

OAKLAND ENERGY



ENERGY STATEMENT

Client: INFLUENCE PLANNING

Project: R/O Trevarth View, Lanner Moor
REDRUTH, TR16 6JF

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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 r/o Trevarth View.

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: 281.40m²

FABRIC FIRST STRATEGY

- Wall U Value – 0.17W/m²K
- Roof U Value – 0.10W/m²K & 0.14W/m²K
- Floor U Value – 0.12W/m²K
- Glazing U Value – 1.10W/m²K
- enhanced thermal bridging details
- Air permeability of 3 or lower.

HEATING STRATEGY

- Air Source Heat Pump

VENTILATION STRATEGY

- Mechanical ventilation with heat recovery

OVERHEATING MITIGATION

- Low g values

RENEWABLE ENERGY

- Solar PV Panels – 4.25kW 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.

	DPD Policy kWh/m ² /yr	Proposed Dwelling kWh/m ² /yr
Space Heating Demand	<30	7.8
Predicted Total Energy Use	<40	13.4
Renewable Energy	> Total Energy	13.8
Annual Renewable Energy Deficit		-211.9kWh/yr

The proposals are therefore compliant with the Climate Emergency DPD.

Report completed on 12th August 2023.

By Sophie Oakland - Accredited Assessor EES/011881.

Full SAP Calculation Printout



Property Reference	_23.SAP.119 Dan Mitchell		Issued on Date	12/08/2023	
Assessment Reference	AS DESIGNED	Prop Type Ref			
Property	R/O Trevarth View, Lanner Moor, REDRUTH, TR16 6JF				
SAP Rating	96 A	DER	-0.46	TER	10.17
Environmental	101 A	% DER < TER			104.52
CO ₂ Emissions (t/year)	-0.16	DFEE	36.04	TFEE	36.92
Compliance Check	See BREL	% DFEE < TFEE			2.38
% DPER < TPER	78.06	DPER	11.64	TPER	53.05
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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	54.9500 (1b)	x 2.3600 (2b)	= 129.6820 (1b) -
First floor	59.5000 (1c)	x 2.5500 (2c)	= 151.7250 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	281.4070 (5)

2. Ventilation rate

	m ³ per hour											
Number of open chimneys	0 * 80 =	0.0000 (6a)										
Number of open flues	0 * 20 =	0.0000 (6b)										
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)										
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)										
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)										
Number of blocked chimneys	0 * 20 =	0.0000 (6f)										
Number of intermittent extract fans	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		3.0000 (17)										
Infiltration rate		0.1500 (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) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (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	0.2441	0.2409	0.2377	0.2217	0.2186	0.2026	0.2026	0.1994	0.2090	0.2186	0.2249	0.2313 (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 = 1.10)			10.6200	1.0536	11.1897		(27)
NEW DOORS (Uw = 1.10)			5.8800	1.0536	6.1954		(27)

Full SAP Calculation Printout



DOOR			2.1000	1.1000	2.3100				(26)
RL			0.6100	1.0536	0.6427				(27a)
Heat Loss Floor 1			54.9500	0.1200	6.5940	75.0000	4121.2500		(28a)
External Wall 1	144.8500	18.6000	126.2500	0.1700	21.4625	9.0000	1136.2500		(29a)
External Roof 1	51.9300		51.9300	0.1000	5.1930	9.0000	467.3700		(30)
Pitched Roof	9.2200	0.6100	8.6100	0.1400	1.2054	9.0000	77.4900		(30)
Total net area of external elements Aum(A, m2)			260.9500						(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.7927				(33)
Internal Wall 1			199.0600			9.0000	1791.5400		(32c)
Internal Floor 1			54.9500			18.0000	989.1000		(32d)
Internal Ceiling 1			54.9500			9.0000	494.5500		(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9077.5500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 79.3145 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.1000	0.1710	2.2401
E3 Sill	12.1000	0.0320	0.3872
E4 Jamb	26.4000	0.0450	1.1880
E5 Ground floor (normal)	29.7800	0.1410	4.1990
E6 Intermediate floor within a dwelling	30.9800	0.1200	3.7176
R1 Head of roof window	0.7800	0.2400	0.1872
R2 Sill of roof window	0.7800	0.2400	0.1872
R3 Jamb of roof window	1.5600	0.2400	0.3744
E11 Eaves (insulation at rafter level)	8.7000	0.0500	0.4350
E12 Gable (insulation at ceiling level)	18.8000	0.0690	1.2972
E13 Gable (insulation at rafter level)	4.2400	0.0550	0.2332
E16 Corner (normal)	30.4000	0.0590	1.7936
R7 Flat ceiling (inverted)	3.6000	0.0000	0.0000
R9 Roof to wall (flat ceiling)	5.2200	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.2397 (36)
 Point Thermal bridges 0.0000 (36a) =
 Total fabric heat loss (33) + (36) + (36a) = 71.0324 (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	22.6647	22.3687	22.0727	20.5927	20.2967	18.8166	18.8166	18.5206	19.4086	20.2967	20.8887	21.4807
Average = Sum(39)m / 12 =	93.6971	93.4010	93.1050	91.6250	91.3290	89.8490	89.8490	89.5530	90.4410	91.3290	91.9210	92.5130

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8187	0.8161	0.8135	0.8006	0.7980	0.7851	0.7851	0.7825	0.7902	0.7980	0.8032	0.8083
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8391				
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)	
Hot water usage for baths	82.8453	81.6150	79.8824	76.6877	74.2956	71.6431	70.2104	71.9309	73.8042	76.6424	79.9029	82.5653	82.5653	82.5653	82.5653	(42b)	
Hot water usage for other uses	43.7048	42.1156	40.5263	38.9370	37.3478	35.7585	35.7585	37.3478	38.9370	40.5263	42.1156	43.7048	43.7048	43.7048	43.7048	(42c)	
Average daily hot water use (litres/day)																116.5423	(43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	126.5502	123.7305	120.4086	115.6247	111.6434	107.4016	105.9689	109.2787	112.7412	117.1687	122.0184	126.2701		
Energy content (annual)	200.4245	176.1906	185.0636	158.2845	150.2934	132.0628	128.1602	135.3098	139.0212	158.9969	173.8376	197.7084		
Distribution loss (46)m = 0.15 x (45)m	30.0637	26.4286	27.7595	23.7427	22.5440	19.8094	19.2240	20.2965	20.8532	23.8495	26.0756	29.6563		
Total													1935.3536	(45)

Water storage loss: 250.0000 (47)
 Store volume 2.1000 (48)

a) If manufacturer declared loss factor is known (kWh/day):
 Temperature factor from Table 2b 0.5400 (49)
 Enter (49) or (54) in (55) 1.1340 (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 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 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 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 (61)

Total heat required for water heating calculated for each month 258.8409 228.9538 243.4800 214.8165 208.7098 188.5948 186.5766 193.7262 195.5532 217.4133 230.3696 256.1248 (62)

WVHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 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 (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 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h 258.8409 228.9538 243.4800 214.8165 208.7098 188.5948 186.5766 193.7262 195.5532 217.4133 230.3696 256.1248 (64)
 Total per year (kWh/year) = Sum(64)m = 2623.1596 (64)

12Total per year (kWh/year) 2623 (64)
 Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month 113.3743 100.7939 108.2668 97.8552 96.7057 89.1365 89.3464 91.7236 91.4502 99.5996 103.0266 112.4712 (65)

Full SAP Calculation Printout



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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	152.3354	168.6570	152.3354	157.4132	152.3354	157.4132	152.3354	152.3354	157.4132	152.3354	157.4132	152.3354 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.8008	280.6835	273.4192	257.9543	238.4327	220.0851	207.8278	204.9451	212.2094	227.6743	247.1959	265.5435 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624 (71)
Water heating gains (Table 5)	152.3848	149.9910	145.5198	135.9100	129.9808	123.8007	120.0892	123.2845	127.0141	133.8704	143.0925	151.1709 (72)
Total internal gains	648.1069	664.9174	636.8603	616.8634	586.3347	566.8849	545.8383	546.1508	562.2227	579.4660	613.2876	634.6357 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North	4.2300	10.6334	0.5700	0.5700	0.7000	0.7700	12.4371 (74)					
East	1.0800	19.6403	0.5700	0.5700	0.7000	0.7700	5.8651 (76)					
South	4.7700	46.7521	0.5700	0.5700	0.7000	0.7700	61.6631 (78)					
West	0.5400	19.6403	0.5700	0.5700	0.7000	0.7700	2.9326 (80)					
South	5.8800	46.7521	0.5700	0.5700	0.7000	0.7700	76.0124 (78)					
North	0.6100	16.7973	0.5700	0.5700	0.7000	1.0000	3.6795 (82)					
Solar gains	162.5897	273.5048	368.9069	454.4552	511.1572	509.6092	490.3343	446.9021	397.9343	300.4775	194.0245	139.6595 (83)
Total gains	810.6966	938.4223	1005.7673	1071.3187	1097.4919	1076.4941	1036.1726	993.0529	960.1569	879.9435	807.3120	774.2952 (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)	26.9116	26.9969	27.0828	27.5202	27.6094	28.0642	28.0642	28.1570	27.8805	27.6094	27.4316	27.2561
alpha	2.7941	2.7998	2.8055	2.8347	2.8406	2.8709	2.8709	2.8771	2.8587	2.8406	2.8288	2.8171
util living area	0.9164	0.8795	0.8343	0.7518	0.6390	0.4891	0.3663	0.3949	0.5680	0.7672	0.8786	0.9242 (86)
Living	19.4467	19.6974	19.9911	20.3546	20.6295	20.8065	20.8650	20.8580	20.7527	20.4048	19.8861	19.4111
Non living	18.3898	18.7040	19.0707	19.5230	19.8489	20.0535	20.1098	20.1063	19.9956	19.5926	18.9531	18.3519
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	20.2054	19.6974	19.9911	20.3546	20.6295	20.8065	20.8650	20.8580	20.7527	20.4048	19.8861	19.6334 (87)
Th 2	20.2372	20.2394	20.2416	20.2528	20.2551	20.2663	20.2663	20.2686	20.2618	20.2551	20.2506	20.2461 (88)
util rest of house	0.9080	0.8680	0.8185	0.7282	0.6047	0.4422	0.3097	0.3377	0.5218	0.7404	0.8653	0.9166 (89)
MIT 2	19.5007	18.7040	19.0707	19.5230	19.8489	20.0535	20.1098	20.1063	19.9956	19.5926	18.9531	18.6932 (90)
Living area fraction									fLA = Living area / (4) =			0.3649 (91)
MIT	19.7578	19.0665	19.4065	19.8265	20.1337	20.3282	20.3854	20.3806	20.2719	19.8889	19.2935	19.0363 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7578	19.0665	19.4065	19.8265	20.1337	20.3282	20.3854	20.3806	20.2719	19.8889	19.2935	19.0363 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9022	0.8476	0.7989	0.7137	0.5988	0.4463	0.3191	0.3467	0.5225	0.7260	0.8454	0.9021 (94)
Ext temp.	731.3875	795.3786	803.4761	764.5883	657.2314	480.4193	330.6562	344.2548	501.6457	638.8010	682.5224	698.4910 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1448.3511	1323.1660	1201.6626	1001.1373	770.2427	514.6763	340.1121	356.4727	558.1911	848.3504	1120.8433	1372.5471 (97)
Space heating requirement - total per year (kWh/year)	533.4209	354.6731	296.2508	170.3153	84.0804	0.0000	0.0000	0.0000	0.0000	155.9048	315.5911	501.4977 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	533.4209	354.6731	296.2508	170.3153	84.0804	0.0000	0.0000	0.0000	0.0000	155.9048	315.5911	501.4977 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2411.7342
Space heating per m ²										(98c) / (4) =		21.0724 (99)

Full SAP Calculation Printout



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 %)													263.8415 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	533.4209	354.6731	296.2508	170.3153	84.0804	0.0000	0.0000	0.0000	0.0000	155.9048	315.5911	501.4977	(98)
Space heating efficiency (main heating system 1)	263.8415	263.8415	263.8415	263.8415	263.8415	0.0000	0.0000	0.0000	0.0000	263.8415	263.8415	263.8415	(210)
Space heating fuel (main heating system)	202.1747	134.4266	112.2836	64.5521	31.8678	0.0000	0.0000	0.0000	0.0000	59.0903	119.6139	190.0754	(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	258.8409	228.9538	243.4800	214.8165	208.7098	188.5948	186.5766	193.7262	195.5532	217.4133	230.3696	256.1248	(64)
Efficiency of water heater (217)m	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	(216)
Fuel for water heating, kWh/month	158.1964	139.9302	148.8082	131.2899	127.5577	115.2639	114.0304	118.4001	119.5167	132.8770	140.7955	156.5364	(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	26.2426	23.7030	26.2426	25.3960	26.2426	25.3960	26.2426	26.2426	25.3960	26.2426	25.3960	26.2426	(231)
Lighting	32.3855	25.9809	23.3929	17.1386	13.2384	10.8159	12.0765	15.6975	29.3895	26.7521	30.2164	33.2856	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-76.2218	-107.7085	-155.0718	-171.1965	-180.3760	-162.2314	-160.3508	-152.4199	-136.3157	-119.9694	-82.9561	-65.5545	(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	-36.4728	-80.3464	-165.2073	-258.0406	-349.9103	-359.1244	-354.1151	-297.0716	-215.7262	-120.4339	-50.7160	-28.7516	(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													914.0845 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													163.6200
Water heating fuel used													1603.2023 (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)													308.9849 (230a)
Total electricity for the above, kWh/year													308.9849 (231)
Electricity for lighting (calculated in Appendix L)													261.3695 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-3886.2886 (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													-798.6474 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	914.0845	0.1555	142.1599	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1603.2023	0.1408	225.7323	(264)
Space and water heating			367.8922	(265)
Pumps, fans and electric keep-hot	308.9849	0.1387	42.8600	(267)
Energy for lighting	261.3695	0.1443	37.7237	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1570.3724	0.1351	-212.1701	
PV Unit electricity exported	-2315.9163	0.1247	-288.8027	
Total			-500.9727	(269)
Total CO2, kg/year			-52.4969	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.4600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	914.0845	1.5757	1440.3496 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1603.2023	1.5206	2437.8704 (278)
Space and water heating			3878.2200 (279)
Pumps, fans and electric keep-hot	308.9849	1.5128	467.4323 (281)
Energy for lighting	261.3695	1.5338	400.8973 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1570.3724	1.4994	-2354.5791
PV Unit electricity exported	-2315.9163	0.4577	-1059.9692
Total			-3414.5483 (283)
Total Primary energy kWh/year			1332.0013 (286)
Dwelling Primary energy Rate (DPER)			11.6400 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	54.9500 (1b)	x 2.3600 (2b)	= 129.6820 (1b)
First floor	59.5000 (1c)	x 2.5500 (2c)	= 151.7250 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.4070 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1421 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3921 (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) = 0.3333 (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	0.4250	0.4167	0.4083	0.3667	0.3583	0.3167	0.3167	0.3083	0.3333	0.3583	0.3750	0.3917 (22b)
Effective ac	0.5903	0.5868	0.5834	0.5672	0.5642	0.5501	0.5501	0.5475	0.5556	0.5642	0.5703	0.5767 (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
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.20)			16.5000	1.1450	18.8931		(27)
RL			0.6100	1.5918	0.9710		(27a)
Heat Loss Floor 1			54.9500	0.1300	7.1435		(28a)

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External Wall 1	144.8500	18.6000	126.2500	0.1800	22.7250	(29a)
External Roof 1	51.9300		51.9300	0.1100	5.7123	(30)
Pitched Roof	9.2200	0.6100	8.6100	0.1100	0.9471	(30)
Total net area of external elements Aum(A, m2)			260.9500			(31)
Fabric heat loss, W/K = Sum (A x U)					58.4920	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 79.3145 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.1000	0.0500	0.6550
E3 Sill	12.1000	0.0500	0.6050
E4 Jamb	26.4000	0.0500	1.3200
E5 Ground floor (normal)	29.7800	0.1600	4.7648
E6 Intermediate floor within a dwelling	30.9800	0.0000	0.0000
R1 Head of roof window	0.7800	0.0800	0.0624
R2 Sill of roof window	0.7800	0.0600	0.0468
R3 Jamb of roof window	1.5600	0.0800	0.1248
E11 Eaves (insulation at rafter level)	8.7000	0.0400	0.3480
E12 Gable (insulation at ceiling level)	18.8000	0.0600	1.1280
E13 Gable (insulation at rafter level)	4.2400	0.0800	0.3392
E16 Corner (normal)	30.4000	0.0900	2.7360
R7 Flat ceiling (inverted)	3.6000	0.0400	0.1440
R9 Roof to wall (Flat ceiling)	5.2200	0.0400	0.2088

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.4828 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 70.9748 (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	54.8184	54.4927	54.1735	52.6743	52.3937	51.0879	51.0879	50.8461	51.5909	52.3937	52.9612	53.5545 (38)
Average = Sum(39)m / 12 =	125.7932	125.4675	125.1483	123.6491	123.3686	122.0627	122.0627	121.8209	122.5657	123.3686	123.9360	124.5293 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0991	1.0963	1.0935	1.0804	1.0779	1.0665	1.0665	1.0644	1.0709	1.0779	1.0829	1.0881 (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 2.8391 (42)

Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	82.8453	81.6150	79.8824	76.6877	74.2956	71.6431	70.2104	71.9309	73.8042	76.6424	79.9029	82.5653 (42b)	
Hot water usage for other uses	43.7048	42.1156	40.5263	38.9370	37.3478	35.7585	35.7585	37.3478	38.9370	40.5263	42.1156	43.7048 (42c)	
Average daily hot water use (litres/day)												116.5423 (43)	

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	126.5502	123.7305	120.4086	115.6247	111.6434	107.4016	105.9689	109.2787	112.7412	117.1687	122.0184	126.2701 (44)
Energy content (annual)	200.4245	176.1906	185.0636	158.2845	150.2934	132.0628	128.1602	135.3098	139.0212	158.9969	173.8376	197.7084 (45)
Distribution loss (46)m = 0.15 x (45)m	30.0637	26.4286	27.7595	23.7427	22.5440	19.8094	19.2240	20.2965	20.8532	23.8495	26.0756	29.6563 (46)
Water storage loss:												250.0000 (47)
Store volume												1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.0208 (55)
Enter (49) or (54) in (55)												
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	255.3313	225.7838	239.9704	211.4201	205.2002	185.1984	183.0670	190.2166	192.1568	213.9037	226.9732	252.6152 (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	255.3313	225.7838	239.9704	211.4201	205.2002	185.1984	183.0670	190.2166	192.1568	213.9037	226.9732	252.6152 (64)
Total per year (kWh/year) = Sum(64)m =												2581.8368 (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	110.5666	98.2580	105.4591	95.1381	93.8980	86.4194	86.5387	88.9159	88.7330	96.7919	100.3095	109.6635 (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
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(66)m	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	141.9530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	147.9974	163.8543	147.9974	152.9306	147.9974	152.9306	147.9974	147.9974	152.9306	147.9974	152.9306	147.9974	152.9306	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.8008	280.6835	273.4192	257.9543	238.4327	220.0851	207.8278	204.9451	212.2094	227.6743	247.1959	265.5435	265.5435	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	37.1953	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	-113.5624	(71)
Water heating gains (Table 5)	148.6110	146.2172	141.7461	132.1362	126.2070	120.0269	116.3155	119.5107	123.2403	130.0966	139.3187	147.3972	147.3972	(72)
Total internal gains	642.9951	659.3409	631.7486	611.6071	581.2230	558.6286	537.7266	538.0391	553.9663	574.3542	608.0312	629.5240	629.5240	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	4.2300	10.6334	0.6300	0.7000	0.7700	13.7462 (74)
East	1.0800	19.6403	0.6300	0.7000	0.7700	6.4825 (76)
South	10.6500	46.7521	0.6300	0.7000	0.7700	152.1676 (78)
West	0.5400	19.6403	0.6300	0.7000	0.7700	3.2413 (80)
North	0.6100	16.7973	0.6300	0.7000	1.0000	4.0668 (82)

Solar gains	179.7044	302.2948	407.7393	502.2926	564.9632	563.2522	541.9484	493.9444	439.8221	332.1067	214.4481	154.3604	154.3604	(83)
Total gains	822.6995	961.6357	1039.4878	1113.8997	1146.1862	1121.8808	1079.6750	1031.9835	993.7884	906.4610	822.4793	783.8844	783.8844	(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)	20.0451	20.0972	20.1484	20.3927	20.4391	20.6578	20.6578	20.6988	20.5730	20.4391	20.3455	20.2486
alpha	2.3363	2.3398	2.3432	2.3595	2.3626	2.3772	2.3772	2.3799	2.3715	2.3626	2.3564	2.3499
util living area	0.9288	0.8993	0.8630	0.7975	0.7030	0.5695	0.4449	0.4766	0.6449	0.8126	0.9001	0.9353 (86)
MIT	18.2241	18.5980	19.0899	19.7280	20.2844	20.7006	20.8807	20.8555	20.5697	19.8553	18.9463	18.1652 (87)
Th 2	20.0016	20.0039	20.0062	20.0169	20.0189	20.0283	20.0283	20.0300	20.0247	20.0189	20.0148	20.0106 (88)
util rest of house	0.9203	0.8876	0.8466	0.7721	0.6629	0.5074	0.3616	0.3939	0.5875	0.7840	0.8866	0.9276 (89)
MIT 2	16.7557	17.2252	17.8419	18.6351	19.3027	19.7762	19.9525	19.9336	19.6409	18.8057	17.6773	16.6865 (90)
Living area fraction	fLA = Living area / (4) =											0.3649 (91)
MIT	17.2915	17.7261	18.2973	19.0339	19.6609	20.1135	20.2912	20.2700	19.9798	19.1887	18.1404	17.2261 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2915	17.7261	18.2973	19.0339	19.6609	20.1135	20.2912	20.2700	19.9798	19.1887	18.1404	17.2261 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8888	0.8530	0.8117	0.7425	0.6467	0.5132	0.3852	0.4155	0.5846	0.7553	0.8532	0.8975 (94)	
Useful gains	731.2446	820.3127	843.7310	827.0307	741.2456	575.7730	415.8598	428.7393	580.9475	684.6059	701.7249	703.5086 (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	1634.2384	1609.2635	1476.4100	1253.0461	982.1243	672.9946	450.5533	471.4476	720.6643	1059.5747	1368.2991	1622.1258 (97)	
Space heating kWh	671.8274	530.1749	470.7132	306.7311	179.2137	0.0000	0.0000	0.0000	0.0000	278.9768	479.9334	683.4512 (98a)	
Space heating requirement - total per year (kWh/year)												3601.0218	
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	671.8274	530.1749	470.7132	306.7311	179.2137	0.0000	0.0000	0.0000	0.0000	278.9768	479.9334	683.4512 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												3601.0218	
Space heating per m2												(98c) / (4) =	31.4637 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	671.8274	530.1749	470.7132	306.7311	179.2137	0.0000	0.0000	0.0000	0.0000	278.9768	479.9334	683.4512 (98)

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Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	727.8737	574.4040	509.9818	332.3198	194.1644	0.0000	0.0000	0.0000	0.0000	0.0000	302.2500	519.9712	740.4672	(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	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	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	0.0000	(215)
Water heating														
Water heating requirement	255.3313	225.7838	239.9704	211.4201	205.2002	185.1984	183.0670	190.2166	192.1568	213.9037	226.9732	252.6152	79.8000	(64)
Efficiency of water heater	86.1250	85.9063	85.5424	84.8934	83.7575	79.8000	79.8000	79.8000	79.8000	84.6564	85.6968	86.1771	86.1771	(216)
Fuel for water heating, kWh/month	296.4659	262.8258	280.5281	249.0420	244.9931	232.0782	229.4073	238.3667	240.7980	252.6727	264.8563	293.1350		(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	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	30.7509	24.6695	22.2122	16.2736	12.5702	10.2700	11.4670	14.9052	19.3604	25.4018	28.6913	31.6056		(232)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-50.0703	-69.9056	-99.4940	-110.6903	-118.3190	-109.9993	-108.5732	-102.9720	-92.9819	-79.3236	-54.7773	-43.3638		(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	-30.3873	-63.6803	-126.1521	-188.8988	-249.2605	-250.3261	-247.4417	-209.7913	-154.1054	-90.9487	-40.5256	-24.0532		(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														3901.4321 (211)
Space heating fuel - main system 2														0.0000 (213)
Space heating fuel - secondary														0.0000 (215)
Efficiency of water heater														79.8000
Water heating fuel used														3085.1691 (219)
Space cooling fuel														0.0000 (221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year														86.0000 (231)
Electricity for lighting (calculated in Appendix L)														248.1777 (232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation														-2716.0414 (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														4604.7374 (238)

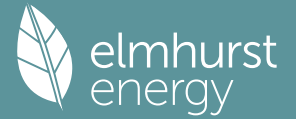
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3901.4321	0.2100	819.3007 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3085.1691	0.2100	647.8855 (264)
Space and water heating			1467.1862 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	248.1777	0.1443	35.8197 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1040.4703	0.1348	-140.2716
PV Unit electricity exported	-1675.5711	0.1260	-211.0875
Total			-351.3592 (269)
Total CO2, kg/year			1163.5760 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.1700 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3901.4321	1.1300	4408.6182 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3085.1691	1.1300	3486.2411 (278)
Space and water heating			7894.8593 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	248.1777	1.5338	380.6632 (282)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1040.4703	1.4983	-1558.9041
PV Unit electricity exported	-1675.5711	0.4624	-774.8419
Total			-2333.7460 (283)
Total Primary energy kWh/year			6071.8774 (286)
Target Primary Energy Rate (TPER)			53.0500 (287)

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)	tbc	17.64
Taps	tbc	7.90
Baths (shower(s) present)	tbc	19.80
Showers (bath(s) present)	tbc	34.96
Kitchen Taps	tbc	13.00
Washing Machines	default	17.16
Dishwasher	default	4.50



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