not technically feasible (for example with apartments) or economically viable renewable energy generation should be maximised as much as possible; and/or connection to an existing or proposed low carbon district energy network; or where this is not possible the residual energy (the amount by which total energy demand exceeds the renewable energy generation) is to be offset by a contribution to Cornwall Council's Offset Fund.

Where economic viability or technical constraints prevent policy compliance, proposals should first and foremost strive to meet the space heating and total energy consumption thresholds. Proposals must then benefit as much as possible from renewable energy generation and/or connection to an existing or proposed low carbon district energy network. As a last resort, any residual energy is to be offset by a contribution to Cornwall Council's Offset Fund, as far as economic viability allows.

5 Water

All dwellings (including conversions, reversions and change of use) should achieve an estimated water consumption of no more than 110 litres/person/day through the incorporation of water saving measures where feasible.

Requirements of section 6 of the policy SEC1 will be covered in the Design & Access Statement.

RENEWABLE & LOW CARBON TECHNOLOGIES

Decentralised Energy – Energy generated off the main grid and produced close to where it will be used rather than at a large plant and sent through the national grid. It can include micro renewables, heating and cooling.

District Heating – is a system for distributing heat generated in a centralised location through a system of insulated pipes for residential and commercial heating requirements.

There are no networks near to the site.

Electricity generating technologies – solar pv, wind turbines, hydroelectricity and micro-CHP.

Solar PV – These modules convert sunlight into electricity for use in the home or to export to the grid. This is one of the simplest technologies to install and provides a reasonable payback (if roof orientation is suitable).

Wind Turbines – These are an effective renewable energy option in terms of energy output but the best sites require an average annual winds speed of at least 5metres per second with an unobstructed flow of wind thus making it inefficient for the most developments.

Micro-CHP - is a heating technology which generates heat and electricity simultaneously from the same energy source. This is a low carbon technology.

Hydroelectricity generate electricity from running water, usually a stream. Very site specific and impossible for most sites.

Heat generating technologies – solar water heating, biomass heating systems and heat pumps.

Solar Water Heating – solar collectors use free heat from the suns rays to warm domestic water which is stored in a hot water cylinder. Low maintenance option subject to the correct roof orientation.

Biomass heating – This is considered renewable as the co2 emitted during combustion is offset by that absorbed during growth. It is typically a boiler fired by wood pellets or chips and is a good option for developments that have no access to natural gas as a fuel. It does however require sufficient space on site for the boiler and fuel storage.

Heat Pumps - This moves heat energy from one place to another – such as from the ground or air to your central heating system and from a lower to a high temperature. Heat pumps use some electricity but they generate more heat energy than the electrical energy they use. These are a good option when there is no access to gas.

FIGURES EXPLAINED

The energy consumption figures are taken from SAP 10.2.

The **TER** is the figure required to comply with SAP & Building Regulations.

The **DER** shows the actual heating demand and co2 emissions produced by the proposed dwelling.

NEW DWELLING

- Proposed gross internal floor area: 127m²

FABRIC FIRST STRATEGY

- Wall U Value – 0.15W/m²K
- Roof U Value – 0.15W/m²K
- Floor U Value – 0.10W/m²K
- Glazing U Value – 1.2W/m²K
- Air permeability of 2 or lower.

HEATING STRATEGY

- Air Source Heat Pump

VENTILATION STRATEGY

- Mechanical ventilation with heat recovery

OVERHEATING MITIGATION

- Areas of glazing minimised

RENEWABLE ENERGY

- Solar PV Panels – 5kW Peak

WATER EFFICIENCY

The requirement of **110l/person/day** will be met by using the following:

WC – 6/3 dual flush

Shower – 8l/min

Bath - 180l to overflow

Basin taps 4l/ min

Sink taps – 6l/min

Dishwasher – 1.25l/ per place setting

Washing machine – 8.17l/kg

CONCLUSION

The thresholds of the Climate Emergency DPD Policy have been met.

NORTH HOUSE	DPD Policy kWh/m ² /yr	Proposed Dwelling kWh/m ² /yr
Space Heating Demand	<30	27.4
Predicted Total Energy Use	<40	29.2
Renewable Energy Generation	> Total Energy	121.00%
Annual Renewable Energy Deficit		0kWh/yr

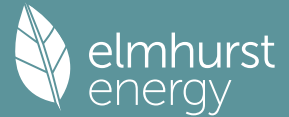
SOUTH HOUSE	DPD Policy kWh/m ² /yr	Proposed Dwelling kWh/m ² /yr
Space Heating Demand	<30	30
Predicted Total Energy Use	<40	29.9
Renewable Energy Generation	> Total Energy	124.00%
Annual Renewable Energy Deficit		0kWh/yr

The proposals are therefore compliant with the Climate Emergency DPD.

Report completed on 31st December 2023.

By Sophie Oakland - Accredited Assessor EES/011881.

Full SAP Calculation Printout



Property Reference	_23.SAP.216 Dan Mitchell NORTH		Issued on Date	31/12/2023	
Assessment Reference	DESIGN	Prop Type Ref			
Property	North House, Perran Round Lane, PERRANPORTH, TR4 9PG				
SAP Rating	99 A	DER	-1.20	TER	10.08
Environmental	101 A	% DER < TER	111.90		
CO ₂ Emissions (t/year)	-0.26	DFEE	33.10	TFEE	38.83
Compliance Check	See BREEL	% DFEE < TFEE	14.77		
% DPER < TPER	91.30	DPER	4.59	TPER	52.73
Assessor Details	Mrs. Sophie Oakland			Assessor ID	F859-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.0000 (1b)	x 2.3000 (2b)	= 142.6000 (1b) - (3b)
First floor	65.0000 (1c)	x 2.8700 (2c)	= 186.5500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.1500 (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	0 * 10 =											0.0000 (7a)
Number of passive vents	0 * 10 =											0.0000 (7b)
Number of flueless gas fires	0 * 40 =											0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =											0.0000 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												2.0000 (17)
Infiltration rate												0.1000 (18)
Number of sides sheltered												2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.0850 (21)
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1084	0.1063	0.1041	0.0935	0.0914	0.0808	0.0808	0.0786	0.0850	0.0914	0.0956	0.0999 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.1899	0.1877	0.1856	0.1750	0.1729	0.1622	0.1622	0.1601	0.1665	0.1729	0.1771	0.1814 (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
NEW WINDOWS (Uw = 1.20)			11.0100	1.1450	12.6069		(27)
NEW PAT/ BIFOLD DOORS (Uw = 1.20)			7.0600	1.1450	8.0840		(27)
Heat Loss Floor 1			62.0000	0.1000	6.2000	75.0000	4650.0000 (28a)
SEMI EX FLOOR			3.0000	0.1000	0.3000	20.0000	60.0000 (28b)
External Wall 1	169.3300	18.0700	151.2600	0.1500	22.6890	9.0000	1361.3400 (29a)
External Roof 1	64.4100		64.4100	0.1500	9.6615	9.0000	579.6900 (30)
External Roof 2	3.0000		3.0000	0.1500	0.4500	9.0000	27.0000 (30)
Total net area of external elements Aum (A, m ²)			301.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.9913		(33)
Internal Wall			168.8000			9.0000	1519.2000 (32c)
Internal Floor 1			62.0000			18.0000	1116.0000 (32d)
Internal Ceiling 1			62.0000			9.0000	558.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9871.2300 (34)

Full SAP Calculation Printout



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

77.7262 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.4400	0.0430	0.6209
E3 Sill	14.4400	0.0340	0.4910
E4 Jamb	25.4000	0.0430	1.0922
E5 Ground floor (normal)	31.9000	0.0210	0.6699
E20 Exposed floor (normal)	5.1200	0.3200	1.6384
E21 Exposed floor (inverted)	3.4700	0.3200	1.1104
E11 Eaves (insulation at rafter level)	19.0000	0.0400	0.7600
E13 Gable (insulation at rafter level)	13.6000	0.0240	0.3264
E14 Flat roof	5.1200	0.0000	0.0000
E16 Corner (normal)	20.9400	0.0300	0.6282
E17 Corner (inverted - internal area greater than external area)	2.3000	-0.0150	-0.0345

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.3029 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 67.2942 (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	20.6241	20.3933	20.1625	19.0084	18.7776	17.6235	17.6235	17.3927	18.0851	18.7776	19.2392	19.7009 (38)
Average = Sum(39)m / 12 =	87.9183	87.6875	87.4567	86.3026	86.0718	84.9177	84.9177	84.6869	85.3794	86.0718	86.5334	86.9951 (39)
												86.2449

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6923	0.6905	0.6886	0.6795	0.6777	0.6686	0.6686	0.6668	0.6723	0.6777	0.6814	0.6850 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.6791
												31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	72.6214	71.5301	69.9397	66.8969	64.6514	62.1473	60.7239	62.3022	64.0323	66.7210	69.8292	72.3432 (42a)
Hot water usage for baths	31.3528	30.8872	30.2315	29.0225	28.1172	27.1133	26.5711	27.2222	27.9312	29.0053	30.2392	31.2468 (42b)
Hot water usage for other uses	44.1934	42.5863	40.9793	39.3723	37.7653	36.1582	36.1582	37.7653	39.3723	40.9793	42.5863	44.1934 (42c)
Average daily hot water use (litres/day)												136.1993 (43)
Daily hot water use	148.1676	145.0036	141.1505	135.2917	130.5338	125.4188	123.4532	127.2897	131.3358	136.7056	142.6547	147.7834 (44)
Energy conte	234.6613	206.4832	216.9431	185.2076	175.7237	154.2171	149.3060	157.6112	161.9501	185.5083	203.2378	231.3931 (45)
Energy content (annual)												Total = Sum(45)m = 2262.2423
Distribution loss (46)m = 0.15 x (45)m	35.1992	30.9725	32.5415	27.7811	26.3585	23.1326	22.3959	23.6417	24.2925	27.8262	30.4857	34.7090 (46)
Water storage loss:												300.0000 (47)
Store volume												2.1000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.1340 (55)
Enter (49) or (54) in (55)												
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (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	293.0777	259.2464	275.3595	241.7396	234.1401	210.7491	207.7224	216.0276	218.4821	243.9247	259.7698	289.8095 (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	293.0777	259.2464	275.3595	241.7396	234.1401	210.7491	207.7224	216.0276	218.4821	243.9247	259.7698	289.8095 (64)
												Total per year (kWh/year) = Sum(64)m = 2950.0483 (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	124.7580	110.8662	118.8667	106.8071	105.1612	96.5028	96.3774	99.1388	99.0740	108.4146	112.8022	123.6713 (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	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.5129	34.2068	27.8189	21.0607	15.7431	13.2910	14.3614	18.6675	25.0554	31.8136	37.1312	39.5833 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	438.9063	443.4608	431.9837	407.5502	376.7074	347.7195	328.3538	323.7993	335.2764	359.7099	390.5527	419.5406 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074 (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)	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707 (71)
Water heating gains (Table 5)	167.6855	164.9795	159.7671	148.3432	141.3457	134.0316	129.5395	133.2511	137.6028	145.7186	156.6697	166.2249 (72)
Total internal gains	758.0474	755.5898	732.5123	689.8968	646.7389	607.9848	585.1973	588.6606	610.8773	650.1848	697.2963	738.2915 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.4600	10.6334	0.6300	0.7000	0.7700	4.7446 (74)
East	7.5200	19.6403	0.6300	0.7000	0.7700	45.1374 (76)

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South		2.0300		46.7521		0.6300		0.7000		0.7700		29.0047 (78)
South		7.0600		46.7521		0.6300		0.7000		0.7700		100.8736 (78)

Solar gains	179.7603	310.0727	431.7733	543.0606	612.3629	608.8582	586.6845	535.4197	470.6885	344.9913	216.0842	153.3009 (83)
Total gains	937.8077	1065.6625	1164.2856	1232.9574	1259.1019	1216.8430	1171.8818	1124.0803	1081.5659	995.1761	913.3804	891.5924 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.1881	31.2702	31.3527	31.7720	31.8572	32.2902	32.2902	32.3782	32.1156	31.8572	31.6873	31.5191
alpha	3.0792	3.0847	3.0902	3.1181	3.1238	3.1527	3.1527	3.1585	3.1410	3.1238	3.1125	3.1013
util living area	0.8918	0.8492	0.7868	0.6911	0.5692	0.4264	0.3129	0.3385	0.5047	0.7160	0.8492	0.9030 (86)
Living	19.8244	20.0370	20.3001	20.5722	20.7580	20.8602	20.8905	20.8870	20.8277	20.5885	20.1702	19.7795
Non living	18.9454	19.2100	19.5350	19.8700	20.0873	20.2059	20.2349	20.2337	20.1707	19.8968	19.3865	18.8946
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3986	20.0370	20.3001	20.5722	20.7580	20.8602	20.8905	20.8870	20.8277	20.5885	20.1702	19.9502 (87)
Th 2	20.3477	20.3493	20.3509	20.3589	20.3605	20.3686	20.3686	20.3702	20.3654	20.3605	20.3573	20.3541 (88)
util rest of house	0.8824	0.8371	0.7703	0.6683	0.5390	0.3886	0.2698	0.2944	0.4656	0.6900	0.8352	0.8945 (89)
MIT 2	19.7886	19.2100	19.5350	19.8700	20.0873	20.2059	20.2349	20.2337	20.1707	19.8968	19.3865	19.1576 (90)
Living area fraction									FLA = Living area / (4) =			0.4488 (91)
MIT	20.0624	19.5811	19.8784	20.1852	20.3883	20.4996	20.5291	20.5270	20.4656	20.2073	19.7383	19.5133 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0624	19.5811	19.8784	20.1852	20.3883	20.4996	20.5291	20.5270	20.4656	20.2073	19.7383	19.5133 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8781	0.8213	0.7574	0.6619	0.5403	0.3966	0.2808	0.3055	0.4719	0.6834	0.8202	0.8821 (94)
Useful gains	823.4636	875.2111	881.7927	816.0959	680.2932	482.5558	329.0800	343.4376	510.4443	680.1444	749.1238	786.4654 (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	1385.8054	1287.3538	1170.0295	973.9413	747.8173	500.9788	333.6515	349.4996	543.4916	826.9142	1093.6326	1332.1860 (97)
Space heating kWh	418.3823	276.9599	214.4482	113.6487	50.2379	0.0000	0.0000	0.0000	0.0000	109.1968	248.0463	406.0161 (98a)
Space heating requirement - total per year (kWh/year)												1836.9361
Solar heating kWh	0.0000	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	418.3823	276.9599	214.4482	113.6487	50.2379	0.0000	0.0000	0.0000	0.0000	109.1968	248.0463	406.0161 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1836.9361
Space heating per m2												(98c) / (4) =
												14.4641 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												
Efficiency of main space heating system 1 (in %)												
Efficiency of main space heating system 2 (in %)												
Efficiency of secondary/supplementary heating system, %												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	418.3823	276.9599	214.4482	113.6487	50.2379	0.0000	0.0000	0.0000	0.0000	109.1968	248.0463	406.0161 (98)
Space heating efficiency (main heating system 1)	318.2164	318.2164	318.2164	318.2164	318.2164	0.0000	0.0000	0.0000	0.0000	318.2164	318.2164	318.2164 (210)
Space heating fuel (main heating system)	131.4773	87.0351	67.3907	35.7143	15.7873	0.0000	0.0000	0.0000	0.0000	34.3153	77.9489	127.5912 (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	293.0777	259.2464	275.3595	241.7396	234.1401	210.7491	207.7224	216.0276	218.4821	243.9247	259.7698	289.8095 (64)
Efficiency of water heater												189.7568 (216)
(217)m	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568 (217)
Fuel for water heating, kWh/month	154.4491	136.6203	145.1118	127.3944	123.3895	111.0627	109.4677	113.8445	115.1380	128.5459	136.8962	152.7268 (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	30.6948	27.7243	30.6948	29.7047	30.6948	29.7047	30.6948	30.6948	29.7047	30.6948	29.7047	30.6948 (223)
Lighting	33.7101	27.0435	24.3497	17.8396	13.7798	11.2582	12.5704	16.3395	21.2234	27.8463	31.4523	34.6470 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-81.6409	-114.3686	-162.8794	-178.8553	-188.8947	-172.7289	-170.6491	-162.6711	-146.2188	-127.4588	-88.8100	-70.5145 (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	-43.5753	-94.5813	-192.9863	-298.0748	-400.3122	-406.5554	-400.9797	-336.7638	-244.9390	-139.6559	-59.7145	-34.2701 (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												577.2601 (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	189.7568
Water heating fuel used	1554.6468 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9000)	
mechanical ventilation fans (SFP = 0.9000)	361.4067 (230a)
Total electricity for the above, kWh/year	361.4067 (231)
Electricity for lighting (calculated in Appendix L)	272.0600 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-4318.0985 (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	-1552.7248 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	577.2601	16.4900	95.1902 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1554.6468	16.4900	256.3613 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	361.4067	16.4900	59.5960 (249)
Energy for lighting	272.0600	16.4900	44.8627 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1665.6901	16.4900	-274.6723
PV Unit electricity exported	-2652.4084	5.5900	-148.2696
Total			-422.9419 (252)
Total energy cost			33.0682 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.0692 (257)
SAP value		98.8781
SAP rating (Section 12)		99 (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	577.2601	0.1561	90.0928 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1554.6468	0.1409	219.0653 (264)
Space and water heating			309.1581 (265)
Pumps, fans and electric keep-hot	361.4067	0.1387	50.1316 (267)
Energy for lighting	272.0600	0.1443	39.2667 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1665.6901	0.1351	-225.0033
PV Unit electricity exported	-2652.4084	0.1251	-331.8923
Total			-556.8957 (269)
Total CO2, kg/year			-158.3394 (272)
CO2 emissions per m2			-1.2500 (273)
EI value			101.2336
EI rating			101 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0000 (1b)	x 2.3000 (2b)	= 142.6000 (1b) - (3b)
First floor	65.0000 (1c)	x 2.8700 (2c)	= 186.5500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.1500 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
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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 0 * 10 = 0.0000 (7a)
 Number of passive vents 0 * 10 = 0.0000 (7b)
 Number of flueless gas fires 0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 2.0000 (17)
 Infiltration rate 0.1000 (18)
 Number of sides sheltered 2 (19)
 Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.0850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.7000	5.4000	5.4000	4.8000	4.8000	4.2000	4.2000	4.1000	4.4000	5.0000	5.1000	5.6000
Wind factor	1.4250	1.3500	1.3500	1.2000	1.2000	1.0500	1.0500	1.0250	1.1000	1.2500	1.2750	1.4000
Adj infilt rate	0.1211	0.1148	0.1148	0.1020	0.1020	0.0893	0.0893	0.0871	0.0935	0.1063	0.1084	0.1190
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.2026	0.1962	0.1962	0.1835	0.1835	0.1707	0.1707	0.1686	0.1750	0.1877	0.1899	0.2005

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
NEW WINDOWS (Uw = 1.20)			11.0100	1.1450	12.6069		(27)
NEW PAT/ BIFOLD DOORS (Uw = 1.20)			7.0600	1.1450	8.0840		(27)
Heat Loss Floor 1			62.0000	0.1000	6.2000	75.0000	4650.0000 (28a)
SEMI EX FLOOR			3.0000	0.1000	0.3000	20.0000	60.0000 (28b)
External Wall 1	169.3300	18.0700	151.2600	0.1500	22.6890	9.0000	1361.3400 (29a)
External Roof 1	64.4100		64.4100	0.1500	9.6615	9.0000	579.6900 (30)
External Roof 2	3.0000		3.0000	0.1500	0.4500	9.0000	27.0000 (30)
Total net area of external elements Aum(A, m2)			301.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.9913		(33)
Internal Wall			168.8000			9.0000	1519.2000 (32c)
Internal Floor 1			62.0000			18.0000	1116.0000 (32d)
Internal Ceiling 1			62.0000			9.0000	558.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9871.2300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							77.7262 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.4400	0.0430	0.6209
E3 Sill	14.4400	0.0340	0.4910
E4 Jamb	25.4000	0.0430	1.0922
E5 Ground floor (normal)	31.9000	0.0210	0.6699
E20 Exposed floor (normal)	5.1200	0.3200	1.6384
E21 Exposed floor (inverted)	3.4700	0.3200	1.1104
E11 Eaves (insulation at rafter level)	19.0000	0.0400	0.7600
E13 Gable (insulation at rafter level)	13.6000	0.0240	0.3264
E14 Flat roof	5.1200	0.0000	0.0000
E16 Corner (normal)	20.9400	0.0300	0.6282
E17 Corner (inverted - internal area greater than external area)	2.3000	-0.0150	-0.0345

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.3029 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 67.2942 (37)

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

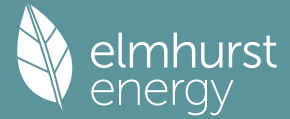
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	22.0090	21.3166	21.3166	19.9317	19.9317	18.5468	18.5468	18.3160	19.0084	20.3933	20.6241	21.7782
Heat transfer coeff	89.3032	88.6108	88.6108	87.2259	87.2259	85.8410	85.8410	85.6102	86.3026	87.6875	87.9183	89.0724
Average = Sum(39)m / 12 =												87.4375

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.7032	0.6977	0.6977	0.6868	0.6868	0.6759	0.6759	0.6741	0.6795	0.6905	0.6923	0.7014
HLP (average)												0.6885
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.8868 (42)
Hot water usage for mixer showers												
Hot water usage for baths												
Hot water usage for other uses												
Average daily hot water use (litres/day)												136.1993 (43)
Daily hot water use	148.1676	145.0036	141.1505	135.2917	130.5338	125.4188	123.4532	127.2897	131.3358	136.7056	142.6547	147.7834
Energy conte	234.6613	206.4832	216.9431	185.2076	175.7237	154.2171	149.3060	157.6112	161.9501	185.5083	203.2378	231.3931
Energy content (annual)												2262.2423
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1340 (55)

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Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (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	293.0777	259.2464	275.3595	241.7396	234.1401	210.7491	207.7224	216.0276	218.4821	243.9247	259.7698	289.8095 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
FV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	293.0777	259.2464	275.3595	241.7396	234.1401	210.7491	207.7224	216.0276	218.4821	243.9247	259.7698	289.8095 (64)
												Total per year (kWh/year) = Sum(64)m = 2950.0483 (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	124.7580	110.8662	118.8667	106.8071	105.1612	96.5028	96.3774	99.1388	99.0740	108.4146	112.8022	123.6713 (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	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.5129	34.2068	27.8189	21.0607	15.7431	13.2910	14.3614	18.6675	25.0554	31.8136	37.1312	39.5833 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	438.9063	443.4608	431.9837	407.5502	376.7074	347.7195	328.3538	323.7993	335.2764	359.7099	390.5527	419.5406 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074 (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)	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707 (71)
Water heating gains (Table 5)	167.6855	164.9795	159.7671	148.3432	141.3457	134.0316	129.5395	133.2511	137.6028	145.7186	156.6697	166.2249 (72)
Total internal gains	758.0474	755.5898	732.5123	689.8968	646.7389	607.9848	585.1973	588.6606	610.8773	650.1848	697.2963	738.2915 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	1.4600	14.1647	0.6300	0.7000	0.7700	6.3202 (74)						
East	7.5200	26.5321	0.6300	0.7000	0.7700	60.9764 (76)						
South	2.0300	58.8467	0.6300	0.7000	0.7700	36.5081 (78)						
South	7.0600	58.8467	0.6300	0.7000	0.7700	126.9692 (78)						
Solar gains	230.7739	341.4298	467.7989	602.9185	646.4130	703.8477	619.4328	604.0379	539.9487	394.3074	267.2039	189.5116 (83)
Total gains	988.8213	1097.0196	1200.3112	1292.8153	1293.1519	1311.8325	1204.6301	1192.6984	1150.8260	1044.4921	964.5002	927.8031 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil/m (see Table 9a)	30.7045	30.9444	30.9444	31.4357	31.4357	31.9429	31.9429	32.0290	31.7720	31.2702	31.1881	30.7840
alpha	3.0470	3.0630	3.0630	3.0957	3.0957	3.1295	3.1295	3.1353	3.1181	3.0847	3.0792	3.0523
util living area	0.8455	0.8053	0.7440	0.6569	0.5579	0.4136	0.3406	0.3299	0.4594	0.6461	0.7816	0.8553 (86)
Living	20.1071	20.2482	20.4301	20.6233	20.7625	20.8606	20.8841	20.8866	20.8462	20.6907	20.4175	20.1006
Non living	19.2912	19.4665	19.6864	19.9237	20.0844	20.1993	20.2226	20.2265	20.1828	20.0050	19.6818	19.2861
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.5433	20.2482	20.4301	20.6233	20.7625	20.8606	20.8841	20.8866	20.8462	20.6907	20.4175	20.2264 (87)
Th 2	20.3380	20.3428	20.3428	20.3525	20.3525	20.3622	20.3622	20.3638	20.3589	20.3493	20.3477	20.3396 (88)
util rest of house	0.8317	0.7892	0.7242	0.6325	0.5272	0.3774	0.2986	0.2873	0.4198	0.6145	0.7609	0.8417 (89)
MIT 2	19.9207	19.4665	19.6864	19.9237	20.0844	20.1993	20.2226	20.2265	20.1828	20.0050	19.6818	19.4759 (90)
Living area fraction	20.2001	19.8173	20.0202	20.2377	20.3888	20.4961	20.5195	20.5228	20.4805	20.3128	20.0120	19.8128 (91)
Temperature adjustment	20.2001	19.8173	20.0202	20.2377	20.3888	20.4961	20.5195	20.5228	20.4805	20.3128	20.0120	0.0000
adjusted MIT	20.2001	19.8173	20.0202	20.2377	20.3888	20.4961	20.5195	20.5228	20.4805	20.3128	20.0120	19.8128 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8287	0.7752	0.7138	0.6280	0.5290	0.3851	0.3091	0.2981	0.4274	0.6127	0.7493	0.8298 (94)
Useful gains	819.4282	850.4353	856.7693	811.9014	684.0428	505.1605	372.3237	355.4995	491.8862	639.9596	722.7358	769.8523 (95)
Ext temp.	6.4000	6.7000	7.8000	9.4000	11.8000	14.4000	16.1000	16.3000	14.5000	11.9000	9.2000	6.8000 (96)
Heat loss rate W	1232.3940	1162.3386	1082.8433	945.3254	749.1619	523.2934	379.3729	361.5123	516.1371	737.6945	950.5727	1159.0784 (97)
Space heating kWh	307.2466	209.5990	168.1991	96.0652	48.4486	0.0000	0.0000	0.0000	0.0000	72.7148	164.0425	289.5842 (98a)
Space heating requirement - total per year (kWh/year)												1355.9000
Solar heating kWh	0.0000	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	307.2466	209.5990	168.1991	96.0652	48.4486	0.0000	0.0000	0.0000	0.0000	72.7148	164.0425	289.5842 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1355.9000
Space heating per m2												(98c) / (4) = 10.6764 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 1)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													318.8847 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	307.2466	209.5990	168.1991	96.0652	48.4486	0.0000	0.0000	0.0000	0.0000	72.7148	164.0425	289.5842	(98)
Space heating efficiency (main heating system 1)	318.8847	318.8847	318.8847	318.8847	318.8847	0.0000	0.0000	0.0000	0.0000	318.8847	318.8847	318.8847	(210)
Space heating fuel (main heating system)	96.3504	65.7288	52.7461	30.1254	15.1931	0.0000	0.0000	0.0000	0.0000	22.8028	51.4426	90.8116	(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	293.0777	259.2464	275.3595	241.7396	234.1401	210.7491	207.7224	216.0276	218.4821	243.9247	259.7698	289.8095	(64)
Efficiency of water heater (217)m	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	(216)
Fuel for water heating, kWh/month	154.5573	136.7161	145.2135	127.4837	123.4760	111.1405	109.5444	113.9242	115.2186	128.6360	136.9921	152.8338	(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	30.6948	27.7243	30.6948	29.7047	30.6948	29.7047	30.6948	30.6948	29.7047	30.6948	29.7047	30.6948	(231)
Lighting	33.7101	27.0435	24.3497	17.8396	13.7798	11.2582	12.5704	16.3395	21.2234	27.8463	31.4523	34.6470	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-99.5961	-123.0722	-171.8388	-189.1038	-194.2890	-182.7628	-175.0971	-172.2489	-158.0801	-139.3466	-104.1047	-83.9367	(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	-65.5872	-113.7562	-224.7373	-352.5970	-437.9893	-495.8661	-437.3623	-402.6614	-302.6982	-174.9736	-84.7420	-49.0727	(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													425.2008 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													189.6239
Water heating fuel used													1555.7361 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9000) mechanical ventilation fans (SFP = 0.9000)													361.4067 (230a)
Total electricity for the above, kWh/year													361.4067 (231)
Electricity for lighting (calculated in Appendix L)													272.0600 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-4935.5202 (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													-2321.1166 (238)

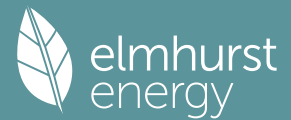
10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	425.2008	21.5100	91.4607 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1555.7361	21.5100	334.6388 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	361.4067	21.5100	77.7386 (249)
Energy for lighting	272.0600	21.5100	58.5201 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1793.4768	21.5100	-385.7769
PV Unit electricity exported	-3142.0434	5.5900	-175.6402
Total			-561.4171 (252)
Total energy cost			0.9411 (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	425.2008	0.1559	66.2766 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1555.7361	0.1409	219.2187 (264)
Space and water heating			285.4953 (265)
Pumps, fans and electric keep-hot	361.4067	0.1387	50.1316 (267)
Energy for lighting	272.0600	0.1443	39.2667 (268)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1793.4768	0.1356	-243.2026
PV Unit electricity exported	-3142.0434	0.1260	-395.9243
Total			-639.1269 (269)
Total CO ₂ , kg/year			-264.2334 (272)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	425.2008	1.5770	670.5539 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1555.7361	1.5210	2366.3284 (278)
Space and water heating			3036.8823 (279)
Pumps, fans and electric keep-hot	361.4067	1.5128	546.7361 (281)
Energy for lighting	272.0600	1.5338	417.2947 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1793.4768	1.5012	-2692.3875
PV Unit electricity exported	-3142.0434	0.4625	-1453.3183
Total			-4145.7058 (283)
Total Primary energy kWh/year			-144.7927 (286)

SAP 10 EPC IMPROVEMENTS

DESIGN

Current energy efficiency rating:	A 99
Current environmental impact rating:	A 101

N Solar water heating	Recommended
U Solar photovoltaic panels	Already installed
V2 Wind turbine	Not applicable
Recommended measures:	
N Solar water heating	SAP change + 1.4, Cost change -£ 63, CO ₂ change -45 kg (16.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£63, 0.35 kg/m ²	A 100	A 102
Total Savings	£63, 0.35 kg/m ²		

Potential energy efficiency rating:	A 100
Potential environmental impact rating:	A 102

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
 Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £562	Potential £485	Saving £78
Electricity			
Space heating	£169	£187	-£17
Water heating	£335	£240	£95
Lighting	£59	£59	£0
Generated (PV)	-£561	-£547	-£14
Total cost of fuels	£1	-£62	£64
Total cost of uses	£2	-£61	£64
Delivered energy	-18 kWh/m ²	-21 kWh/m ²	3 kWh/m ²
Carbon dioxide emissions	-0.3 tonnes	-0.3 tonnes	0.0 tonnes
CO ₂ emissions per m ²	-2 kg/m ²	-2 kg/m ²	0 kg/m ²
Primary energy	-1 kWh/m ²	-5 kWh/m ²	3 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.0000 (1b)	x 2.3000 (2b)	= 142.6000 (1b) - (3b)
First floor	65.0000 (1c)	x 2.8700 (2c)	= 186.5500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 329.1500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)

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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			2.0000 (17)
Infiltration rate			0.1000 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.0850 (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	0.1084	0.1063	0.1041	0.0935	0.0914	0.0808	0.0808	0.0786	0.0850	0.0914	0.0956	0.0999	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													83.7000 (23c)
Effective ac	0.1899	0.1877	0.1856	0.1750	0.1729	0.1622	0.1622	0.1601	0.1665	0.1729	0.1771	0.1814	(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	
NEW WINDOWS (Uw = 1.20)			11.0100	1.1450	12.6069			(27)
NEW PAT/ BIFOLD DOORS (Uw = 1.20)			7.0600	1.1450	8.0840			(27)
Heat Loss Floor 1			62.0000	0.1000	6.2000	75.0000	4650.0000	(28a)
SEMI EX FLOOR			3.0000	0.1000	0.3000	20.0000	60.0000	(28b)
External Wall 1	169.3300	18.0700	151.2600	0.1500	22.6890	9.0000	1361.3400	(29a)
External Roof 1	64.4100		64.4100	0.1500	9.6615	9.0000	579.6900	(30)
External Roof 2	3.0000		3.0000	0.1500	0.4500	9.0000	27.0000	(30)
Total net area of external elements Aum(A, m2)			301.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...	(30) + (32) =	59.9913		(33)
Internal Wall			168.8000			9.0000	1519.2000	(32c)
Internal Floor 1			62.0000			18.0000	1116.0000	(32d)
Internal Ceiling 1			62.0000			9.0000	558.0000	(32e)
Heat capacity Cm = Sum(A x k)							(28)...	(30) + (32) + (32a)...
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							9871.2300	(34)
List of Thermal Bridges							77.7262	(35)

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.4400	0.0430	0.6209
E3 Sill	14.4400	0.0340	0.4910
E4 Jamb	25.4000	0.0430	1.0922
E5 Ground floor (normal)	31.9000	0.0210	0.6699
E20 Exposed floor (normal)	5.1200	0.3200	1.6384
E21 Exposed floor (inverted)	3.4700	0.3200	1.1104
E11 Eaves (insulation at rafter level)	19.0000	0.0400	0.7600
E13 Gable (insulation at rafter level)	13.6000	0.0240	0.3264
E14 Flat roof	5.1200	0.0000	0.0000
E16 Corner (normal)	20.9400	0.0300	0.6282
E17 Corner (inverted - internal area greater than external area)	2.3000	-0.0150	-0.0345
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.3029 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 67.2942 (37)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	20.6241	20.3933	20.1625	19.0084	18.7776	17.6235	17.6235	17.3927	18.0851	18.7776	19.2392	19.7009	(38)
Average = Sum(39)m / 12 =	87.9183	87.6875	87.4567	86.3026	86.0718	84.9177	84.9177	84.6869	85.3794	86.0718	86.5334	86.9951	(39)
												86.2449	(39)
HLP	0.6923	0.6905	0.6886	0.6795	0.6777	0.6686	0.6686	0.6668	0.6723	0.6777	0.6814	0.6850	(40)
HLP (average)												0.6791	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Assumed occupancy													2.8868 (42)
Hot water usage for mixer showers	72.6214	71.5301	69.9397	66.8969	64.6514	62.1473	60.7239	62.3022	64.0323	66.7210	69.8292	72.3432	(42a)
Hot water usage for baths	31.3528	30.8872	30.2315	29.0225	28.1172	27.1133	26.5711	27.2222	27.9312	29.0053	30.2392	31.2468	(42b)
Hot water usage for other uses	44.1934	42.5863	40.9793	39.3723	37.7653	36.1582	36.1582	37.7653	39.3723	40.9793	42.5863	44.1934	(42c)
Average daily hot water use (litres/day)													136.1993 (43)
Daily hot water use	148.1676	145.0036	141.1505	135.2917	130.5338	125.4188	123.4532	127.2897	131.3358	136.7056	142.6547	147.7834	(44)
Energy conte	234.6613	206.4832	216.9431	185.2076	175.7237	154.2171	149.3060	157.6112	161.9501	185.5083	203.2378	231.3931	(45)
Energy content (annual)													Total = Sum(45)m = 2262.2423
Distribution loss (46)m = 0.15 x (45)m	35.1992	30.9725	32.5415	27.7811	26.3585	23.1326	22.3959	23.6417	24.2925	27.8262	30.4857	34.7090	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1340 (55)
Total storage loss													

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If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (56)
Primary loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (57)
Combi loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
WWHRS	293.0777	259.2464	273.9638	234.9860	221.3457	198.1424	194.6954	203.9312	213.0792	242.5289	259.7698	289.8095 (62)
FV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Aperture area of solar collector	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Zero-loss collector efficiency												3.0000 (H1)
Collector linear heat loss coefficient												0.8000 (H2)
Collector 2nd order heat loss coefficient												1.8000 (H3)
Collector loop efficiency												0.0000 (H4)
Incidence angle modifier												0.9000 (H5)
Overall heat loss coefficient of system												1.0000 (H6)
Heat loss coefficient of collector loop												0.8000 (H8)
Dedicated solar storage volume												6.5000 (H10)
Effective solar volume												3.9667 (H11)
Reference volume												75.0000 (H12)
Storage tank correction coefficient												75.0000 (H14)
Heat delivered to hot water												225.0000 (H15)
Heat delivered to space heating												1.3161 (H16)
Solar input												633.5248 (H24)
Solar input												0.0000 (H29)
FGHRS	-0.0000	-16.1922	-58.8971	-81.4596	-107.0921	-98.8610	-98.2295	-85.4907	-58.5458	-28.7568	-0.0000	-0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
	293.0777	243.0542	215.0666	153.5263	114.2537	99.2814	96.4660	118.4404	154.5334	213.7721	259.7698	289.8095 (64)
												Total per year (kWh/year) = Sum(64)m = 2251.0511 (64)
Electric shower(s)												0.0000 (64a)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	124.7580	110.8662	117.7501	101.4042	94.9258	86.4174	85.9558	89.4617	94.7517	107.2980	112.8022	123.6713 (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	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.5129	34.2068	27.8189	21.0607	15.7431	13.2910	14.3614	18.6675	25.0554	31.8136	37.1312	39.5833 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	438.9063	443.4608	431.9837	407.5502	376.7074	347.7195	328.3538	323.7993	335.2764	359.7099	390.5527	419.5406 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074 (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)	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707 (71)
Water heating gains (Table 5)	167.6855	164.9795	158.2663	140.8392	127.5884	120.0242	115.5320	120.2442	131.5996	144.2178	156.6697	166.2249 (72)
Total internal gains	758.0474	755.5898	731.0115	682.3928	632.9816	593.9773	571.1898	575.6537	604.8741	648.6840	697.2963	738.2915 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
North	1.4600	10.6334	0.6300	0.7000	0.7700	4.7446 (74)						
East	7.5200	19.6403	0.6300	0.7000	0.7700	45.1374 (76)						
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047 (78)						
South	7.0600	46.7521	0.6300	0.7000	0.7700	100.8736 (78)						
Solar gains	179.7603	310.0727	431.7733	543.0606	612.3629	608.8582	586.6845	535.4197	470.6885	344.9913	216.0842	153.3009 (83)
Total gains	937.8077	1065.6625	1162.7848	1225.4534	1245.3445	1202.8355	1157.8743	1111.0734	1075.5627	993.6753	913.3804	891.5924 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	31.1881	31.2702	31.3527	31.7720	31.8572	32.2902	32.2902	32.3782	32.1156	31.8572	31.6873	31.5191
alpha	3.0792	3.0847	3.0902	3.1181	3.1238	3.1527	3.1527	3.1585	3.1410	3.1238	3.1125	3.1013
util living area	0.8918	0.8492	0.7872	0.6936	0.5739	0.4308	0.3165	0.3422	0.5070	0.7166	0.8492	0.9030 (86)
Living	19.8244	20.0370	20.2990	20.5687	20.7546	20.8590	20.8901	20.8866	20.8268	20.5877	20.1702	19.7795
Non living	18.9454	19.2100	19.5337	19.8659	20.0837	20.2048	20.2346	20.2334	20.1698	19.8959	19.3865	18.8946
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3986	20.0370	20.2990	20.5687	20.7546	20.8590	20.8901	20.8866	20.8268	20.5877	20.1702	19.9502 (87)
Th 2	20.3477	20.3493	20.3509	20.3589	20.3605	20.3686	20.3686	20.3702	20.3654	20.3605	20.3573	20.3541 (88)
util rest of house	0.8824	0.8371	0.7707	0.6709	0.5436	0.3927	0.2729	0.2977	0.4678	0.6907	0.8352	0.8945 (89)
MIT 2	19.7886	19.2100	19.5337	19.8659	20.0837	20.2048	20.2346	20.2334	20.1698	19.8959	19.3865	19.1576 (90)
Living area fraction												0.4488 (91)
MIT	20.0624	19.5811	19.8772	20.1813	20.3848	20.4984	20.5288	20.5265	20.4647	20.2064	19.7383	19.5133 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0624	19.5811	19.8772	20.1813	20.3848	20.4984	20.5288	20.5265	20.4647	20.2064	19.7383	19.5133 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation	0.8781	0.8213	0.7578	0.6643	0.5448	0.4006	0.2841	0.3089	0.4741	0.6840	0.8202	0.8821 (94)
Useful gains	823.4636	875.2111	881.1802	814.1123	678.4284	481.9157	328.8974	343.2074	509.9393	679.7067	749.1238	786.4654 (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	1385.8054	1287.3538	1169.9220	973.6072	747.5152	500.8784	333.6225	349.4631	543.4111	826.8399	1093.6326	1332.1860 (97)
Space heating kWh	418.3823	276.9599	214.8239	114.8364	51.4006	0.0000	0.0000	0.0000	0.0000	109.4671	248.0463	406.0161 (98a)
Space heating requirement - total per year (kWh/year)												1839.9326
Solar heating kWh	-0.0000	-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	418.3823	276.9599	214.8239	114.8364	51.4006	0.0000	0.0000	0.0000	0.0000	109.4671	248.0463	406.0161 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1839.9326
Space heating per m2												(98c) / (4) = 14.4877 (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 %)												318.2164 (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	418.3823	276.9599	214.8239	114.8364	51.4006	0.0000	0.0000	0.0000	0.0000	109.4671	248.0463	406.0161 (98)
Space heating efficiency (main heating system 1)	318.2164	318.2164	318.2164	318.2164	318.2164	0.0000	0.0000	0.0000	0.0000	318.2164	318.2164	318.2164 (210)
Space heating fuel (main heating system)	131.4773	87.0351	67.5088	36.0875	16.1527	0.0000	0.0000	0.0000	0.0000	34.4002	77.9489	127.5912 (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	293.0777	243.0542	215.0666	153.5263	114.2537	99.2814	96.4660	118.4404	154.5334	213.7721	259.7698	289.8095 (64)
Efficiency of water heater (217)m	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568	189.7568 (216)
Fuel for water heating, kWh/month	154.4491	128.0872	113.3380	80.9069	60.2106	52.3203	50.8366	62.4170	81.4376	112.6558	136.8962	152.7268 (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	37.4893	33.8613	37.4893	36.2800	37.4893	36.2800	37.4893	37.4893	36.2800	37.4893	36.2800	37.4893 (231)
Lighting	33.7101	27.0435	24.3497	17.8396	13.7798	11.2582	12.5704	16.3395	21.2234	27.8463	31.4523	34.6470 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-81.8142	-114.2260	-160.1553	-171.7948	-175.4124	-158.6903	-156.7187	-152.2477	-141.3748	-126.5947	-89.0749	-70.6570 (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	-43.4021	-94.7240	-195.7104	-305.1352	-413.7946	-420.5940	-414.9101	-347.1872	-249.7830	-140.5200	-59.4496	-34.1277 (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												578.2018 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												189.7568
Water heating fuel used												1186.2821 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9000) mechanical ventilation fans (SFP = 0.9000) pump for solar water heating												361.4067 (230a)
												80.0000 (230g)
Total electricity for the above, kWh/year												441.4067 (231)
Electricity for lighting (calculated in Appendix L)												272.0600 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-4318.0985 (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												-1840.1479 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	578.2018	16.4900	95.3455 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1186.2821	16.4900	195.6179 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	361.4067	16.4900	59.5960 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	272.0600	16.4900	44.8627 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1598.7606	16.4900	-263.6356
PV Unit electricity exported	-2719.3379	5.5900	-152.0110

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Total
Total energy cost -415.6466 (252)
-7.0326 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.3600 (256)
SAP value -0.0147 (257)
SAP rating (Section 12) 100.2386
SAP band 100 (258)
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	578.2018	0.1560	90.2240 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1186.2821	0.1452	172.2617 (264)
Space and water heating			262.4857 (265)
Pumps, fans and electric keep-hot	441.4067	0.1387	61.2286 (267)
Energy for lighting	272.0600	0.1443	39.2667 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1598.7606	0.1356	-216.7591
PV Unit electricity exported	-2719.3379	0.1248	-339.5000
Total			-556.2591 (269)
Total CO2, kg/year			-193.2781 (272)
CO2 emissions per m2			-1.5200 (273)
EI value			101.5058
EI rating			102 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0000 (1b)	x 2.3000 (2b)	= 142.6000 (1b) - (3b)
First floor	65.0000 (1c)	x 2.8700 (2c)	= 186.5500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 329.1500 (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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.0000 (17)
Infiltration rate	0.1000 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.0850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.7000	5.4000	5.4000	4.8000	4.8000	4.2000	4.2000	4.1000	4.4000	5.0000	5.1000	5.6000 (22)
Wind factor	1.4250	1.3500	1.3500	1.2000	1.2000	1.0500	1.0500	1.0250	1.1000	1.2500	1.2750	1.4000 (22a)
Adj infilt rate	0.1211	0.1148	0.1148	0.1020	0.1020	0.0893	0.0893	0.0871	0.0935	0.1063	0.1084	0.1190 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.2026	0.1962	0.1962	0.1835	0.1835	0.1707	0.1707	0.1686	0.1750	0.1877	0.1899	0.2005 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.5129	34.2068	27.8189	21.0607	15.7431	13.2910	14.3614	18.6675	25.0554	31.8136	37.1312	39.5833 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	438.9063	443.4608	431.9837	407.5502	376.7074	347.7195	328.3538	323.7993	335.2764	359.7099	390.5527	419.5406 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074 (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)	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707 (71)
Water heating gains (Table 5)	167.6855	164.9795	158.2663	140.8392	127.5884	120.0242	115.5320	120.2442	131.5996	144.2178	156.6697	166.2249 (72)
Total internal gains	758.0474	755.5898	731.0115	682.3928	632.9816	593.9773	571.1898	575.6537	604.8741	648.6840	697.2963	738.2915 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
North	1.4600	14.1647	0.6300	0.7000	0.7700	0.7700	6.3202 (74)					
East	7.5200	26.5321	0.6300	0.7000	0.7700	0.7700	60.9764 (76)					
South	2.0300	58.8467	0.6300	0.7000	0.7700	0.7700	36.5081 (78)					
South	7.0600	58.8467	0.6300	0.7000	0.7700	0.7700	126.9692 (78)					
Solar gains	230.7739	341.4298	467.7989	602.9185	646.4130	703.8477	619.4328	604.0379	539.9487	394.3074	267.2039	189.5116 (83)
Total gains	988.8213	1097.0196	1198.8104	1285.3113	1279.3946	1297.8251	1190.6227	1179.6915	1144.8228	1042.9913	964.5002	927.8031 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	30.7045	30.9444	30.9444	31.4357	31.4357	31.9429	31.9429	32.0290	31.7720	31.2702	31.1881	30.7840
tau	3.0470	3.0630	3.0630	3.0957	3.0957	3.1295	3.1295	3.1353	3.1181	3.0847	3.0792	3.0523
util living area	0.8455	0.8053	0.7445	0.6594	0.5625	0.4175	0.3444	0.3333	0.4615	0.6468	0.7816	0.8553 (86)
Living	20.1071	20.2482	20.4292	20.6202	20.7593	20.8595	20.8836	20.8862	20.8455	20.6901	20.4175	20.1006
Non living	19.2912	19.4665	19.6854	19.9203	20.0811	20.1982	20.2221	20.2261	20.1822	20.0044	19.6818	19.2861
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.5433	20.2482	20.4292	20.6202	20.7593	20.8595	20.8836	20.8862	20.8455	20.6901	20.4175	20.2264 (87)
Th 2	20.3380	20.3428	20.3428	20.3525	20.3525	20.3622	20.3622	20.3638	20.3589	20.3493	20.3477	20.3396 (88)
util rest of house	0.8317	0.7892	0.7246	0.6350	0.5317	0.3811	0.3019	0.2904	0.4217	0.6152	0.7609	0.8417 (89)
MIT 2	19.9207	19.4665	19.6854	19.9203	20.0811	20.1982	20.2221	20.2261	20.1822	20.0044	19.6818	19.4759 (90)
Living area fraction	20.2001	19.8173	20.0192	20.2344	20.3855	20.4950	20.5190	20.5224	20.4799	20.3122	20.0120	19.8128 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2001	19.8173	20.0192	20.2344	20.3855	20.4950	20.5190	20.5224	20.4799	20.3122	20.0120	19.8128 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	819.4282	850.4353	856.2588	810.2189	682.2851	504.5755	372.0583	355.2851	491.5240	639.6494	722.7358	769.8523 (95)
Ext temp.	6.4000	6.7000	7.8000	9.4000	11.8000	14.4000	16.1000	16.3000	14.5000	11.9000	9.2000	6.8000 (96)
Heat loss rate W	1232.3940	1162.3386	1082.7542	945.0432	748.8755	523.2014	379.3308	361.4782	516.0794	737.6424	950.5727	1159.0784 (97)
Space heating kWh	307.2466	209.5990	168.5125	97.0735	49.5433	0.0000	0.0000	0.0000	0.0000	72.9068	164.0425	289.5842 (98a)
Space heating requirement - total per year (kWh/year)												1358.5084
Solar heating kWh	-0.0000	-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	307.2466	209.5990	168.5125	97.0735	49.5433	0.0000	0.0000	0.0000	0.0000	72.9068	164.0425	289.5842 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1358.5084
Space heating per m ²												(98c) / (4) = 10.6969 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fraction of space heat from main system(s)												0.0000 (201)
Efficiency of main space heating system 1 (in %)												1.0000 (202)
Efficiency of main space heating system 2 (in %)												318.8847 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	307.2466	209.5990	168.5125	97.0735	49.5433	0.0000	0.0000	0.0000	0.0000	72.9068	164.0425	289.5842 (98)
Space heating efficiency (main heating system 1)	318.8847	318.8847	318.8847	318.8847	318.8847	0.0000	0.0000	0.0000	0.0000	318.8847	318.8847	318.8847 (210)
Space heating fuel (main heating system)	96.3504	65.7288	52.8443	30.4416	15.5364	0.0000	0.0000	0.0000	0.0000	22.8631	51.4426	90.8116 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	285.7761	233.4933	202.5358	138.2459	105.1986	80.7189	89.0210	102.5385	137.8338	199.2368	248.8051	289.8095	(64)
Efficiency of water heater												189.6239	(216)
(217)m	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	189.6239	(217)
Fuel for water heating, kWh/month	150.7068	123.1349	106.8092	72.9053	55.4775	42.5679	46.9461	54.0747	72.6880	105.0694	131.2098	152.8338	(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	37.4893	33.8613	37.4893	36.2800	37.4893	36.2800	37.4893	36.2800	37.4893	36.2800	37.4893	36.2800	(231)
Lighting	33.7101	27.0435	24.3497	17.8396	13.7798	11.2582	12.5704	16.3395	21.2234	27.8463	31.4523	34.6470	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-99.7106	-122.5323	-167.8202	-179.2708	-178.5886	-163.4921	-159.1145	-158.0535	-150.4659	-137.3590	-104.1505	-84.1450	(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	-65.4728	-114.2961	-228.7560	-362.4300	-453.6897	-515.1368	-453.3449	-416.8568	-310.3124	-176.9612	-84.6962	-48.8644	(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												426.0187	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												189.6239	
Water heating fuel used												1114.4231	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9000)													
mechanical ventilation fans (SFP = 0.9000)												361.4067	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												441.4067	(231)
Electricity for lighting (calculated in Appendix L)												272.0600	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4935.5202	(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												-2681.6116	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost f/year	
Space heating - main system 1	426.0187	21.5100	91.6366	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1114.4231	21.5100	239.7124	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	361.4067	21.5100	77.7386	(249)
Pump for solar water heating	80.0000	21.5100	17.2080	(249)
Energy for lighting	272.0600	21.5100	58.5201	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1704.7029	21.5100	-366.6816	
PV Unit electricity exported	-3230.8173	5.5900	-180.6027	
Total			-547.2843	(252)
Total energy cost			-62.4685	(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	426.0187	0.1558	66.3903	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1114.4231	0.1459	162.6145	(264)
Space and water heating			229.0049	(265)
Pumps, fans and electric keep-hot	441.4067	0.1387	61.2286	(267)
Energy for lighting	272.0600	0.1443	39.2667	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1704.7029	0.1362	-232.2067	
PV Unit electricity exported	-3230.8173	0.1257	-406.1339	
Total			-638.3405	(269)
Total CO2, kg/year			-308.8404	(272)

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

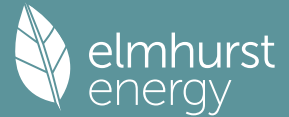
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	426.0187	1.5769	671.7928	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1114.4231	1.5398	1715.9642	(278)
Space and water heating			2387.7571	(279)
Pumps, fans and electric keep-hot	441.4067	1.5128	667.7601	(281)
Energy for lighting	272.0600	1.5338	417.2947	(282)
Energy saving/generation technologies				

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PV Unit electricity used in dwelling	-1704.7029	1.5035	-2563.0390
PV Unit electricity exported	-3230.8173	0.4614	-1490.7504
Total			-4053.7894 (283)
Total Primary energy kWh/year			-580.9776 (286)

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Property Reference	_23.SAP.216 Dan Mitchell SOUTH		Issued on Date	31/12/2023	
Assessment Reference	DESIGN	Prop Type Ref			
Property	North House, Perran Round Lane, PERRANPORTH, TR4 9PG				
SAP Rating	98 A	DER	-1.05	TER	10.47
Environmental	101 A	% DER < TER		110.03	
CO ₂ Emissions (t/year)	-0.25	DFEE	35.16	TFEE	40.47
Compliance Check	See BREL	% DFEE < TFEE		13.14	
% DPER < TPER	88.93	DPER	6.07	TPER	54.83
Assessor Details	Mrs. Sophie Oakland			Assessor ID	F859-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.0000 (1b)	x 2.3000 (2b)	= 142.6000 (1b) - (3b)
First floor	65.0000 (1c)	x 2.8700 (2c)	= 186.5500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 329.1500 (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	0 * 10 =											0.0000 (7a)
Number of passive vents	0 * 10 =											0.0000 (7b)
Number of flueless gas fires	0 * 40 =											0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =											0.0000 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												2.0000 (17)
Infiltration rate												0.1000 (18)
Number of sides sheltered												2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.0850 (21)
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1084	0.1063	0.1041	0.0935	0.0914	0.0808	0.0808	0.0786	0.0850	0.0914	0.0956	0.0999 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.1899	0.1877	0.1856	0.1750	0.1729	0.1622	0.1622	0.1601	0.1665	0.1729	0.1771	0.1814 (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
NEW WINDOWS (Uw = 1.20)			9.6200	1.1450	11.0153		(27)
NEW PAT/ BIFOLD DOORS (Uw = 1.20)			7.0600	1.1450	8.0840		(27)
Heat Loss Floor 1			62.0000	0.1000	6.2000	75.0000	4650.0000 (28a)
SEMI EX FLOOR			3.0000	0.1000	0.3000	20.0000	60.0000 (28b)
External Wall 1	169.3300	16.6800	152.6500	0.1500	22.8975	9.0000	1373.8500 (29a)
External Roof 1	64.4100		64.4100	0.1500	9.6615	9.0000	579.6900 (30)
External Roof 2	3.0000		3.0000	0.1500	0.4500	9.0000	27.0000 (30)
Total net area of external elements Aum (A, m ²)			301.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.6082		(33)
Internal Wall			168.8000			9.0000	1519.2000 (32c)
Internal Floor 1			62.0000			18.0000	1116.0000 (32d)
Internal Ceiling 1			62.0000			9.0000	558.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9883.7400 (34)

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

77.8247 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.5400	0.0430	0.4962
E3 Sill	11.5000	0.0340	0.3910
E4 Jamb	24.0000	0.0430	1.0320
E5 Ground floor (normal)	31.9000	0.0210	0.6699
E20 Exposed floor (normal)	5.1200	0.3200	1.6384
E21 Exposed floor (inverted)	3.4700	0.3200	1.1104
E11 Eaves (insulation at rafter level)	19.0000	0.0400	0.7600
E13 Gable (insulation at rafter level)	13.6000	0.0240	0.3264
E14 Flat roof	5.1200	0.0000	0.0000
E16 Corner (normal)	20.9400	0.0300	0.6282
E17 Corner (inverted - internal area greater than external area)	2.3000	-0.0150	-0.0345
E2 Other lintels (including other steel lintels)	1.3500	1.0000	1.3500

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

Point Thermal bridges	(36a) =	8.3680 (36)
Total fabric heat loss	(33) + (36) + (36a) =	66.9763 (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	20.6241	20.3933	20.1625	19.0084	18.7776	17.6235	17.6235	17.3927	18.0851	18.7776	19.2392	19.7009 (38)
Average = Sum(39)m / 12 =	87.6004	87.3696	87.1388	85.9847	85.7539	84.5998	84.5998	84.3690	85.0614	85.7539	86.2155	86.6771 (39)
												85.9270

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6898	0.6879	0.6861	0.6770	0.6752	0.6661	0.6661	0.6643	0.6698	0.6752	0.6789	0.6825 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8868 (42)											
Hot water usage for mixer showers	72.6214	71.5301	69.9397	66.8969	64.6514	62.1473	60.7239	62.3022	64.0323	66.7210	69.8292	72.3432 (42a)
Hot water usage for baths	31.3528	30.8872	30.2315	29.0225	28.1172	27.1133	26.5711	27.2222	27.9312	29.0053	30.2392	31.2468 (42b)
Hot water usage for other uses	44.1934	42.5863	40.9793	39.3723	37.7653	36.1582	36.1582	37.7653	39.3723	40.9793	42.5863	44.1934 (42c)
Average daily hot water use (litres/day)												136.1993 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	148.1676	145.0036	141.1505	135.2917	130.5338	125.4188	123.4532	127.2897	131.3358	136.7056	142.6547	147.7834 (44)
Energy content (annual)	234.6613	206.4832	216.9431	185.2076	175.7237	154.2171	149.3060	157.6112	161.9501	185.5083	203.2378	231.3931 (45)
Distribution loss (46)m = 0.15 x (45)m	35.1992	30.9725	32.5415	27.7811	26.3585	23.1326	22.3959	23.6417	24.2925	27.8262	30.4857	34.7090 (46)

Water storage loss:
 Store volume 300.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day): 2.6000 (48)
 Temperature factor from Table 2b 0.5400 (49)
 Enter (49) or (54) in (55) 1.4040 (55)
 Total storage loss

43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240 (56)
43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240 (57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
301.4477	266.8064	283.7295	249.8396	242.5101	218.8491	216.0924	224.3976	226.5821	252.2947	267.8698	298.1795	298.1795 (62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h 301.4477 266.8064 283.7295 249.8396 242.5101 218.8491 216.0924 224.3976 226.5821 252.2947 267.8698 298.1795 (64)
 Total per year (kWh/year) = Sum(64)m = 3048.5983 (64)

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

Heat gains from water heating, kWh/month 131.4540 116.9142 125.5627 113.2871 111.8572 102.9828 103.0734 105.8348 105.5540 115.1106 119.2822 130.3673 (65)

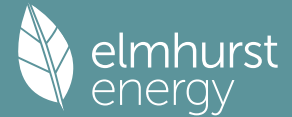
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1942	34.8119	28.3109	21.4332	16.0216	13.5261	14.6154	18.9977	25.4986	32.3764	37.7880	40.2835 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	438.9063	443.4608	431.9837	407.5502	376.7074	347.7195	328.3538	323.7993	335.2764	359.7099	390.5527	419.5406 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074 (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)	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707 (71)
Water heating gains (Table 5)	176.6855	173.9795	168.7671	157.3432	150.3457	143.0316	138.5395	142.2511	146.6028	154.7186	165.6697	175.2249 (72)
Total internal gains	767.7287	765.1949	742.0044	699.2693	656.0174	617.2199	594.4513	597.9908	620.3205	659.7475	706.9531	747.9917 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.6400	10.6334	0.6300	0.7000	0.7700	2.0798 (74)

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East	7.5200	19.6403	0.6300	0.7000	0.7700	45.1374 (76)
South	1.4600	46.7521	0.6300	0.7000	0.7700	20.8605 (78)
North	7.0600	10.6334	0.6300	0.7000	0.7700	22.9429 (74)

Solar gains	91.0207	170.2823	270.1914	391.7851	486.9882	503.6140	477.2295	403.8080	312.2821	198.5459	111.8767	76.0044 (83)
Total gains	858.7494	935.4772	1012.1957	1091.0545	1143.0056	1120.8339	1071.6808	1001.7988	932.6026	858.2934	818.8298	823.9961 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.3410	31.4238	31.5070	31.9299	32.0159	32.4526	32.4526	32.5414	32.2765	32.0159	31.8444	31.6748
alpha	3.0894	3.0949	3.1005	3.1287	3.1344	3.1635	3.1635	3.1694	3.1518	3.1344	3.1230	3.1117
util living area	0.9102	0.8832	0.8326	0.7395	0.6096	0.4568	0.3393	0.3754	0.5659	0.7725	0.8783	0.9183 (86)
Living	19.7403	19.9114	20.1830	20.5015	20.7291	20.8521	20.8879	20.8823	20.8007	20.5094	20.0811	19.7058
Non living	18.8427	19.0577	19.3962	19.7906	20.0586	20.2008	20.2354	20.2325	20.1466	19.8085	19.2798	18.8045
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3556	19.9114	20.1830	20.5015	20.7291	20.8521	20.8879	20.8823	20.8007	20.5094	20.0811	19.8868 (87)
Th 2	20.3499	20.3515	20.3531	20.3612	20.3628	20.3708	20.3708	20.3725	20.3676	20.3628	20.3595	20.3563 (88)
util rest of house	0.9021	0.8731	0.8181	0.7179	0.5790	0.4173	0.2931	0.3276	0.5251	0.7486	0.8661	0.9109 (89)
MIT 2	19.7490	19.0577	19.3962	19.7906	20.0586	20.2008	20.2354	20.2325	20.1466	19.8085	19.2798	19.0842 (90)
Living area fraction												fLA = Living area / (4) = 0.4488 (91)
MIT	20.0213	19.4409	19.7493	20.1096	20.3595	20.4931	20.5282	20.5241	20.4401	20.1231	19.6394	19.4444 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0213	19.4409	19.7493	20.1096	20.3595	20.4931	20.5282	20.5241	20.4401	20.1231	19.6394	19.4444 (93)

8. Space heating requirement

Utilisation	0.8977	0.8569	0.8034	0.7090	0.5789	0.4251	0.3048	0.3393	0.5299	0.7389	0.8506	0.8989 (94)
Useful gains	770.8775	801.5907	813.1697	773.5129	661.6641	476.4600	326.6380	339.8965	494.1851	634.2342	696.5188	740.6945 (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	1377.1879	1270.4312	1154.5278	963.8559	742.5892	498.5553	332.3271	347.9489	539.3004	816.6407	1081.0914	1321.3410 (97)
Space heating kWh	451.0949	315.0608	253.9704	137.0470	60.2082	0.0000	0.0000	0.0000	0.0000	135.7104	276.8923	432.0010 (98a)
Space heating requirement - total per year (kWh/year)												2061.9851
Solar heating kWh	0.0000	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	451.0949	315.0608	253.9704	137.0470	60.2082	0.0000	0.0000	0.0000	0.0000	135.7104	276.8923	432.0010 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2061.9851
Space heating per m2												(98c) / (4) = 16.2361 (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 %)												318.0355 (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	451.0949	315.0608	253.9704	137.0470	60.2082	0.0000	0.0000	0.0000	0.0000	135.7104	276.8923	432.0010 (98)
Space heating efficiency (main heating system 1)	318.0355	318.0355	318.0355	318.0355	318.0355	0.0000	0.0000	0.0000	0.0000	318.0355	318.0355	318.0355 (210)
Space heating fuel (main heating system)	141.8379	99.0647	79.8560	43.0917	18.9313	0.0000	0.0000	0.0000	0.0000	42.6715	87.0633	135.8342 (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	301.4477	266.8064	283.7295	249.8396	242.5101	218.8491	216.0924	224.3976	226.5821	252.2947	267.8698	298.1795 (64)
Efficiency of water heater (217)m	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929 (216)
Fuel for water heating, kWh/month	158.8298	140.5776	149.4943	131.6380	127.7762	115.3094	113.8569	118.2329	119.3839	132.9316	141.1380	157.1078 (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	30.6948	27.7243	30.6948	29.7047	30.6948	29.7047	30.6948	30.6948	29.7047	30.6948	29.7047	30.6948 (231)
Lighting	34.3064	27.5219	24.7804	18.1552	14.0236	11.4574	12.7928	16.6285	21.5988	28.3388	32.0087	35.2599 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-82.0289	-115.3302	-164.7007	-180.8815	-190.6508	-173.8532	-171.8131	-163.7033	-147.0131	-128.6969	-89.3661	-70.7903 (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	-43.1873	-93.6198	-191.1650	-296.0486	-398.5561	-405.4311	-399.8157	-335.7317	-244.1447	-138.4178	-59.1584	-33.9943 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	648.3506 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	189.7929
Water heating fuel used	1606.2763 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9000) mechanical ventilation fans (SFP = 0.9000)	361.4067 (230a)
Total electricity for the above, kWh/year	361.4067 (231)
Electricity for lighting (calculated in Appendix L)	276.8725 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-4318.0985 (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	-1425.1924 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	648.3506	16.4900	106.9130 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1606.2763	16.4900	264.8750 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	361.4067	16.4900	59.5960 (249)
Energy for lighting	276.8725	16.4900	45.6563 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1678.8280	16.4900	-276.8387
PV Unit electricity exported	-2639.2705	5.5900	-147.5352
Total			-424.3740 (252)
Total energy cost			52.6663 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.1102 (257)
SAP value		98.2131
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	648.3506	0.1557	100.9398 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1606.2763	0.1408	226.2263 (264)
Space and water heating			327.1661 (265)
Pumps, fans and electric keep-hot	361.4067	0.1387	50.1316 (267)
Energy for lighting	276.8725	0.1443	39.9613 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1678.8280	0.1351	-226.7946
PV Unit electricity exported	-2639.2705	0.1251	-330.0495
Total			-556.8441 (269)
Total CO2, kg/year			-139.5852 (272)
CO2 emissions per m2			-1.1000 (273)
EI value			101.0875
EI rating			101 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0000 (1b)	x 2.3000 (2b)	= 142.6000 (1b) - (3b)
First floor	65.0000 (1c)	x 2.8700 (2c)	= 186.5500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.1500 (5)

2. Ventilation rate

m3 per hour

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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			2.0000 (17)
Infiltration rate			0.1000 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.0850 (21)

Wind speed	Jan 5.7000	Feb 5.4000	Mar 5.4000	Apr 4.8000	May 4.8000	Jun 4.2000	Jul 4.2000	Aug 4.1000	Sep 4.4000	Oct 5.0000	Nov 5.1000	Dec 5.6000 (22)
Wind factor	1.4250	1.3500	1.3500	1.2000	1.2000	1.0500	1.0500	1.0250	1.1000	1.2500	1.2750	1.4000 (22a)
Adj infilt rate	0.1211	0.1148	0.1148	0.1020	0.1020	0.0893	0.0893	0.0871	0.0935	0.1063	0.1084	0.1190 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												83.7000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2026	0.1962	0.1962	0.1835	0.1835	0.1707	0.1707	0.1686	0.1750	0.1877	0.1899	0.2005 (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
NEW WINDOWS (Uw = 1.20)			9.6200	1.1450	11.0153		(27)
NEW PAT/ BIFOLD DOORS (Uw = 1.20)			7.0600	1.1450	8.0840		(27)
Heat Loss Floor 1			62.0000	0.1000	6.2000	75.0000	4650.0000 (28a)
SEMI EX FLOOR			3.0000	0.1000	0.3000	20.0000	60.0000 (28b)
External Wall 1	169.3300	16.6800	152.6500	0.1500	22.8975	9.0000	1373.8500 (29a)
External Roof 1	64.4100		64.4100	0.1500	9.6615	9.0000	579.6900 (30)
External Roof 2	3.0000		3.0000	0.1500	0.4500	9.0000	27.0000 (30)
Total net area of external elements Aum(A, m2)			301.7400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	58.6082	(33)
Internal Wall			168.8000			9.0000	1519.2000 (32c)
Internal Floor 1			62.0000			18.0000	1116.0000 (32d)
Internal Ceiling 1			62.0000			9.0000	558.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							9883.7400 (34)
List of Thermal Bridges							77.8247 (35)

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.5400	0.0430	0.4962
E3 Sill	11.5000	0.0340	0.3910
E4 Jamb	24.0000	0.0430	1.0320
E5 Ground floor (normal)	31.9000	0.0210	0.6699
E20 Exposed floor (normal)	5.1200	0.3200	1.6384
E21 Exposed floor (inverted)	3.4700	0.3200	1.1104
E11 Eaves (insulation at rafter level)	19.0000	0.0400	0.7600
E13 Gable (insulation at rafter level)	13.6000	0.0240	0.3264
E14 Flat roof	5.1200	0.0000	0.0000
E16 Corner (normal)	20.9400	0.0300	0.6282
E17 Corner (inverted - internal area greater than external area)	2.3000	-0.0150	-0.0345
E2 Other lintels (including other steel lintels)	1.3500	1.0000	1.3500
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.3680 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 66.9763 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 22.0090	Feb 21.3166	Mar 21.3166	Apr 19.9317	May 19.9317	Jun 18.5468	Jul 18.5468	Aug 18.3160	Sep 19.0084	Oct 20.3933	Nov 20.6241	Dec 21.7782 (38)
Heat transfer coeff	88.9853	88.2928	88.2928	86.9079	86.9079	85.5230	85.5230	85.2922	85.9847	87.3696	87.6004	88.7545 (39)
Average = Sum(39)m / 12 =												87.1195
HLP	Jan 0.7007	Feb 0.6952	Mar 0.6952	Apr 0.6843	May 0.6843	Jun 0.6734	Jul 0.6734	Aug 0.6716	Sep 0.6770	Oct 0.6879	Nov 0.6898	Dec 0.6989 (40)
HLP (average)												0.6860
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8868 (42)
Hot water usage for mixer showers												72.3432 (42a)
Hot water usage for baths												31.2468 (42b)
Hot water usage for other uses												44.1934 (42c)
Average daily hot water use (litres/day)												136.1993 (43)
Daily hot water use	Jan 148.1676	Feb 145.0036	Mar 141.1505	Apr 135.2917	May 130.5338	Jun 125.4188	Jul 123.4532	Aug 127.2897	Sep 131.3358	Oct 136.7056	Nov 142.6547	Dec 147.7834 (44)
Energy conte	234.6613	206.4832	216.9431	185.2076	175.7237	154.2171	149.3060	157.6112	161.9501	185.5083	203.2378	231.3931 (45)
Energy content (annual)												Total = Sum(45)m = 2262.2423
Distribution loss (46)m = 0.15 x (45)m												34.7090 (46)
Water storage loss:												300.0000 (47)
Store volume												2.6000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

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Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												1.4040 (55)	
Total storage loss	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240	(56)
If cylinder contains dedicated solar storage	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240	(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	301.4477	266.8064	283.7295	249.8396	242.5101	218.8491	216.0924	224.3976	226.5821	252.2947	267.8698	298.1795	(62)
WWHS	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)
FGHS	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	301.4477	266.8064	283.7295	249.8396	242.5101	218.8491	216.0924	224.3976	226.5821	252.2947	267.8698	298.1795	(64)
	Total per year (kWh/year) = Sum(64)m =											3048.5983 (64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)	
Heat gains from water heating, kWh/month	131.4540	116.9142	125.5627	113.2871	111.8572	102.9828	103.0734	105.8348	105.5540	115.1106	119.2822	130.3673	(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	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1942	34.8119	28.3109	21.4332	16.0216	13.5261	14.6154	18.9977	25.4986	32.3764	37.7880	40.2835	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	438.9063	443.4608	431.9837	407.5502	376.7074	347.7195	328.3538	323.7993	335.2764	359.7099	390.5527	419.5406	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	(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)	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	(71)
Water heating gains (Table 5)	176.6855	173.9795	168.7671	157.3432	150.3457	143.0316	138.5395	142.2511	146.6028	154.7186	165.6697	175.2249	(72)
Total internal gains	767.7287	765.1949	742.0044	699.2693	656.0174	617.2199	594.4513	597.9908	620.3205	659.7475	706.9531	747.9917	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	0.6400	14.1647	0.6300	0.7000	0.7700	2.7705 (74)							
East	7.5200	26.5321	0.6300	0.7000	0.7700	60.9764 (76)							
South	1.4600	58.8467	0.6300	0.7000	0.7700	26.2571 (78)							
North	7.0600	14.1647	0.6300	0.7000	0.7700	30.5621 (74)							
Solar gains	120.5660	194.4408	304.6277	451.2039	529.5967	597.3426	517.9333	471.3266	372.6431	235.7776	142.9693	96.7844	(83)
Total gains	888.2947	959.6357	1046.6321	1150.4732	1185.6142	1214.5625	1112.3846	1069.3174	992.9637	895.5251	849.9224	844.7761	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	30.8532	31.0952	31.0952	31.5907	31.5907	32.1023	32.1023	32.1891	31.9299	31.4238	31.3410	30.9335	
alpha	3.0569	3.0730	3.0730	3.1060	3.1060	3.1402	3.1402	3.1459	3.1287	3.0949	3.0894	3.0622	
util living area	0.8742	0.8465	0.7934	0.7044	0.5938	0.4413	0.3656	0.3640	0.5179	0.7091	0.8237	0.8794	(86)
Living	20.0141	20.1353	20.3310	20.5635	20.7379	20.8533	20.8808	20.8823	20.8253	20.6280	20.3325	20.0224	
Non living	19.1796	19.3324	19.5715	19.8579	20.0606	20.1948	20.2223	20.2255	20.1655	19.9385	19.5834	19.1925	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4957	20.1353	20.3310	20.5635	20.7379	20.8533	20.8808	20.8823	20.8253	20.6280	20.3325	20.1592	(87)
Th 2	20.3402	20.3451	20.3451	20.3547	20.3547	20.3644	20.3644	20.3660	20.3612	20.3515	20.3499	20.3418	(88)
util rest of house	0.8621	0.8326	0.7754	0.6808	0.5627	0.4035	0.3211	0.3179	0.4757	0.6787	0.8052	0.8674	(89)
MIT 2	19.8775	19.3324	19.5715	19.8579	20.0606	20.1948	20.2223	20.2255	20.1655	19.9385	19.5834	19.3996	(90)
Living area fraction									fLA = Living area / (4) =				0.4488 (91)
MIT	20.1550	19.6928	19.9124	20.1746	20.3646	20.4904	20.5179	20.5203	20.4616	20.2480	19.9196	19.7405	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1550	19.6928	19.9124	20.1746	20.3646	20.4904	20.5179	20.5203	20.4616	20.2480	19.9196	19.7405	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8585	0.8172	0.7626	0.6739	0.5632	0.4112	0.3320	0.3293	0.4825	0.6736	0.7917	0.8552	(94)
Useful gains	762.6201	784.1940	798.1106	775.3031	667.7616	499.3825	369.3301	352.1019	479.0864	603.2290	672.9102	722.4229	(95)
Ext temp.	6.4000	6.7000	7.8000	9.4000	11.8000	14.4000	16.1000	16.3000	14.5000	11.9000	9.2000	6.8000	(96)
Heat loss rate W	1223.9889	1147.1686	1069.4365	936.3979	744.3314	520.8662	377.8310	359.9583	512.6078	729.3573	939.0386	1148.5277	(97)
Space heating kWh	343.2584	243.9189	201.8665	115.9883	56.9680	0.0000	0.0000	0.0000	0.0000	93.8394	191.6124	317.0220	(98a)
Space heating requirement - total per year (kWh/year)												1564.4738	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	343.2584	243.9189	201.8665	115.9883	56.9680	0.0000	0.0000	0.0000	0.0000	93.8394	191.6124	317.0220	(98c)

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Space heating requirement after solar contribution - total per year (kWh/year)
 Space heating per m2

1564.4738
 (98c) / (4) = 12.3187 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													318.7080 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	343.2584	243.9189	201.8665	115.9883	56.9680	0.0000	0.0000	0.0000	0.0000	93.8394	191.6124	317.0220	(98)
Space heating efficiency (main heating system 1)	318.7080	318.7080	318.7080	318.7080	318.7080	0.0000	0.0000	0.0000	0.0000	318.7080	318.7080	318.7080	(210)
Space heating fuel (main heating system)	107.7031	76.5337	63.3390	36.3933	17.8747	0.0000	0.0000	0.0000	0.0000	29.4437	60.1216	99.4710	(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	301.4477	266.8064	283.7295	249.8396	242.5101	218.8491	216.0924	224.3976	226.5821	252.2947	267.8698	298.1795	(64)
Efficiency of water heater (217)m	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	(216)
Fuel for water heating, kWh/month	158.9419	140.6769	149.5998	131.7309	127.8664	115.3908	113.9373	118.3164	119.4682	133.0254	141.2376	157.2187	(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	30.6948	27.7243	30.6948	29.7047	30.6948	29.7047	30.6948	30.6948	29.7047	30.6948	29.7047	30.6948	(231)
Lighting	34.3064	27.5219	24.7804	18.1552	14.0236	11.4574	12.7928	16.6285	21.5988	28.3388	32.0087	35.2599	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-100.2232	-124.1523	-173.7208	-191.2145	-196.0549	-184.0536	-176.3350	-173.4242	-159.0145	-140.6748	-104.8716	-84.3526	(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	-64.9601	-112.6760	-222.8554	-350.4863	-436.2234	-494.5753	-436.1244	-401.4861	-301.7639	-173.6453	-83.9750	-48.6568	(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													490.8800 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													189.6590
Water heating fuel used													1607.4103 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9000) mechanical ventilation fans (SFP = 0.9000)													361.4067 (230a)
Total electricity for the above, kWh/year													361.4067 (231)
Electricity for lighting (calculated in Appendix L)													276.8725 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-4935.5202 (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													-2198.9507 (238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	490.8800	21.5100	105.5883	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1607.4103	21.5100	345.7540	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	361.4067	21.5100	77.7386	(249)
Energy for lighting	276.8725	21.5100	59.5553	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1808.0922	21.5100	-388.9206	
PV Unit electricity exported	-3127.4280	5.5900	-174.8232	
Total			-563.7438	(252)
Total energy cost			24.8922	(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	490.8800	0.1555	76.3520	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1607.4103	0.1408	226.3860	(264)
Space and water heating			302.7380	(265)

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Pumps, fans and electric keep-hot	361.4067	0.1387	50.1316 (267)
Energy for lighting	276.8725	0.1443	39.9613 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1808.0922	0.1356	-245.2027
PV Unit electricity exported	-3127.4280	0.1259	-393.8584
Total			-639.0612 (269)
Total CO2, kg/year			-246.2303 (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	490.8800	1.5758	773.5396 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1607.4103	1.5208	2444.4987 (278)
Space and water heating			3218.0384 (279)
Pumps, fans and electric keep-hot	361.4067	1.5128	546.7361 (281)
Energy for lighting	276.8725	1.5338	424.6762 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1808.0922	1.5013	-2714.3989
PV Unit electricity exported	-3127.4280	0.4623	-1445.7205
Total			-4160.1194 (283)
Total Primary energy kWh/year			29.3313 (286)

 SAP 10 EPC IMPROVEMENTS

DESIGN

Current energy efficiency rating: A 98
 Current environmental impact rating: A 101

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 64	-45 kg (18.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£64 0.35 kg/m ²	A 100	A 101
Total Savings	£64 0.35 kg/m²		

Potential energy efficiency rating: A 100
 Potential environmental impact rating: A 101

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
 Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £589	Potential £510	Saving £78
Electricity			
Space heating	£183	£201	-£17
Water heating	£346	£250	£96
Lighting	£60	£60	£0
Generated (PV)	-£564	-£550	-£14
Total cost of fuels	£25	-£40	£64
Total cost of uses	£25	-£39	£65
Delivered energy	-17 kWh/m ²	-20 kWh/m ²	3 kWh/m ²
Carbon dioxide emissions	-0.2 tonnes	-0.3 tonnes	0.0 tonnes
CO2 emissions per m ²	-2 kg/m ²	-2 kg/m ²	0 kg/m ²
Primary energy	0 kWh/m ²	-3 kWh/m ²	3 kWh/m ²

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

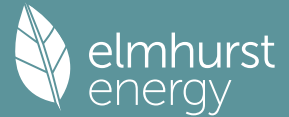
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.0000 (1b)	x 2.3000 (2b)	= 142.6000 (1b) - (3b)
First floor	65.0000 (1c)	x 2.8700 (2c)	= 186.5500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 329.1500 (5)

2. Ventilation rate

m3 per hour

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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000	Air changes per hour	0.0000 (8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50				2.0000 (17)
Infiltration rate				0.1000 (18)
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =			0.0850 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1084	0.1063	0.1041	0.0935	0.0914	0.0808	0.0808	0.0786	0.0850	0.0914	0.0956	0.0999	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													83.7000 (23c)
Effective ac	0.1899	0.1877	0.1856	0.1750	0.1729	0.1622	0.1622	0.1601	0.1665	0.1729	0.1771	0.1814	(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
NEW WINDOWS (Uw = 1.20)			9.6200	1.1450	11.0153		(27)
NEW PAT/ BIFOLD DOORS (Uw = 1.20)			7.0600	1.1450	8.0840		(27)
Heat Loss Floor 1			62.0000	0.1000	6.2000	75.0000	4650.0000 (28a)
SEMI EX FLOOR			3.0000	0.1000	0.3000	20.0000	60.0000 (28b)
External Wall 1	169.3300	16.6800	152.6500	0.1500	22.8975	9.0000	1373.8500 (29a)
External Roof 1	64.4100		64.4100	0.1500	9.6615	9.0000	579.6900 (30)
External Roof 2	3.0000		3.0000	0.1500	0.4500	9.0000	27.0000 (30)
Total net area of external elements Aum (A, m2)			301.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.6082		(33)
Internal Wall			168.8000			9.0000	1519.2000 (32c)
Internal Floor 1			62.0000			18.0000	1116.0000 (32d)
Internal Ceiling 1			62.0000			9.0000	558.0000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9883.7400 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 77.8247 (35)

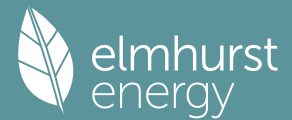
List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.5400	0.0430	0.4962
E3 Sill	11.5000	0.0340	0.3910
E4 Jamb	24.0000	0.0430	1.0320
E5 Ground floor (normal)	31.9000	0.0210	0.6699
E20 Exposed floor (normal)	5.1200	0.3200	1.6384
E21 Exposed floor (inverted)	3.4700	0.3200	1.1104
E11 Eaves (insulation at rafter level)	19.0000	0.0400	0.7600
E13 Gable (insulation at rafter level)	13.6000	0.0240	0.3264
E14 Flat roof	5.1200	0.0000	0.0000
E16 Corner (normal)	20.9400	0.0300	0.6282
E17 Corner (inverted - internal area greater than external area)	2.3000	-0.0150	-0.0345
E2 Other lintels (including other steel lintels)	1.3500	1.0000	1.3500
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.3680 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 66.9763 (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	
	20.6241	20.3933	20.1625	19.0084	18.7776	17.6235	17.6235	17.3927	18.0851	18.7776	19.2392	19.7009	(38)
Heat transfer coeff	87.6004	87.3696	87.1388	85.9847	85.7539	84.5998	84.5998	84.3690	85.0614	85.7539	86.2155	86.6771	(39)
Average = Sum(39)m / 12 =												85.9270	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.6898	0.6879	0.6861	0.6770	0.6752	0.6661	0.6661	0.6643	0.6698	0.6752	0.6789	0.6825	(40)
HLP (average)												0.6766	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8868 (42)
Hot water usage for mixer showers													
	72.6214	71.5301	69.9397	66.8969	64.6514	62.1473	60.7239	62.3022	64.0323	66.7210	69.8292	72.3432	(42a)
Hot water usage for baths													
	31.3528	30.8872	30.2315	29.0225	28.1172	27.1133	26.5711	27.2222	27.9312	29.0053	30.2392	31.2468	(42b)
Hot water usage for other uses													
	44.1934	42.5863	40.9793	39.3723	37.7653	36.1582	36.1582	37.7653	39.3723	40.9793	42.5863	44.1934	(42c)
Average daily hot water use (litres/day)													136.1993 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	148.1676	145.0036	141.1505	135.2917	130.5338	125.4188	123.4532	127.2897	131.3358	136.7056	142.6547	147.7834	(44)
Energy conte	234.6613	206.4832	216.9431	185.2076	175.7237	154.2171	149.3060	157.6112	161.9501	185.5083	203.2378	231.3931	(45)
Energy content (annual)													Total = Sum(45)m = 2262.2423
Distribution loss (46)m = 0.15 x (45)m													
	35.1992	30.9725	32.5415	27.7811	26.3585	23.1326	22.3959	23.6417	24.2925	27.8262	30.4857	34.7090	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.6000 (48)

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Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.4040 (55)
Total storage loss	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240 (56)
If cylinder contains dedicated solar storage	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	301.4477	266.8064	282.3338	243.0860	229.7157	206.2424	203.0654	212.3012	221.1792	250.8989	267.8698	298.1795 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												638.5625 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												638.5625
Solar input	-0.0000	-16.1867	-59.0958	-81.9581	-108.0941	-99.9217	-99.3753	-86.2701	-58.8702	-28.7905	-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	301.4477	250.6197	223.2379	161.1278	121.6216	106.3207	103.6901	126.0310	162.3091	222.1084	267.8698	298.1795 (64)
												Total per year (kWh/year) = Sum(64)m = 2344.5633 (64)
Electric shower(s)												0.0000 (64a)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	131.4540	116.9142	124.4461	107.8842	101.6218	92.8974	92.6518	96.1577	101.2317	113.9940	119.2822	130.3673 (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	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1942	34.8119	28.3109	21.4332	16.0216	13.5261	14.6154	18.9977	25.4986	32.3764	37.7880	40.2835 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	438.9063	443.4608	431.9837	407.5502	376.7074	347.7195	328.3538	323.7993	335.2764	359.7099	390.5527	419.5406 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074 (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)	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707 (71)
Water heating gains (Table 5)	176.6855	173.9795	167.2663	149.8392	136.5884	129.0242	124.5320	129.2442	140.5996	153.2178	165.6697	175.2249 (72)
Total internal gains	767.7287	765.1949	740.5036	691.7653	642.2601	603.2124	580.4439	584.9839	614.3173	658.2467	706.9531	747.9917 (73)

6. Solar gains

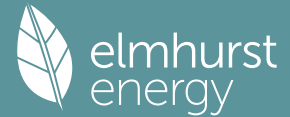
[Jan]		Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North		0.6400	10.6334	0.6300	0.7000	0.7700	2.0798 (74)					
East		7.5200	19.6403	0.6300	0.7000	0.7700	45.1374 (76)					
South		1.4600	46.7521	0.6300	0.7000	0.7700	20.8605 (78)					
North		7.0600	10.6334	0.6300	0.7000	0.7700	22.9429 (74)					
Solar gains	91.0207	170.2823	270.1914	391.7851	486.9882	503.6140	477.2295	403.8080	312.2821	198.5459	111.8767	76.0044 (83)
Total gains	858.7494	935.4772	1010.6949	1083.5505	1129.2483	1106.8264	1057.6733	988.7919	926.5994	856.7926	818.8298	823.9961 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	31.3410	31.4238	31.5070	31.9299	32.0159	32.4526	32.4526	32.5414	32.2765	32.0159	31.8444	31.6748
alpha	3.0894	3.0949	3.1005	3.1287	3.1344	3.1635	3.1635	3.1694	3.1518	3.1344	3.1230	3.1117
util living area	0.9102	0.8832	0.8330	0.7422	0.6148	0.4618	0.3434	0.3799	0.5686	0.7731	0.8783	0.9183 (86)
Living	19.7403	19.9114	20.1816	20.4970	20.7248	20.8505	20.8874	20.8816	20.7992	20.5084	20.0811	19.7058
Non living	18.8427	19.0577	19.3945	19.7853	20.0540	20.1993	20.2350	20.2319	20.1452	19.8073	19.2798	18.8045
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3556	19.9114	20.1816	20.4970	20.7248	20.8505	20.8874	20.8816	20.7992	20.5084	20.0811	19.8868 (87)
Th 2	20.3499	20.3515	20.3531	20.3612	20.3628	20.3708	20.3708	20.3725	20.3676	20.3628	20.3595	20.3563 (88)
util rest of house	0.9021	0.8731	0.8186	0.7207	0.5842	0.4220	0.2968	0.3316	0.5278	0.7493	0.8661	0.9109 (89)
MIT 2	19.7490	19.0577	19.3945	19.7853	20.0540	20.1993	20.2350	20.2319	20.1452	19.8073	19.2798	19.0842 (90)
Living area fraction										FLA = Living area / (4) =		0.4488 (91)
MIT	20.0213	19.4409	19.7478	20.1047	20.3551	20.4916	20.5278	20.5235	20.4387	20.1219	19.6394	19.4444 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0213	19.4409	19.7478	20.1047	20.3551	20.4916	20.5278	20.5235	20.4387	20.1219	19.6394	19.4444 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8977	0.8569	0.8038	0.7116	0.5839	0.4297	0.3086	0.3434	0.5325	0.7396	0.4506	0.8989	(94)
Useful gains	770.8775	801.5907	812.4330	771.0410	659.3211	475.6453	326.3926	339.5605	493.4362	633.6725	696.5188	740.6945	(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	1377.1879	1270.4312	1154.3971	963.4339	742.2062	498.4272	332.2881	347.8957	539.1795	816.5439	1081.0914	1321.3410	(97)
Space heating kWh	451.0949	315.0608	254.4213	138.5229	61.6665	0.0000	0.0000	0.0000	0.0000	136.0563	276.8923	432.0010	(98a)
Space heating requirement - total per year (kWh/year)												2065.7161	
Solar heating kWh	-0.0000	-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	451.0949	315.0608	254.4213	138.5229	61.6665	0.0000	0.0000	0.0000	0.0000	136.0563	276.8923	432.0010	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2065.7161	
Space heating per m2										(98c) / (4) =		16.2655	(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 %)													318.0355	(206)	
Efficiency of main space heating system 2 (in %)													0.0000	(207)	
Efficiency of secondary/supplementary heating system, %													0.0000	(208)	
Space heating requirement	451.0949	315.0608	254.4213	138.5229	61.6665	0.0000	0.0000	0.0000	0.0000	136.0563	276.8923	432.0010	(98)		
Space heating efficiency (main heating system 1)	318.0355	318.0355	318.0355	318.0355	318.0355	0.0000	0.0000	0.0000	0.0000	318.0355	318.0355	318.0355	(210)		
Space heating fuel (main heating system)	141.8379	99.0647	79.9978	43.5558	19.3898	0.0000	0.0000	0.0000	0.0000	42.7802	87.0633	135.8342	(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	301.4477	250.6197	223.2379	161.1278	121.6216	106.3207	103.6901	126.0310	162.3091	222.1084	267.8698	298.1795	(64)		
Efficiency of water heater (217)m	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929	189.7929	(216)		
Fuel for water heating, kWh/month	158.8298	132.0490	117.6219	84.8967	64.0812	56.0193	54.6333	66.4045	85.5190	117.0267	141.1380	157.1078	(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	37.4893	33.8613	37.4893	36.2800	37.4893	36.2800	37.4893	36.2800	37.4893	36.2800	37.4893	36.2800	(231)		
Lighting	34.3064	27.5219	24.7804	18.1552	14.0236	11.4574	12.7928	16.6285	21.5988	28.3388	32.0087	35.2599	(232)		
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-82.1974	-115.1924	-162.0537	-173.9559	-177.2702	-159.7969	-157.8582	-153.2943	-142.1929	-127.8587	-89.6232	-70.9292	(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	-43.0189	-93.7575	-193.8120	-302.9742	-411.9367	-419.4874	-413.7706	-346.1407	-248.9649	-139.2560	-58.9013	-33.8554	(233b)		
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)		
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)		
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)		
Annual totals kWh/year															
Space heating fuel - main system 1													649.5237	(211)	
Space heating fuel - main system 2													0.0000	(213)	
Space heating fuel - secondary													0.0000	(215)	
Efficiency of water heater													189.7929		
Water heating fuel used													1235.3273	(219)	
Space cooling fuel													0.0000	(221)	
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9000)															
mechanical ventilation fans (SFP = 0.9000)														361.4067	(230a)
pump for solar water heating														80.0000	(230g)
Total electricity for the above, kWh/year														441.4067	(231)
Electricity for lighting (calculated in Appendix L)														276.8725	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV generation														-4318.0985	(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														-1714.9683	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	649.5237	16.4900	107.1065	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1235.3273	16.4900	203.7055	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	361.4067	16.4900	59.5960	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	276.8725	16.4900	45.6563	(250)
Additional standing charges			0.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1612.2230	16.4900	-265.8556
PV Unit electricity exported	-2705.8755	5.5900	-151.2584
Total			-417.1140 (252)
Total energy cost			12.1421 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.0254 (257)
SAP value		99.5880
SAP rating (Section 12)		100 (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	649.5237	0.1557	101.1032 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1235.3273	0.1450	179.1055 (264)
Space and water heating			280.2086 (265)
Pumps, fans and electric keep-hot	441.4067	0.1387	61.2286 (267)
Energy for lighting	276.8725	0.1443	39.9613 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1612.2230	0.1356	-218.5963
PV Unit electricity exported	-2705.8755	0.1248	-337.6085
Total			-556.2048 (269)
Total CO2, kg/year			-174.8064 (272)
CO2 emissions per m2			-1.3800 (273)
EI value			101.3619
EI rating			101 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0000 (1b)	x 2.3000 (2b)	= 142.6000 (1b) - (3b)
First floor	65.0000 (1c)	x 2.8700 (2c)	= 186.5500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	329.1500 (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	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	2.0000	(17)
Infiltration rate	0.1000	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.7000	5.4000	5.4000	4.8000	4.8000	4.2000	4.2000	4.1000	4.4000	5.0000	5.1000	5.6000 (22)
Wind factor	1.4250	1.3500	1.3500	1.2000	1.2000	1.0500	1.0500	1.0250	1.1000	1.2500	1.2750	1.4000 (22a)
Adj infilt rate	0.1211	0.1148	0.1148	0.1020	0.1020	0.0893	0.0893	0.0871	0.0935	0.1063	0.1084	0.1190 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.2026	0.1962	0.1962	0.1835	0.1835	0.1707	0.1707	0.1686	0.1750	0.1877	0.1899	0.2005 (25)

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3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K						
NEW WINDOWS (Uw = 1.20)			9.6200	1.1450	11.0153			(27)					
NEW PAT/ BIFOLD DOORS (Uw = 1.20)			7.0600	1.1450	8.0840			(27)					
Heat Loss Floor 1			62.0000	0.1000	6.2000	75.0000	4650.0000	(28a)					
SEMI EX FLOOR			3.0000	0.1000	0.3000	20.0000	60.0000	(28b)					
External Wall 1	169.3300	16.6800	152.6500	0.1500	22.8975	9.0000	1373.8500	(29a)					
External Roof 1	64.4100		64.4100	0.1500	9.6615	9.0000	579.6900	(30)					
External Roof 2	3.0000		3.0000	0.1500	0.4500	9.0000	27.0000	(30)					
Total net area of external elements Aum(A, m ²)			301.7400					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.6082			(33)					
Internal Wall			168.8000			9.0000	1519.2000	(32c)					
Internal Floor 1			62.0000			18.0000	1116.0000	(32d)					
Internal Ceiling 1			62.0000			9.0000	558.0000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9883.7400	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							77.8247	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				11.5400	0.0430	0.4962							
E3 Sill				11.5000	0.0340	0.3910							
E4 Jamb				24.0000	0.0430	1.0320							
E5 Ground floor (normal)				31.9000	0.0210	0.6699							
E20 Exposed floor (normal)				5.1200	0.3200	1.6384							
E21 Exposed floor (inverted)				3.4700	0.3200	1.1104							
E11 Eaves (insulation at rafter level)				19.0000	0.0400	0.7600							
E13 Gable (insulation at rafter level)				13.6000	0.0240	0.3264							
E14 Flat roof				5.1200	0.0000	0.0000							
E16 Corner (normal)				20.9400	0.0300	0.6282							
E17 Corner (inverted - internal area greater than external area)				2.3000	-0.0150	-0.0345							
E2 Other lintels (including other steel lintels)				1.3500	1.0000	1.3500							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3680	(36)					
Point Thermal bridges							0.0000	(36a)					
Total fabric heat loss						(33) + (36) + (36a) =	66.9763	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 22.0090	Feb 21.3166	Mar 21.3166	Apr 19.9317	May 19.9317	Jun 18.5468	Jul 18.5468	Aug 18.3160	Sep 19.0084	Oct 20.3933	Nov 20.6241	Dec 21.7782	(38)
Heat transfer coeff	88.9853	88.2928	88.2928	86.9079	86.9079	85.5230	85.5230	85.2922	85.9847	87.3696	87.6004	88.7545	(39)
Average = Sum(39)m / 12 =												87.1195	
HLP	Jan 0.7007	Feb 0.6952	Mar 0.6952	Apr 0.6843	May 0.6843	Jun 0.6734	Jul 0.6734	Aug 0.6716	Sep 0.6770	Oct 0.6879	Nov 0.6898	Dec 0.6989	(40)
HLP (average)												0.6860	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy														2.8868	(42)
Hot water usage for mixer showers	72.6214	71.5301	69.9397	66.8969	64.6514	62.1473	60.7239	62.3022	64.0323	66.7210	69.8292	72.3432	72.3432	72.3432	(42a)
Hot water usage for baths	31.3528	30.8872	30.2315	29.0225	28.1172	27.1133	26.5711	27.2222	27.9312	29.0053	30.2392	31.2468	31.2468	31.2468	(42b)
Hot water usage for other uses	44.1934	42.5863	40.9793	39.3723	37.7653	36.1582	36.1582	37.7653	39.3723	40.9793	42.5863	44.1934	44.1934	44.1934	(42c)
Average daily hot water use (litres/day)														136.1993	(43)
Daily hot water use	Jan 148.1676	Feb 145.0036	Mar 141.1505	Apr 135.2917	May 130.5338	Jun 125.4188	Jul 123.4532	Aug 127.2897	Sep 131.3358	Oct 136.7056	Nov 142.6547	Dec 147.7834	147.7834	147.7834	(44)
Energy conte	234.6613	206.4832	216.9431	185.2076	175.7237	154.2171	149.3060	157.6112	161.9501	185.5083	203.2378	231.3931	231.3931	231.3931	(45)
Energy content (annual)														2262.2423	
Distribution loss (46)m = 0.15 x (45)m	35.1992	30.9725	32.5415	27.7811	26.3585	23.1326	22.3959	23.6417	24.2925	27.8262	30.4857	34.7090	34.7090	34.7090	(46)
Water storage loss:															
Store volume														300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):														2.6000	(48)
Temperature factor from Table 2b														0.5400	(49)
Enter (49) or (54) in (55)														1.4040	(55)
Total storage loss	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	43.5240	(56)
If cylinder contains dedicated solar storage	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	43.5240	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	301.4477	266.8064	282.3338	243.0860	229.7157	206.2424	203.0654	212.3012	221.1792	250.8989	267.8698	298.1795	298.1795	298.1795	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector														3.0000	(H1)
Zero-loss collector efficiency														0.8000	(H2)
Collector linear heat loss coefficient														1.8000	(H3)
Collector 2nd order heat loss coefficient														0.0000	(H4)
Collector loop efficiency														0.9000	(H5)
Incidence angle modifier														1.0000	(H6)
Overshading factor														0.8000	(H8)
Overall heat loss coefficient of system														6.5000	(H10)
Heat loss coefficient of collector loop														3.9667	(H11)
Dedicated solar storage volume														75.0000	(H12)
Effective solar volume														75.0000	(H14)
Reference volume														225.0000	(H15)
Storage tank correction coefficient														1.3161	(H16)
Heat delivered to hot water														778.0520	(H24)
Heat delivered to space heating														0.0000	(H29)
Solar input														778.0520	
Solar input	-7.2703	-25.7846	-71.7105	-97.4266	-117.3194	-118.9184	-107.0055	-102.4805	-75.7776	-43.4257	-10.9330	-0.0000	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	294.1774	241.0217	210.6232	145.6593	112.3964	87.3240	96.0599	109.8207	145.4017	207.4733	256.9369	298.1795	298.1795	298.1795	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =														0.0000	(64a)
Heat gains from water heating, kWh/month	131.4540	116.9142	124.4461	107.8842	101.6218	92.8974	92.6518	96.1577	101.2317	113.9940	119.2822	130.3673	130.3673	130.3673	(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	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	173.2060	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1942	34.8119	28.3109	21.4332	16.0216	13.5261	14.6154	18.9977	25.4986	32.3764	37.7880	40.2835	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	438.9063	443.4608	431.9837	407.5502	376.7074	347.7195	328.3538	323.7993	335.2764	359.7099	390.5527	419.5406	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	55.2074	(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)	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	-115.4707	(71)
Water heating gains (Table 5)	176.6855	173.9795	167.2663	149.8392	136.5884	129.0242	124.5320	129.2442	140.5996	153.2178	165.6697	175.2249	(72)
Total internal gains	767.7287	765.1949	740.5036	691.7653	642.2601	603.2124	580.4439	584.9839	614.3173	658.2467	706.9531	747.9917	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
North	0.6400	14.1647	0.6300	0.7000	0.7700	0.7700	2.7705 (74)						
East	7.5200	26.5321	0.6300	0.7000	0.7700	0.7700	60.9764 (76)						
South	1.4600	58.8467	0.6300	0.7000	0.7700	0.7700	26.2571 (78)						
North	7.0600	14.1647	0.6300	0.7000	0.7700	0.7700	30.5621 (74)						
Solar gains	120.5660	194.4408	304.6277	451.2039	529.5967	597.3426	517.9333	471.3266	372.6431	235.7776	142.9693	96.7844	(83)
Total gains	888.2947	959.6357	1045.1313	1142.9692	1171.8568	1200.5550	1098.3771	1056.3105	986.9605	894.0243	849.9224	844.7761	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods 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	30.8532	31.0952	31.0952	31.5907	31.5907	32.1023	32.1023	32.1891	31.9299	31.4238	31.3410	30.9335	
alpha	3.0569	3.0730	3.0730	3.1060	3.1060	3.1402	3.1402	3.1459	3.1287	3.0949	3.0894	3.0622	
util living area	0.8742	0.8465	0.7939	0.7071	0.5988	0.4458	0.3699	0.3681	0.5204	0.7098	0.8237	0.8794	(86)
Living	20.0141	20.1353	20.3298	20.5596	20.7340	20.8519	20.8801	20.8816	20.8242	20.6272	20.3325	20.0224	
Non living	19.1796	19.3324	19.5702	19.8536	20.0564	20.1935	20.2218	20.2250	20.1645	19.9377	19.5834	19.1925	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4957	20.1353	20.3298	20.5596	20.7340	20.8519	20.8801	20.8816	20.8242	20.6272	20.3325	20.1592	(87)
Th 2	20.3402	20.3451	20.3451	20.3547	20.3547	20.3644	20.3644	20.3660	20.3612	20.3515	20.3499	20.3418	(88)
util rest of house	0.8621	0.8326	0.7759	0.6835	0.5677	0.4078	0.3250	0.3216	0.4781	0.6794	0.8052	0.8674	(89)
MIT 2	19.8775	19.3324	19.5702	19.8536	20.0564	20.1935	20.2218	20.2250	20.1645	19.9377	19.5834	19.3996	(90)
Living area fraction									FLA = Living area / (4) =				0.4488 (91)
MIT	20.1550	19.6928	19.9111	20.1705	20.3605	20.4890	20.5173	20.5197	20.4606	20.2471	19.9196	19.7405	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1550	19.6928	19.9111	20.1705	20.3605	20.4890	20.5173	20.5197	20.4606	20.2471	19.9196	19.7405	(93)

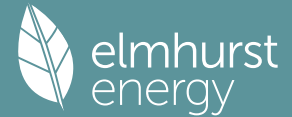
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8585	0.8172	0.7630	0.6765	0.5680	0.4153	0.3359	0.3330	0.4849	0.6743	0.7917	0.8552	(94)
Useful gains	762.6201	784.1940	797.4827	773.1925	665.6003	498.6486	368.9879	351.7952	478.5372	602.8080	672.9102	722.4229	(95)
Ext temp.	6.4000	6.7000	7.8000	9.4000	11.8000	14.4000	16.1000	16.3000	14.5000	11.9000	9.2000	6.8000	(96)
Heat loss rate W	1223.9889	1147.1686	1069.3254	936.0391	743.9766	520.7505	377.7767	359.9095	512.5194	729.2852	939.0386	1148.5277	(97)
Space heating kWh	343.2584	243.9189	202.2510	117.2496	58.3120	0.0000	0.0000	0.0000	0.0000	94.0990	191.6124	317.0220	(98a)
Space heating requirement - total per year (kWh/year)												1567.7232	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	343.2584	243.9189	202.2510	117.2496	58.3120	0.0000	0.0000	0.0000	0.0000	94.0990	191.6124	317.0220	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1567.7232	
Space heating per m ²										(98c) / (4) =		12.3443	(99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													318.7080 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	343.2584	243.9189	202.2510	117.2496	58.3120	0.0000	0.0000	0.0000	0.0000	94.0990	191.6124	317.0220	(98)
Space heating efficiency (main heating system 1)	318.7080	318.7080	318.7080	318.7080	318.7080	0.0000	0.0000	0.0000	0.0000	318.7080	318.7080	318.7080	(210)
Space heating fuel (main heating system)	107.7031	76.5337	63.4596	36.7890	18.2964	0.0000	0.0000	0.0000	0.0000	29.5251	60.1216	99.4710	(211)
Space heating efficiency (main heating system 2)													

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
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	294.1774	241.0217	210.6232	145.6593	112.3964	87.3240	96.0599	109.8207	145.4017	207.4733	256.9369	298.1795	(64)
Efficiency of water heater (217)m	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	189.6590	(216)
Fuel for water heating, kWh/month	155.1086	127.0816	111.0537	76.8006	59.2623	46.0426	50.6488	57.9043	76.6648	109.3928	135.4731	157.2187	(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	37.4893	33.8613	37.4893	36.2800	37.4893	36.2800	37.4893	36.2800	37.4893	36.2800	37.4893	36.2800	(231)
Lighting	34.3064	27.5219	24.7804	18.1552	14.0236	11.4574	12.7928	16.6285	21.5988	28.3388	32.0087	35.2599	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-100.3349	-123.6280	-169.7997	-181.5279	-180.4355	-164.7059	-160.3044	-159.2171	-151.4223	-138.7321	-104.9170	-84.5554	(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	-64.8485	-113.2003	-226.7765	-360.1729	-451.8428	-513.9229	-452.1550	-415.6932	-309.3561	-175.5881	-83.9296	-48.4540	(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												491.8996	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												189.6590	(217)
Water heating fuel used												1162.6518	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9000)													
mechanical ventilation fans (SFP = 0.9000)												361.4067	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												441.4067	(231)
Electricity for lighting (calculated in Appendix L)												276.8725	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-4935.5202	(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												-2562.6896	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	491.8996	21.5100	105.8076 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1162.6518	21.5100	250.0864 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	361.4067	21.5100	77.7386 (249)
Pump for solar water heating	80.0000	21.5100	17.2080 (249)
Energy for lighting	276.8725	21.5100	59.5553 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1719.5802	21.5100	-369.8817
PV Unit electricity exported	-3215.9400	5.5900	-179.7710
Total			-549.6527 (252)
Total energy cost			-39.2569 (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	491.8996	0.1555	76.4938 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1162.6518	0.1457	169.3581 (264)
Space and water heating			245.8519 (265)
Pumps, fans and electric keep-hot	441.4067	0.1387	61.2286 (267)
Energy for lighting	276.8725	0.1443	39.9613 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1719.5802	0.1362	-234.2473
PV Unit electricity exported	-3215.9400	0.1256	-404.0219
Total			-638.2692 (269)
Total CO2, kg/year			-291.2274 (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	491.8996	1.5757	775.0839 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1162.6518	1.5388	1789.1259 (278)
Space and water heating			2564.2098 (279)

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Pumps, fans and electric keep-hot	441.4067	1.5128	667.7601 (281)
Energy for lighting	276.8725	1.5338	424.6762 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1719.5802	1.5035	-2585.4628
PV Unit electricity exported	-3215.9400	0.4611	-1482.9811
Total			-4068.4440 (283)
Total Primary energy kWh/year			-411.7979 (286)

Installation Type	Unit of Measure	Capacity/Flow rate (1)	Use Factor (2)	Fixed use (litres/person/day) (3)	Litres/person/day = [(1)x(2)] + (3) (4)
WC (single flush)	Flush Volume (litres)		4.42	0.00	0
WC (dual flush)	Full flush Volume (litres)	6	1.46	0.00	8.76
	Part flush Volume (litres)	3	2.96	0.00	8.88
WC (multiple fittings)	Average effective flushing Volume (litres)		4.42	0.00	0
Taps (excluding kitchen/utility room taps)	Flow rate (litres/min)	4.00	1.58	1.58	7.90
Bath (where shower also present)	Capacity to overflow(litres)	180.00	0.11	0.00	19.80
Shower (where bath also present)	Flow Rate(litres / minute)	8.00	4.37	0.00	34.96
Bath Only	Capacity to overflow(litres)		0.50	0.00	0
Shower Only	Flow Rate (litres/minute)		5.60	0.00	0
Kitchen/Utility room sink taps	Flow rate (litres/minute)	6.00	0.44	10.36	13.00
Washing Machine	(Litres/kg dry load)	8.17	2.1	0.00	17.16
Dishwasher	(Litres/place setting)	1.25	3.6	0.00	4.50
Waste disposal unit	(Litres/use)	<input type="checkbox"/> Present	3.08	0.00	0
Water Softener	(Litres/person/day)		1.00	0.00	0
(5)	Total Calculated use (litres/person/day) =SUM(column 4)				114.96
(6)	Contribution from greywater (litres/person/day)				0
(7)	Contribution from rainwater (litres/person/day)				0
(8)	Normalisation factor				0.91
(9)	Total internal water consumption = [(5)-(6)-(7)]x(8) (litres/person/day)				104.61
(10)	External water use				5.0
(11)	Total water consumption (Building Regulation 17.K) =(9)+(10)(litres/person/day)				109.6

Installation Type	Make/Model (mandatory)	Litres/Person/Day
WC (dual flush)	6/3 dual flush	17.64
Taps	4l/min	14.22
Baths (shower(s) present)	180l to overflow	19.80
Showers (bath(s) present)	8l/min	43.70
Kitchen Taps	6l/min	13.88
Washing Machines	8.17per kg	17.16
Dishwasher	1.25 per place	4.50



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