

OAKLAND ENERGY



ENERGY STATEMENT

Client: ALA ARCHITECTS

Project: 40 Vicarage Meadow
FOWEY, PL23 1EA

Contact: Sophie Oakland
email: sophie@oakland-energy.co.uk
phone: 07792070039

Report Issue Date: 25/09/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

INTRODUCTION

This report has been prepared by Oakland Energy LTD, under instruction from ALA Architects to accompany the planning application for 1no. New dwelling at 40 Vicarage Meadow, Fowey.

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.



EXCESSIVE GLAZING CALCULATIONS | SAP CALCULATIONS | WATER EFFICIENCY CALCULATIONS
ENERGY STATEMENTS | NEW BUILD & CONVERSION EPC | PART O ASSESSMENTS

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.

Oakland Energy LTD, Registered in England & Wales No. 11599703
Registered office - 8 Lodge Drive, Truro, Cornwall, TR1 1TX, UK.

t. 07792 070039
e. sophie@oakland-energy.co.uk
w. www.oakland-energy.co.uk



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: 157.63m²

FABRIC FIRST STRATEGY

- Wall U Value – 0.15W/m²K
- Roof U Value – 0.15W/m²K
- Floor U Value – 0.09W/m²K
- Glazing U Value – 1.10W/m²K
- Air permeability of 1.5 or lower.

HEATING STRATEGY

- Air Source Heat Pump

VENTILATION STRATEGY

- Mechanical ventilation with heat recovery

OVERHEATING MITIGATION

- Low g values
- Deep overhangs

RENEWABLE ENERGY

- Solar PV Panels – 6.5kW 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.

	DPD Policy kWh/m ² /yr	Proposed Dwelling kWh/m ² /yr
Space Heating Demand	<30	20.7
Predicted Total Energy Use	<40	33.3
Renewable Energy Generation	> Total Energy	34
Annual Renewable Energy Deficit		-110.10kWh/yr

The proposals are therefore compliant with the Climate Emergency DPD.

Report completed on 25th September 2023.

By Sophie Oakland - Accredited Assessor EES/011881.

Full SAP Calculation Printout



Property Reference	23.SAP.129 ALA		Issued on Date	24/09/2023	
Assessment Reference	DESIGN	Prop Type Ref			
Property	40 Vicarage Meadow, FOWEY, PL23 1EA				
SAP Rating	95 A	DER	-0.42	TER	10.06
Environmental	101 A	% DER < TER	104.17		
CO ₂ Emissions (t/year)	-0.22	DFEE	42.18	TFEE	46.45
Compliance Check	See BREL	% DFEE < TFEE	9.19		
% DPER < TPER	76.18	DPER	12.61	TPER	52.92
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	84.9800 (1b)	x 2.3900 (2b)	= 203.1022 (1b) -
First floor	72.6500 (1c)	x 3.3900 (2c)	= 246.2835 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	157.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 449.3857 (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		1.5000	(17)												
Infiltration rate		0.0750	(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) =	0.0638	(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	0.0813	0.0797	0.0781	0.0701	0.0685	0.0606	0.0606	0.0590	0.0638	0.0685	0.0717	0.0749	(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	0.1628	0.1612	0.1596	0.1516	0.1500	0.1421	0.1421	0.1405	0.1452	0.1500	0.1532	0.1564	(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)			13.0100	1.0536	13.7079		(27)
NEW PAT/ BIFOLD DOORS (Uw = 1.10)			18.5100	1.0536	19.5029		(27)

Full SAP Calculation Printout



DOOR			3.5600	1.1000	3.9160				(26)
SW RL			4.3900	1.0536	4.6255				(27a)
RL			1.6700	1.0536	1.7596				(27a)
Heat Loss Floor 1			84.9800	0.0900	7.6482	75.0000	6373.5000		(28a)
Heat Loss Floor 2			8.3600	0.1200	1.0032	20.0000	167.2000		(28b)
External Wall 1	188.8600	35.0800	153.7800	0.1500	23.0670	9.0000	1384.0200		(29a)
External Roof 1	109.9100	6.0600	103.8500	0.1500	15.5775	9.0000	934.6500		(30)
Total net area of external elements Aum(A, m2)			392.1100						(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.8077				(33)
Internal Wall 1			218.6400			9.0000	1967.7600		(32c)
Internal Floor 1			64.3000			18.0000	1157.4000		(32d)
Internal Ceiling 1			64.3000			9.0000	578.7000		(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12563.2300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 79.7008 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	21.3200	0.0430	0.9168
E3 Sill	19.6000	0.0340	0.6664
E4 Jamb	66.9800	0.0430	2.8801
E5 Ground floor (normal)	37.7500	0.0210	0.7928
E6 Intermediate floor within a dwelling	40.1500	0.0800	3.2120
E16 Corner (normal)	23.1200	0.0300	0.6936
R1 Head of roof window	2.7800	0.2400	0.6672
R2 Sill of roof window	2.7800	0.2400	0.6672
R3 Jamb of roof window	12.2000	0.2400	2.9280
E11 Eaves (insulation at rafter level)	28.5700	0.0310	0.8857
E13 Gable (insulation at rafter level)	22.7400	0.0240	0.5458
E17 Corner (inverted - internal area greater than external area)	2.3100	-0.0150	-0.0347
E20 Exposed floor (normal)	9.3600	0.3200	2.9952
E21 Exposed floor (inverted)	6.9700	0.3200	2.2304
R4 Ridge (vaulted ceiling)	10.4300	0.1200	1.2516

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.2980 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 112.1057 (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	24.1400	23.9037	23.6673	22.4856	22.2492	21.0675	21.0675	20.8311	21.5402	22.2492	22.7219	23.1946 (38)
Average = Sum(39)m / 12 =	136.2457	136.0094	135.7730	134.5913	134.3549	133.1732	133.1732	132.9368	133.6459	134.3549	134.8276	135.3003 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8643	0.8628	0.8613	0.8538	0.8523	0.8448	0.8448	0.8433	0.8478	0.8523	0.8553	0.8583 (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												2.9455 (42)
Hot water usage for mixer showers	73.6070	72.5008	70.8889	67.8048	65.5288	62.9907	61.5480	63.1477	64.9013	67.6265	70.7768	73.3250 (42a)
Hot water usage for baths	31.7766	31.3047	30.6401	29.4148	28.4973	27.4799	26.9303	27.5902	28.3088	29.3974	30.6480	31.6692 (42b)
Hot water usage for other uses	44.7954	43.1664	41.5375	39.9086	38.2797	36.6507	36.6507	38.2797	39.9086	41.5375	43.1664	44.7954 (42c)
Average daily hot water use (litres/day)												138.0482 (43)
Daily hot water use	150.1790	146.9720	143.0666	137.1282	132.3058	127.1213	125.1291	129.0176	133.1187	138.5614	144.5913	149.7895 (44)
Energy content (annual)	237.8468	209.2861	219.8880	187.7217	178.1090	156.3105	151.3328	159.7508	164.1486	188.0265	205.9968	234.5342 (45)
Distribution loss (46)m = 0.15 x (45)m	35.6770	31.3929	32.9832	28.1582	26.7163	23.4466	22.6999	23.9626	24.6223	28.2040	30.8995	35.1801 (46)
Water storage loss:												250.0000 (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	296.2632	262.0493	278.3044	244.2537	236.5254	212.8425	209.7492	218.1672	220.6806	246.4429	262.5288	292.9506 (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	296.2632	262.0493	278.3044	244.2537	236.5254	212.8425	209.7492	218.1672	220.6806	246.4429	262.5288	292.9506 (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	125.8172	111.7982	119.8459	107.6431	105.9544	97.1988	97.0513	99.8502	99.8050	109.2519	113.7195	124.7158 (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	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	130.5719	115.9728	94.3155	71.4029	53.3745	45.0610	48.6900	63.2891	84.9465	107.8591	125.8874	134.2009 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	490.6056	495.6966	482.8675	455.5560	421.0802	388.6778	367.0309	361.9400	374.7690	402.0805	436.5564	468.9588 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188 (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)	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219 (71)
Water heating gains (Table 5)	169.1091	166.3664	161.0832	149.5042	142.4118	134.9984	130.4452	134.2073	138.6181	146.8440	157.9438	167.6287 (72)
Total internal gains	904.8165	892.5656	852.7960	790.9929	731.3962	683.2669	660.6960	673.9662	712.8633	771.3134	834.9174	885.3182 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	2.7800	11.2829	0.5700	0.7000	0.7700	8.6731 (75)						
Southeast	6.9100	36.7938	0.5700	0.7000	0.7700	70.3006 (77)						
Southwest	1.2800	36.7938	0.5700	0.7000	0.7700	13.0224 (79)						
Northwest	2.0400	11.2829	0.5700	0.7000	0.7700	6.3644 (81)						
Southeast	6.6200	36.7938	0.5700	0.7000	0.7700	67.3502 (77)						
Southwest	4.2800	36.7938	0.5700	0.7000	0.7700	43.5437 (79)						
Northwest	7.6100	11.2829	0.5700	0.7000	0.7700	23.7418 (81)						
Northeast	1.6700	18.0708	0.5700	0.7000	1.0000	10.8370 (82)						
Southwest	4.3900	37.0308	0.5700	0.7000	1.0000	58.3772 (82)						
Solar gains	302.2104	543.3244	813.8144	1117.5342	1344.9818	1374.5635	1308.9937	1134.4291	918.8207	619.9978	367.3086	255.1091 (83)
Total gains	1207.0269	1435.8900	1666.6103	1908.5271	2076.3780	2057.8304	1969.6897	1808.3953	1631.6841	1391.3112	1202.2260	1140.4273 (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	25.6139	25.6584	25.7031	25.9288	25.9744	26.2049	26.2049	26.2515	26.1122	25.9744	25.8833	25.7929
alpha	2.7076	2.7106	2.7135	2.7286	2.7316	2.7470	2.7470	2.7501	2.7408	2.7316	2.7256	2.7195
util living area	0.9067	0.8614	0.7883	0.6715	0.5313	0.3918	0.2899	0.3266	0.5068	0.7336	0.8678	0.9173 (86)
Living	19.4159	19.6992	20.0703	20.4534	20.7047	20.8306	20.8697	20.8623	20.7688	20.4161	19.8485	19.3549
Non living	18.3218	18.6742	19.1310	19.5946	19.8830	20.0228	20.0592	20.0549	19.9620	19.5639	18.8716	18.2494
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	20.1897	19.6992	20.0703	20.4534	20.7047	20.8306	20.8697	20.8623	20.7688	20.4161	19.8485	19.5850 (87)
Th 2	20.1979	20.1992	20.2005	20.2069	20.2082	20.2146	20.2146	20.2159	20.2121	20.2082	20.2056	20.2031 (88)
util rest of house	0.8974	0.8483	0.7695	0.6446	0.4962	0.3487	0.2405	0.2743	0.4600	0.7040	0.8531	0.9088 (89)
MIT 2	19.4500	18.6742	19.1310	19.5946	19.8830	20.0228	20.0592	20.0549	19.9620	19.5639	18.8716	18.6015 (90)
Living area fraction									fLA = Living area / (4) =			0.3904 (91)
MIT	19.7388	19.0744	19.4977	19.9298	20.2038	20.3382	20.3756	20.3701	20.2770	19.8966	19.2530	18.9855 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7388	19.0744	19.4977	19.9298	20.2038	20.3382	20.3756	20.3701	20.2770	19.8966	19.2530	18.9855 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8914	0.8273	0.7513	0.6347	0.4960	0.3556	0.2508	0.2848	0.4640	0.6914	0.8327	0.8936 (94)
Useful gains	1075.9769	1187.9047	1252.0577	1211.2722	1029.9134	731.7726	493.9607	515.0119	757.1580	961.9821	1001.1103	1019.0784 (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	2103.4652	1927.8487	1764.7342	1484.5211	1142.5274	764.1721	502.8134	527.7767	825.5246	1249.0487	1638.5646	2000.4768 (97)
Space heating kWh	764.4513	497.2424	381.4313	196.7392	83.7848	0.0000	0.0000	0.0000	0.0000	213.5776	458.9671	730.1604 (98a)
Space heating requirement - total per year (kWh/year)												3326.3541
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	764.4513	497.2424	381.4313	196.7392	83.7848	0.0000	0.0000	0.0000	0.0000	213.5776	458.9671	730.1604 (98c)

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

3326.3541
 (98c) / (4) = 21.1023 (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 %) 333.8809 (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	764.4513	497.2424	381.4313	196.7392	83.7848	0.0000	0.0000	0.0000	0.0000	213.5776	458.9671	730.1604	(98)
Space heating efficiency (main heating system 1)	333.8809	333.8809	333.8809	333.8809	333.8809	0.0000	0.0000	0.0000	0.0000	333.8809	333.8809	333.8809	(210)
Space heating fuel (main heating system)	228.9592	148.9280	114.2417	58.9250	25.0942	0.0000	0.0000	0.0000	0.0000	63.9682	137.4643	218.6889	(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	296.2632	262.0493	278.3044	244.2537	236.5254	212.8425	209.7492	218.1672	220.6806	246.4429	262.5288	292.9506	(64)
Efficiency of water heater (217)m	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	(216)
Fuel for water heating, kWh/month	157.8702	139.6386	148.3004	130.1558	126.0376	113.4177	111.7693	116.2550	117.5944	131.3224	139.8941	156.1050	(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	56.0627	50.6373	56.0627	54.2543	56.0627	54.2543	56.0627	56.0627	54.2543	56.0627	54.2543	56.0627	(231)
Lighting	114.2889	91.6868	82.5538	60.4824	46.7184	38.1693	42.6181	55.3966	71.9547	94.4084	106.6341	117.4653	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-96.7465	-139.0639	-202.2791	-223.1777	-233.5979	-211.8606	-210.2674	-201.8121	-181.4105	-157.1369	-106.3823	-82.8197	(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	-46.5183	-106.5353	-230.5265	-373.3357	-514.2393	-527.0003	-517.3630	-427.3148	-300.3083	-161.0524	-64.9058	-36.1168	(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													996.2695 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													187.6625
Water heating fuel used													1588.3605 (219)
Space cooling fuel													0.0000 (221)

Electricity for pumps and fans:
 (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.2040)
 mechanical ventilation fans (SFP = 1.2040) 660.0937 (230a)
 Total electricity for the above, kWh/year 660.0937 (231)
 Electricity for lighting (calculated in Appendix L) 922.3765 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV generation -5351.7709 (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 -1184.6707 (238)

 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	996.2695	16.4900	164.2848	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1588.3605	16.4900	261.9206	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	660.0937	16.4900	108.8494	(249)
Energy for lighting	922.3765	16.4900	152.0999	(250)
Additional standing charges			0.0000	(251)

Energy saving/generation technologies

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PV Unit electricity used in dwelling	-2046.5544	16.4900	-337.4768
PV Unit electricity exported	-3305.2165	5.5900	-184.7616
Total			-522.2384 (252)
Total energy cost			164.9164 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.2930 (257)
SAP value		95.2505
SAP rating (Section 12)		95 (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	996.2695	0.1561	155.4696 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1588.3605	0.1409	223.8268 (264)
Space and water heating			379.2964 (265)
Pumps, fans and electric keep-hot	660.0937	0.1387	91.5631 (267)
Energy for lighting	922.3765	0.1443	133.1274 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2046.5544	0.1349	-276.1499
PV Unit electricity exported	-3305.2165	0.1240	-409.7016
Total			-685.8515 (269)
Total CO2, kg/year			-81.8645 (272)
CO2 emissions per m2			-0.5200 (273)
EI value			100.5414
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	84.9800 (1b)	x 2.3900 (2b)	= 203.1022 (1b) -
First floor	72.6500 (1c)	x 3.3900 (2c)	= 246.2835 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	157.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	449.3857 (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)+(7a)+(7b)+(7c) =	0.0000 / (5) =
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		1.5000 (17)
Infiltration rate		0.0750 (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) =	0.0638 (21)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	6.6000	6.2000	6.0000	5.4000	5.4000	4.7000	4.8000	4.7000	5.1000	6.0000	6.1000	6.7000	(22)
Wind factor	1.6500	1.5500	1.5000	1.3500	1.3500	1.1750	1.2000	1.1750	1.2750	1.5000	1.5250	1.6750	(22a)
Adj infilt rate	0.1052	0.0988	0.0956	0.0861	0.0861	0.0749	0.0765	0.0749	0.0813	0.0956	0.0972	0.1068	(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	0.1867	0.1803	0.1771	0.1676	0.1676	0.1564	0.1580	0.1564	0.1628	0.1771	0.1787	0.1883	(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 = 1.10)			13.0100	1.0536	13.7079			(27)
NEW PAT/ BIFOLD DOORS (Uw = 1.10)			18.5100	1.0536	19.5029			(27)
DOOR			3.5600	1.1000	3.9160			(26)
SW RL			4.3900	1.0536	4.6255			(27a)
RL			1.6700	1.0536	1.7596			(27a)
Heat Loss Floor 1			84.9800	0.0900	7.6482	75.0000	6373.5000	(28a)
Heat Loss Floor 2			8.3600	0.1200	1.0032	20.0000	167.2000	(28b)
External Wall 1	188.8600	35.0800	153.7800	0.1500	23.0670	9.0000	1384.0200	(29a)
External Roof 1	109.9100	6.0600	103.8500	0.1500	15.5775	9.0000	934.6500	(30)
Total net area of external elements Aum(A, m2)			392.1100					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	90.8077		(33)
Internal Wall 1			218.6400			9.0000	1967.7600	(32c)
Internal Floor 1			64.3000			18.0000	1157.4000	(32d)
Internal Ceiling 1			64.3000			9.0000	578.7000	(32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	12563.2300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								79.7008 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	21.3200	0.0430	0.9168
E3 Sill	19.6000	0.0340	0.6664
E4 Jamb	66.9800	0.0430	2.8801
E5 Ground floor (normal)	37.7500	0.0210	0.7928
E6 Intermediate floor within a dwelling	40.1500	0.0800	3.2120
E16 Corner (normal)	23.1200	0.0300	0.6936
R1 Head of roof window	2.7800	0.2400	0.6672
R2 Sill of roof window	2.7800	0.2400	0.6672
R3 Jamb of roof window	12.2000	0.2400	2.9280
E11 Eaves (insulation at rafter level)	28.5700	0.0310	0.8857
E13 Gable (insulation at rafter level)	22.7400	0.0240	0.5458
E17 Corner (inverted - internal area greater than external area)	2.3100	-0.0150	-0.0347
E20 Exposed floor (normal)	9.3600	0.3200	2.9952
E21 Exposed floor (inverted)	6.9700	0.3200	2.2304
R4 Ridge (vaulted ceiling)	10.4300	0.1200	1.2516

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

Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	112.1057 (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	27.6852	26.7399	26.2672	24.8491	24.8491	23.1946	23.4310	23.1946	24.1400	26.2672	26.5035	27.9216	(38)
Average = Sum(39)m / 12 =	139.7910	138.8456	138.3729	136.9548	136.9548	135.3003	135.5367	135.3003	136.2457	138.3729	138.6092	140.0273	(39)
													137.5260

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8868	0.8808	0.8778	0.8688	0.8688	0.8583	0.8598	0.8583	0.8643	0.8778	0.8793	0.8883	(40)
HLP (average)													0.8725
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9455 (42)
Hot water usage for mixer showers	73.6070	72.5008	70.8889	67.8048	65.5288	62.9907	61.5480	63.1477	64.9013	67.6265	70.7768	73.3250	(42a)
Hot water usage for baths	31.7766	31.3047	30.6401	29.4148	28.4973	27.4799	26.9303	27.5902	28.3088	29.3974	30.6480	31.6692	(42b)
Hot water usage for other uses	44.7954	43.1664	41.5375	39.9086	38.2797	36.6507	36.6507	38.2797	39.9086	41.5375	43.1664	44.7954	(42c)
Average daily hot water use (litres/day)													138.0482 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	150.1790	146.9720	143.0666	137.1282	132.3058	127.1213	125.1291	129.0176	133.1187	138.5614	144.5913	149.7895	(44)
Energy content (annual)	237.8468	209.2861	219.8880	187.7217	178.1090	156.3105	151.3328	159.7508	164.1486	188.0265	205.9968	234.5342	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2292.9517
Water storage loss:	35.6770	31.3929	32.9832	28.1582	26.7163	23.4466	22.6999	23.9626	24.6223	28.2040	30.8995	35.1801	(46)

Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1000 (48)

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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 (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	296.2632	262.0493	278.3044	244.2537	236.5254	212.8425	209.7492	218.1672	220.6806	246.4429	262.5288	292.9506 (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	296.2632	262.0493	278.3044	244.2537	236.5254	212.8425	209.7492	218.1672	220.6806	246.4429	262.5288	292.9506 (64)
	Total per year (kWh/year) = Sum(64)m =										2980.7577 (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	125.8172	111.7982	119.8459	107.6431	105.9544	97.1988	97.0513	99.8502	99.8050	109.2519	113.7195	124.7158 (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	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	130.5719	115.9728	94.3155	71.4029	53.3745	45.0610	48.6900	63.2891	84.9465	107.8591	125.8874	134.2009 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	490.6056	495.6966	482.8675	455.5560	421.0802	388.6778	367.0309	361.9400	374.7690	402.0805	436.5564	468.9588 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188 (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)	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219 (71)
Water heating gains (Table 5)	169.1091	166.3664	161.0832	149.5042	142.4118	134.9984	130.4452	134.2073	138.6181	146.8440	157.9438	167.6287 (72)
Total internal gains	904.8165	892.5656	852.7960	790.9929	731.3962	683.2669	660.6960	673.9662	712.8633	771.3134	834.9174	885.3182 (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
Northeast	2.7800	15.8738	0.5700	0.7000	0.7700	12.2020 (75)
Southeast	6.9100	48.3051	0.5700	0.7000	0.7700	92.2948 (77)
Southwest	1.2800	48.3051	0.5700	0.7000	0.7700	17.0966 (79)
Northwest	2.0400	15.8738	0.5700	0.7000	0.7700	8.9540 (81)
Southeast	6.6200	48.3051	0.5700	0.7000	0.7700	88.4214 (77)
Southwest	4.2800	48.3051	0.5700	0.7000	0.7700	57.1667 (79)
Northwest	7.6100	15.8738	0.5700	0.7000	0.7700	33.4020 (81)
Northeast	1.6700	25.7574	0.5700	0.7000	1.0000	15.4466 (82)
Southwest	4.3900	50.7647	0.5700	0.7000	1.0000	80.0280 (82)

Solar gains	405.0122	610.0704	894.7444	1263.6125	1435.7327	1584.4838	1347.6703	1267.0445	1049.2662	706.0680	472.3711	342.8050 (83)
Total gains	1309.8287	1502.6360	1747.5403	2054.6055	2167.1290	2267.7507	2008.3663	1941.0106	1762.1295	1477.3814	1307.2885	1228.1232 (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	24.9643	25.1343	25.2202	25.4813	25.4813	25.7929	25.7479	25.7929	25.6139	25.2202	25.1772	24.9222
alpha	2.6643	2.6756	2.6813	2.6988	2.6988	2.7195	2.7165	2.7195	2.7076	2.6813	2.6785	2.6615
util living area	0.8632	0.8220	0.7443	0.6270	0.5120	0.3641	0.3135	0.3169	0.4547	0.6592	0.8012	0.8720 (86)
Living	19.7623	19.9405	20.2346	20.5301	20.7166	20.8372	20.8611	20.8612	20.7987	20.5668	20.1749	19.7542
Non living	18.7421	18.9626	19.3192	19.6716	19.8824	20.0167	20.0388	20.0405	19.9778	19.7201	19.2577	18.7332
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	20.3669	19.9405	20.2346	20.5301	20.7166	20.8372	20.8611	20.8612	20.7987	20.5668	20.1749	19.9285 (87)
Th 2	20.1787	20.1838	20.1864	20.1941	20.1941	20.2031	20.2018	20.2031	20.1979	20.1864	20.1851	20.1774 (88)
util rest of house	0.8486	0.8046	0.7213	0.5979	0.4761	0.3228	0.2644	0.2663	0.4062	0.6212	0.7780	0.8577 (89)
MIT 2	19.6060	18.9626	19.3192	19.6716	19.8824	20.0167	20.0388	20.0405	19.9778	19.7201	19.2577	18.9935 (90)
Living area fraction	fLA = Living area / (4) =										0.3904 (91)	
MIT	19.9030	19.3444	19.6766	20.0068	20.2081	20.3370	20.3599	20.3609	20.2983	20.0507	19.6158	19.3585 (92)
Temperature adjustment											0.0000	

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adjusted MIT 19.9030 19.3444 19.6766 20.0068 20.2081 20.3370 20.3599 20.3609 20.2983 20.0507 19.6158 19.3585 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8433	0.7844	0.7056	0.5907	0.4768	0.3299	0.2743	0.2765	0.4124	0.6144	0.7599	0.8414	(94)
Useful gains	1104.5888	1178.6599	1233.0954	1213.7365	1033.2012	748.0428	550.8356	536.5958	726.7858	907.7368	993.4135	1033.3115	(95)
Ext temp.	6.4000	6.6000	7.8000	9.5000	11.9000	14.6000	16.2000	16.3000	14.6000	12.1000	9.3000	6.8000	(96)
Heat loss rate W	1887.6014	1769.4989	1643.3975	1438.9507	1137.8284	776.2209	563.8128	549.4428	776.3628	1100.1589	1429.8627	1758.5318	(97)
Space heating kWh	582.5613	397.0438	305.2648	162.1542	77.8426	0.0000	0.0000	0.0000	0.0000	143.1621	314.2434	539.5639	(98a)
Space heating requirement - total per year (kWh/year)												2521.8362	
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	582.5613	397.0438	305.2648	162.1542	77.8426	0.0000	0.0000	0.0000	0.0000	143.1621	314.2434	539.5639	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2521.8362	
Space heating per m2												15.9985	(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 %)													334.6203	(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	582.5613	397.0438	305.2648	162.1542	77.8426	0.0000	0.0000	0.0000	0.0000	143.1621	314.2434	539.5639	(98)	
Space heating efficiency (main heating system 1)	334.6203	334.6203	334.6203	334.6203	334.6203	0.0000	0.0000	0.0000	0.0000	334.6203	334.6203	334.6203	(210)	
Space heating fuel (main heating system)	174.0962	118.6550	91.2272	48.4592	23.2630	0.0000	0.0000	0.0000	0.0000	42.7834	93.9104	161.2466	(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	296.2632	262.0493	278.3044	244.2537	236.5254	212.8425	209.7492	218.1672	220.6806	246.4429	262.5288	292.9506	(64)	
Efficiency of water heater (217)m	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047	(216)	
Fuel for water heating, kWh/month	157.8347	139.6072	148.2671	130.1265	126.0093	113.3922	111.7442	116.2289	117.5679	131.2929	139.8626	156.0699	(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	56.0627	50.6373	56.0627	54.2543	56.0627	54.2543	56.0627	56.0627	54.2543	56.0627	54.2543	56.0627	(231)	
Lighting	114.2889	91.6868	82.5538	60.4824	46.7184	38.1693	42.6181	55.3966	71.9547	94.4084	106.6341	117.4653	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-122.0564	-151.0114	-213.1575	-235.2238	-239.1890	-222.1223	-212.3650	-211.1602	-194.3080	-170.1627	-128.0764	-105.3118	(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	-74.3421	-130.2894	-268.9835	-442.4374	-558.6768	-627.7025	-535.6095	-493.0424	-361.1584	-198.6620	-97.1144	-58.2480	(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													753.6411	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													187.7047	
Water heating fuel used													1588.0034	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.2040) mechanical ventilation fans (SFP = 1.2040)													660.0937	(230a)
Total electricity for the above, kWh/year													660.0937	(231)
Electricity for lighting (calculated in Appendix L)													922.3765	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-6050.4110	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)

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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	-2126.2963 (238)

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	753.6411	21.5100	162.1082 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1588.0034	21.5100	341.5795 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	660.0937	21.5100	141.9861 (249)
Energy for lighting	922.3765	21.5100	198.4032 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2204.1446	21.5100	-474.1115
PV Unit electricity exported	-3846.2664	5.5900	-215.0063
Total			-689.1178 (252)
Total energy cost			154.9593 (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	753.6411	0.1560	117.6029 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1588.0034	0.1409	223.7765 (264)
Space and water heating			341.3793 (265)
Pumps, fans and electric keep-hot	660.0937	0.1387	91.5631 (267)
Energy for lighting	922.3765	0.1443	133.1274 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2204.1446	0.1357	-299.1103
PV Unit electricity exported	-3846.2664	0.1255	-482.8558
Total			-781.9661 (269)
Total CO2, kg/year			-215.8962 (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	753.6411	1.5777	1188.9968 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1588.0034	1.5211	2415.4490 (278)
Space and water heating			3604.4458 (279)
Pumps, fans and electric keep-hot	660.0937	1.5128	998.5897 (281)
Energy for lighting	922.3765	1.5338	1414.7719 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2204.1446	1.5016	-3309.7155
PV Unit electricity exported	-3846.2664	0.4608	-1772.4669
Total			-5082.1825 (283)
Total Primary energy kWh/year			935.6250 (286)

SAP 10 EPC IMPROVEMENTS

DESIGN

Current energy efficiency rating:	A 95
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	+ 1.2	-£ 63	-44 kg (20.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£63	0.28 kg/m ²	A 96
Total Savings	£63	0.28 kg/m ²	A 101

Potential energy efficiency rating: A 96
 Potential environmental impact rating: A 101

Fuel prices for cost data on this page from database revision number 526 TEST (30 Aug 2023)
 Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £844	Potential £767	Saving £77
Electricity			
Space heating	£304	£321	-£17
Water heating	£342	£247	£94
Lighting	£198	£198	£0
Generated (PV)	-£689	-£675	-£14
Total cost of fuels	£155	£92	£63
Total cost of uses	£155	£91	£63
Delivered energy	-13 kWh/m ²	-16 kWh/m ²	2 kWh/m ²
Carbon dioxide emissions	-0.2 tonnes	-0.3 tonnes	0.0 tonnes
CO2 emissions per m ²	-1 kg/m ²	-2 kg/m ²	0 kg/m ²
Primary energy	6 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	84.9800 (1b)	x 2.3900 (2b)	= 203.1022 (1b)
First floor	72.6500 (1c)	x 3.3900 (2c)	= 246.2835 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	157.6300		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 449.3857 (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		1.5000 (17)
Infiltration rate		0.0750 (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) =	0.0638 (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	0.0813	0.0797	0.0781	0.0701	0.0685	0.0606	0.0606	0.0590	0.0638	0.0685	0.0717	0.0749 (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	0.1628	0.1612	0.1596	0.1516	0.1500	0.1421	0.1421	0.1405	0.1452	0.1500	0.1532	0.1564 (25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
NEW WINDOWS (Uw = 1.10)			13.0100	1.0536	13.7079		(27)
NEW PAT/ BIFOLD DOORS (Uw = 1.10)			18.5100	1.0536	19.5029		(27)
DOOR			3.5600	1.1000	3.9160		(26)
SW RL			4.3900	1.0536	4.6255		(27a)
RL			1.6700	1.0536	1.7596		(27a)
Heat Loss Floor 1			84.9800	0.0900	7.6482	75.0000	6373.5000 (28a)
Heat Loss Floor 2			8.3600	0.1200	1.0032	20.0000	167.2000 (28b)
External Wall 1	188.8600	35.0800	153.7800	0.1500	23.0670	9.0000	1384.0200 (29a)
External Roof 1	109.9100	6.0600	103.8500	0.1500	15.5775	9.0000	934.6500 (30)
Total net area of external elements Aum(A, m2)			392.1100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	90.8077		(33)
Internal Wall 1			218.6400			9.0000	1967.7600 (32c)
Internal Floor 1			64.3000			18.0000	1157.4000 (32d)
Internal Ceiling 1			64.3000			9.0000	578.7000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12563.2300 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 79.7008 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	21.3200	0.0430	0.9168
E3 Sill	19.6000	0.0340	0.6664
E4 Jamb	66.9800	0.0430	2.8801
E5 Ground floor (normal)	37.7500	0.0210	0.7928
E6 Intermediate floor within a dwelling	40.1500	0.0800	3.2120
E16 Corner (normal)	23.1200	0.0300	0.6936
R1 Head of roof window	2.7800	0.2400	0.6672
R2 Sill of roof window	2.7800	0.2400	0.6672
R3 Jamb of roof window	12.2000	0.2400	2.9280
E11 Eaves (insulation at rafter level)	28.5700	0.0310	0.8857
E13 Gable (insulation at rafter level)	22.7400	0.0240	0.5458
E17 Corner (inverted - internal area greater than external area)	2.3100	-0.0150	-0.0347
E20 Exposed floor (normal)	9.3600	0.3200	2.9952
E21 Exposed floor (inverted)	6.9700	0.3200	2.2304
R4 Ridge (vaulted ceiling)	10.4300	0.1200	1.2516

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.2980 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 112.1057 (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	24.1400	23.9037	23.6673	22.4856	22.2492	21.0675	21.0675	20.8311	21.5402	22.2492	22.7219	23.1946 (38)
Average = Sum(39)m / 12 =	136.2457	136.0094	135.7730	134.5913	134.3549	133.1732	133.1732	132.9368	133.6459	134.3549	134.8276	135.3003 (39)
												134.5322

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8643	0.8628	0.8613	0.8538	0.8523	0.8448	0.8448	0.8433	0.8478	0.8523	0.8553	0.8583 (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 2.9455 (42)

Hot water usage for mixer showers 73.6070 72.5008 70.8889 67.8048 65.5288 62.9907 61.5480 63.1477 64.9013 67.6265 70.7768 73.3250 (42a)

Hot water usage for baths 31.7766 31.3047 30.6401 29.4148 28.4973 27.4799 26.9303 27.5902 28.3088 29.3974 30.6480 31.6692 (42b)

Hot water usage for other uses 44.7954 43.1664 41.5375 39.9086 38.2797 36.6507 36.6507 38.2797 39.9086 41.5375 43.1664 44.7954 (42c)

Average daily hot water use (litres/day) 138.0482 (43)

Daily hot water use 150.1790 146.9720 143.0666 137.1282 132.3058 127.1213 125.1291 129.0176 133.1187 138.5614 144.5913 149.7895 (44)

Energy conte 237.8468 209.2861 219.8880 187.7217 178.1090 156.3105 151.3328 159.7508 164.1486 188.0265 205.9968 234.5342 (45)

Energy content (annual) Total = Sum(45)m = 2292.9517

Distribution loss (46)m = 0.15 x (45)m 35.6770 31.3929 32.9832 28.1582 26.7163 23.4466 22.6999 23.9626 24.6223 28.2040 30.8995 35.1801 (46)

Water storage loss: Store volume 250.0000 (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 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 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 296.2632 262.0493 276.9086 237.5001 223.7311 200.2357 196.7222 206.0707 215.2777 245.0472 262.5288 292.9506 (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)

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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												634.9162 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												634.9162
Solar input	-0.0000	-16.1901	-58.9683	-81.6177	-107.3845	-99.1424	-98.5148	-85.6953	-58.6360	-28.7671	-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	296.2632	245.8592	217.9403	155.8824	116.3466	101.0934	98.2075	120.3754	156.6417	216.2801	262.5288	292.9506 (64)
	Total per year (kWh/year) = Sum(64)m =											2280.3691 (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	125.8172	111.7982	118.7293	102.2402	95.7189	87.1135	86.6297	90.1731	95.4827	108.1354	113.7195	124.7158 (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	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	130.5719	115.9728	94.3155	71.4029	53.3745	45.0610	48.6900	63.2891	84.9465	107.8591	125.8874	134.2009 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	490.6056	495.6966	482.8675	455.5560	421.0802	388.6778	367.0309	361.9400	374.7690	402.0805	436.5564	468.9588 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188 (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)	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219 (71)
Water heating gains (Table 5)	169.1091	166.3664	159.5824	142.0002	128.6544	120.9909	116.4378	121.2004	132.6149	145.3432	157.9438	167.6287 (72)
Total internal gains	904.8165	892.5656	851.2952	783.4889	717.6389	669.2594	646.6885	660.9592	706.8601	769.8126	834.9174	885.3182 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	or Table 6b	Specific data	factor	W
		W/m2		or Table 6c	Table 6d	
Northeast	2.7800	11.2829	0.5700	0.7000	0.7700	8.6731 (75)
Southeast	6.9100	36.7938	0.5700	0.7000	0.7700	70.3006 (77)
Southwest	1.2800	36.7938	0.5700	0.7000	0.7700	13.0224 (79)
Northwest	2.0400	11.2829	0.5700	0.7000	0.7700	6.3644 (81)
Southeast	6.6200	36.7938	0.5700	0.7000	0.7700	67.3502 (77)
Southwest	4.2800	36.7938	0.5700	0.7000	0.7700	43.5437 (79)
Northwest	7.6100	11.2829	0.5700	0.7000	0.7700	23.7418 (81)
Northeast	1.6700	18.0708	0.5700	0.7000	1.0000	10.8370 (82)
Southwest	4.3900	37.0308	0.5700	0.7000	1.0000	58.3772 (82)

Solar gains	302.2104	543.3244	813.8144	1117.5342	1344.9818	1374.5635	1308.9937	1134.4291	918.8207	619.9978	367.3086	255.1091 (83)
Total gains	1207.0269	1435.8900	1665.1095	1901.0231	2062.6207	2043.8229	1955.6822	1795.3884	1625.6809	1389.8104	1202.2260	1140.4273 (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, n11,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	25.6139	25.6584	25.7031	25.9288	25.9744	26.2049	26.2049	26.2515	26.1122	25.9744	25.8833	25.7929
alpha	2.7076	2.7106	2.7135	2.7286	2.7316	2.7470	2.7470	2.7501	2.7408	2.7316	2.7256	2.7195
util living area	0.9067	0.8614	0.7886	0.6730	0.5340	0.3942	0.2919	0.3288	0.5083	0.7340	0.8678	0.9173 (86)
Living	19.4159	19.6992	20.0694	20.4507	20.7024	20.8297	20.8694	20.8619	20.7679	20.4155	19.8485	19.3549
Non living	18.3218	18.6742	19.1299	19.5916	19.8806	20.0221	20.0590	20.0546	19.9612	19.5631	18.8716	18.2494
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	20.1897	19.6992	20.0694	20.4507	20.7024	20.8297	20.8694	20.8619	20.7679	20.4155	19.8485	19.5850 (87)
Th 2	20.1979	20.1992	20.2005	20.2069	20.2082	20.2146	20.2146	20.2159	20.2121	20.2082	20.2056	20.2031 (88)
util rest of house	0.8974	0.8483	0.7698	0.6462	0.4988	0.3508	0.2422	0.2762	0.4614	0.7045	0.8531	0.9088 (89)
MIT 2	19.4500	18.6742	19.1299	19.5916	19.8806	20.0221	20.0590	20.0546	19.9612	19.5631	18.8716	18.6015 (90)
Living area fraction									fLA = Living area / (4) =			0.3904 (91)
MIT	19.7388	19.0744	19.4967	19.9270	20.2015	20.3374	20.3754	20.3698	20.2761	19.8959	19.2530	18.9855 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7388	19.0744	19.4967	19.9270	20.2015	20.3374	20.3754	20.3698	20.2761	19.8959	19.2530	18.9855 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8914	0.8273	0.7516	0.6361	0.4985	0.3578	0.2525	0.2867	0.4654	0.6918	0.8327	0.8936	(94)
Useful gains	1075.9769	1187.9047	1251.4153	1209.3179	1028.2180	731.1795	493.7742	514.7471	756.5615	961.4798	1001.1103	1019.0784	(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	2103.4652	1927.8487	1764.6027	1484.1397	1142.2126	764.0654	502.7793	527.7285	825.4143	1248.9483	1638.5646	2000.4768	(97)
Space heating kWh	764.4513	497.2424	381.8114	197.8717	84.8120	0.0000	0.0000	0.0000	0.0000	213.8766	458.9671	730.1604	(98a)
Space heating requirement - total per year (kWh/year)												3329.1929	
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	764.4513	497.2424	381.8114	197.8717	84.8120	0.0000	0.0000	0.0000	0.0000	213.8766	458.9671	730.1604	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3329.1929	
Space heating per m2												21.1203	(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 %)													333.8809 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	764.4513	497.2424	381.8114	197.8717	84.8120	0.0000	0.0000	0.0000	0.0000	213.8766	458.9671	730.1604	(98)
Space heating efficiency (main heating system 1)	333.8809	333.8809	333.8809	333.8809	333.8809	0.0000	0.0000	0.0000	0.0000	333.8809	333.8809	333.8809	(210)
Space heating fuel (main heating system)	228.9592	148.9280	114.3555	59.2641	25.4019	0.0000	0.0000	0.0000	0.0000	64.0578	137.4643	218.6889	(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	296.2632	245.8592	217.9403	155.8824	116.3466	101.0934	98.2075	120.3754	156.6417	216.2801	262.5288	292.9506	(64)
Efficiency of water heater	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	187.6625	(216)
Fuel for water heating, kWh/month	157.8702	131.0114	116.1342	83.0653	61.9978	53.8698	52.3319	64.1446	83.4699	115.2495	139.8941	156.1050	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	62.8573	56.7743	62.8573	60.8296	62.8573	60.8296	62.8573	62.8573	60.8296	62.8573	60.8296	62.8573	(231)
Lighting	114.2889	91.6868	82.5538	60.4824	46.7184	38.1693	42.6181	55.3966	71.9547	94.4084	106.6341	117.4653	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-96.8860	-138.9347	-199.6829	-216.0228	-219.4670	-196.9526	-195.6085	-191.0673	-176.5934	-156.3462	-106.6020	-82.9327	(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	-46.3788	-106.6644	-233.1226	-380.4906	-528.3702	-541.9083	-532.0219	-438.0596	-305.1254	-161.8431	-64.6861	-36.0038	(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													997.1198 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													187.6625
Water heating fuel used													1215.1435 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.2040)													
mechanical ventilation fans (SFP = 1.2040)													660.0937 (230a)
pump for solar water heating													80.0000 (230g)
Total electricity for the above, kWh/year													740.0937 (231)
Electricity for lighting (calculated in Appendix L)													922.3765 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-5351.7709 (233)
Wind generation													0.0000 (234)
Hydro-electric generation (Appendix N)													0.0000 (235a)

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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	-1477.0375 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	997.1198	16.4900	164.4251 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1215.1435	16.4900	200.3772 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	660.0937	16.4900	108.8494 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	922.3765	16.4900	152.0999 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1977.0962	16.4900	-326.0232
PV Unit electricity exported	-3374.6747	5.5900	-188.6443
Total			-514.6675 (252)
Total energy cost			124.2761 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.2208 (257)
SAP value		96.4209
SAP rating (Section 12)		96 (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	997.1198	0.1560	155.5883 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1215.1435	0.1452	176.4090 (264)
Space and water heating			331.9973 (265)
Pumps, fans and electric keep-hot	740.0937	0.1387	102.6601 (267)
Energy for lighting	922.3765	0.1443	133.1274 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1977.0962	0.1354	-267.6032
PV Unit electricity exported	-3374.6747	0.1237	-417.5784
Total			-685.1816 (269)
Total CO2, kg/year			-117.3967 (272)
CO2 emissions per m2			-0.7400 (273)
EI value			100.7763
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	84.9800 (1b)	x 2.3900 (2b)	= 203.1022 (1b) -
First floor	72.6500 (1c)	x 3.3900 (2c)	= 246.2835 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	157.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	449.3857 (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 1.5000 (17)
 Infiltration rate 0.0750 (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) = 0.0638 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.6000	6.2000	6.0000	5.4000	5.4000	4.7000	4.8000	4.7000	5.1000	6.0000	6.1000	6.7000 (22)
Wind factor	1.6500	1.5500	1.5000	1.3500	1.3500	1.1750	1.2000	1.1750	1.2750	1.5000	1.5250	1.6750 (22a)
Adj infilt rate	0.1052	0.0988	0.0956	0.0861	0.0861	0.0749	0.0765	0.0749	0.0813	0.0956	0.0972	0.1068 (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	0.1867	0.1803	0.1771	0.1676	0.1676	0.1564	0.1580	0.1564	0.1628	0.1771	0.1787	0.1883 (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 = 1.10)			13.0100	1.0536	13.7079		(27)
NEW PAT/ BIFOLD DOORS (Uw = 1.10)			18.5100	1.0536	19.5029		(27)
DOOR			3.5600	1.1000	3.9160		(26)
SW RL			4.3900	1.0536	4.6255		(27a)
RL			1.6700	1.0536	1.7596		(27a)
Heat Loss Floor 1			84.9800	0.0900	7.6482	75.0000	6373.5000 (28a)
Heat Loss Floor 2			8.3600	0.1200	1.0032	20.0000	167.2000 (28b)
External Wall 1	188.8600	35.0800	153.7800	0.1500	23.0670	9.0000	1384.0200 (29a)
External Roof 1	109.9100	6.0600	103.8500	0.1500	15.5775	9.0000	934.6500 (30)
Total net area of external elements Aum(A, m2)			392.1100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 90.8077		(33)
Internal Wall 1			218.6400			9.0000	1967.7600 (32c)
Internal Floor 1			64.3000			18.0000	1157.4000 (32d)
Internal Ceiling 1			64.3000			9.0000	578.7000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12563.2300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 79.7008 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	21.3200	0.0430	0.9168
E3 Sill	19.6000	0.0340	0.6664
E4 Jamb	66.9800	0.0430	2.8801
E5 Ground floor (normal)	37.7500	0.0210	0.7928
E6 Intermediate floor within a dwelling	40.1500	0.0800	3.2120
E16 Corner (normal)	23.1200	0.0300	0.6936
R1 Head of roof window	2.7800	0.2400	0.6672
R2 Sill of roof window	2.7800	0.2400	0.6672
R3 Jamb of roof window	12.2000	0.2400	2.9280
E11 Eaves (insulation at rafter level)	28.5700	0.0310	0.8857
E13 Gable (insulation at rafter level)	22.7400	0.0240	0.5458
E17 Corner (inverted - internal area greater than external area)	2.3100	-0.0150	-0.0347
E20 Exposed floor (normal)	9.3600	0.3200	2.9952
E21 Exposed floor (inverted)	6.9700	0.3200	2.2304
R4 Ridge (vaulted ceiling)	10.4300	0.1200	1.2516

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.2980 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 112.1057 (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	27.6852	26.7399	26.2672	24.8491	24.8491	23.1946	23.4310	23.1946	24.1400	26.2672	26.5035	27.9216 (38)
Average = Sum(39)m / 12 =	139.7910	138.8456	138.3729	136.9548	136.9548	135.3003	135.5367	135.3003	136.2457	138.3729	138.6092	140.0273 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8868	0.8808	0.8778	0.8688	0.8688	0.8583	0.8598	0.8583	0.8643	0.8778	0.8793	0.8883 (40)
HLP (average)												0.8725
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.9455 (42)
Hot water usage for mixer showers	73.6070	72.5008	70.8889	67.8048	65.5288	62.9907	61.5480	63.1477	64.9013	67.6265	70.7768	73.3250 (42a)
Hot water usage for baths	31.7766	31.3047	30.6401	29.4148	28.4973	27.4799	26.9303	27.5902	28.3088	29.3974	30.6480	31.6692 (42b)
Hot water usage for other uses	44.7954	43.1664	41.5375	39.9086	38.2797	36.6507	36.6507	38.2797	39.9086	41.5375	43.1664	44.7954 (42c)
Average daily hot water use (litres/day)												138.0482 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	150.1790	146.9720	143.0666	137.1282	132.3058	127.1213	125.1291	129.0176	133.1187	138.5614	144.5913	149.7895 (44)
Energy content (annual)	237.8468	209.2861	219.8880	187.7217	178.1090	156.3105	151.3328	159.7508	164.1486	188.0265	205.9968	234.5342 (45)
Distribution loss (46)m = 0.15 x (45)m												2292.9517
Distribution loss	35.6770	31.3929	32.9832	28.1582	26.7163	23.4466	22.6999	23.9626	24.6223	28.2040	30.8995	35.1801 (46)
Water storage loss:												250.0000 (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	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	296.2632	262.0493	276.9086	237.5001	223.7311	200.2357	196.7222	206.0707	215.2777	245.0472	262.5288	292.9506 (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												757.0979 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												757.0979
Solar input	-8.6788	-25.6425	-70.5899	-96.3930	-115.3766	-115.4444	-100.8661	-97.8011	-72.5018	-41.4920	-12.3117	-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	287.5844	236.4068	206.3188	141.1071	108.3545	84.7914	95.8561	108.2696	142.7760	203.5552	250.2170	292.9506 (64)
Total per year (kWh/year) = Sum(64)m =												2158.1874 (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	125.8172	111.7982	118.7293	102.2402	95.7189	87.1135	86.6297	90.1731	95.4827	108.1354	113.7195	124.7158 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329	176.7329 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	130.5719	115.9728	94.3155	71.4029	53.3745	45.0610	48.6900	63.2891	84.9465	107.8591	125.8874	134.2009 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	490.6056	495.6966	482.8675	455.5560	421.0802	388.6778	367.0309	361.9400	374.7690	402.0805	436.5564	468.9588 (68)
Pumps, fans	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188	55.6188 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219	-117.8219 (71)
Total internal gains	169.1091	166.3664	159.5824	142.0002	128.6544	120.9909	116.4378	121.2004	132.6149	145.3432	157.9438	167.6287 (72)
	904.8165	892.5656	851.2952	783.4889	717.6389	669.2594	646.6885	660.9592	706.8601	769.8126	834.9174	885.3182 (73)

6. Solar gains						
[Jan]	Area	Solar flux	Specific data	FF	Access	Gains
	m2	Table 6a	g	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
Northeast	2.7800	15.8738	0.5700	0.7000	0.7700	12.2020 (75)

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Southeast			6.9100		48.3051		0.5700		0.7000		0.7700		92.2948 (77)
Southwest			1.2800		48.3051		0.5700		0.7000		0.7700		17.0966 (79)
Northwest			2.0400		15.8738		0.5700		0.7000		0.7700		8.9540 (81)
Southeast			6.6200		48.3051		0.5700		0.7000		0.7700		88.4214 (77)
Southwest			4.2800		48.3051		0.5700		0.7000		0.7700		57.1667 (79)
Northwest			7.6100		15.8738		0.5700		0.7000		0.7700		33.4020 (81)
Northeast			1.6700		25.7574		0.5700		0.7000		1.0000		15.4466 (82)
Southwest			4.3900		50.7647		0.5700		0.7000		1.0000		80.0280 (82)

Solar gains	405.0122	610.0704	894.7444	1263.6125	1435.7327	1584.4838	1347.6703	1267.0445	1049.2662	706.0680	472.3711	342.8050 (83)
Total gains	1309.8287	1502.6360	1746.0395	2047.1015	2153.3716	2253.7432	1994.3588	1928.0037	1756.1263	1475.8806	1307.2885	1228.1232 (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	24.9643	25.1343	25.2202	25.4813	25.4813	25.7929	25.7479	25.7929	25.6139	25.2202	25.1772	24.9222	
alpha	2.6643	2.6756	2.6813	2.6988	2.6988	2.7195	2.7165	2.7195	2.7076	2.6813	2.6785	2.6615	
util living area	0.8632	0.8220	0.7446	0.6285	0.5145	0.3662	0.3156	0.3188	0.4559	0.6596	0.8012	0.8720 (86)	
Living	19.7623	19.9405	20.2339	20.5280	20.7146	20.8365	20.8607	20.8608	20.7981	20.5663	20.1749	19.7542	
Non living	18.7421	18.9626	19.3184	19.6692	19.8803	20.0161	20.0385	20.0402	19.9772	19.7196	19.2577	18.7332	
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	20.3669	19.9405	20.2339	20.5280	20.7146	20.8365	20.8607	20.8608	20.7981	20.5663	20.1749	19.9285 (87)	
Th 2	20.1787	20.1838	20.1864	20.1941	20.1941	20.2031	20.2018	20.2031	20.1979	20.1864	20.1851	20.1774 (88)	
util rest of house	0.8486	0.8046	0.7216	0.5993	0.4785	0.3246	0.2662	0.2680	0.4074	0.6216	0.7780	0.8577 (89)	
MIT 2	19.6060	18.9626	19.3184	19.6692	19.8803	20.0161	20.0385	20.0402	19.9772	19.7196	19.2577	18.9935 (90)	
Living area fraction									flA = Living area / (4) =			0.3904 (91)	
MIT	19.9030	19.3444	19.6758	20.0045	20.2060	20.3364	20.3595	20.3606	20.2977	20.0502	19.6158	19.3585 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.9030	19.3444	19.6758	20.0045	20.2060	20.3364	20.3595	20.3606	20.2977	20.0502	19.6158	19.3585 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8433	0.7844	0.7059	0.5921	0.4791	0.3317	0.2761	0.2782	0.4136	0.6148	0.7599	0.8414 (94)
Useful gains	1104.5888	1178.6599	1232.5560	1212.1434	1031.6761	747.5688	550.5758	536.3488	726.3662	907.3770	993.4135	1033.3115 (95)
Ext temp.	6.4000	6.6000	7.8000	9.5000	11.9000	14.6000	16.2000	16.3000	14.6000	12.1000	9.3000	6.8000 (96)
Heat loss rate W	1887.6014	1769.4989	1643.2873	1438.6414	1137.5434	776.1354	563.7652	549.3975	776.2852	1100.0875	1429.8627	1758.5318 (97)
Space heating kWh	582.5613	397.0438	305.5841	163.0786	78.7653	0.0000	0.0000	0.0000	0.0000	143.3766	314.2434	539.5639 (98a)
Space heating requirement - total per year (kWh/year)												2524.2170
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	582.5613	397.0438	305.5841	163.0786	78.7653	0.0000	0.0000	0.0000	0.0000	143.3766	314.2434	539.5639 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2524.2170
Space heating per m2												(98c) / (4) = 16.0136 (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 %)													334.6203 (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	582.5613	397.0438	305.5841	163.0786	78.7653	0.0000	0.0000	0.0000	0.0000	143.3766	314.2434	539.5639 (98)	
Space heating efficiency (main heating system 1)	334.6203	334.6203	334.6203	334.6203	334.6203	0.0000	0.0000	0.0000	0.0000	334.6203	334.6203	334.6203 (210)	
Space heating fuel (main heating system)	174.0962	118.6550	91.3226	48.7354	23.5387	0.0000	0.0000	0.0000	0.0000	42.8476	93.9104	161.2466 (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	287.5844	236.4068	206.3188	141.1071	108.3545	84.7914	95.8561	108.2696	142.7760	203.5552	250.2170	292.9506 (64)	
Efficiency of water heater (217)m	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047	187.7047 (216)	
Fuel for water heating, kWh/month												187.7047 (217)	

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Space cooling fuel requirement (221)m	153.2110	125.9461	109.9167	75.1750	57.7260	45.1727	51.0675	57.6808	76.0641	108.4444	133.3035	156.0699	(219)
Pumps and Fa	62.8573	56.7743	62.8573	60.8296	62.8573	60.8296	62.8573	62.8573	60.8296	62.8573	60.8296	62.8573	(231)
Lighting	114.2889	91.6868	82.5538	60.4824	46.7184	38.1693	42.6181	55.3966	71.9547	94.4084	106.6341	117.4653	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-122.1290	-150.5273	-209.3718	-225.2922	-222.9916	-202.4885	-196.9855	-197.4995	-187.2296	-168.4648	-128.0772	-105.4984	(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	-74.2695	-130.7735	-272.7693	-452.3689	-574.8742	-647.3363	-550.9891	-506.7032	-368.2368	-200.3599	-97.1136	-58.0614	(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													754.3526 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													187.7047
Water heating fuel used													1149.7778 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.2040) mechanical ventilation fans (SFP = 1.2040) pump for solar water heating													660.0937 (230a) 80.0000 (230g)
Total electricity for the above, kWh/year													740.0937 (231)
Electricity for lighting (calculated in Appendix L)													922.3765 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-6050.4110 (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													-2483.8105 (238)

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	754.3526	21.5100	162.2612 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1149.7778	21.5100	247.3172 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	660.0937	21.5100	141.9861 (249)
Pump for solar water heating	80.0000	21.5100	17.2080 (249)
Energy for lighting	922.3765	21.5100	198.4032 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2116.5554	21.5100	-455.2711
PV Unit electricity exported	-3933.8556	5.5900	-219.9025
Total			-675.1736 (252)
Total energy cost			92.0022 (255)

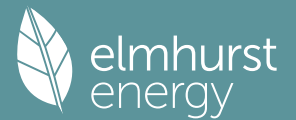
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	754.3526	0.1560	117.7021 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1149.7778	0.1456	167.4578 (264)
Space and water heating			285.1599 (265)
Pumps, fans and electric keep-hot	740.0937	0.1387	102.6601 (267)
Energy for lighting	922.3765	0.1443	133.1274 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2116.5554	0.1362	-288.2500
PV Unit electricity exported	-3933.8556	0.1253	-492.9477
Total			-781.1977 (269)
Total CO2, kg/year			-260.2502 (272)

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

Energy Primary energy factor Primary energy

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	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	754.3526	1.5776	1190.0755 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1149.7778	1.5388	1769.2242 (278)
Space and water heating			2959.2997 (279)
Pumps, fans and electric keep-hot	740.0937	1.5128	1119.6137 (281)
Energy for lighting	922.3765	1.5338	1414.7719 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2116.5554	1.5034	-3182.0540
PV Unit electricity exported	-3933.8556	0.4600	-1809.4739
Total			-4991.5279 (283)
Total Primary energy kWh/year			502.1574 (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)	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	tbc	17.16
Dishwasher	tbc	4.50



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