

OAKLAND ENERGY



ENERGY STATEMENT

Client: ALMA SW LTD

Project: Bryher Cottage, Trethosa
St. Stephen, ST. AUSTELL, PL26 7QH

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EXCELLENCE
IN ENERGY
ASSESSMENT

INTRODUCTION

This report has been prepared by Oakland Energy LTD, under instruction from Alma SW Ltd to accompany the planning application for 1no. New dwelling at Bryher Cottage.

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 made to an existing or proposed low carbon district energy network; or where this is not possible the residual energy (the amount by which total energy demand exceeds the renewable energy generation) is to be offset by a contribution to Cornwall Council's Offset Fund.

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

5 Water

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

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

RENEWABLE & LOW CARBON TECHNOLOGIES

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

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

There are no networks near to the site.

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

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

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

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

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

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

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

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

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

FIGURES EXPLAINED

The energy consumption figures are taken from SAP 10.2.

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

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

NEW DWELLINGS

- Detached dwelling – 91.88m²

FABRIC FIRST STRATEGY

- Wall U Value – 0.15W/m²K
- Roof U Value – 0.10W/m²K
- Floor U Value – 0.12W/m²K
- Glazing U Value – 0.90W/m²K
- Air permeability of 1 or lower.

HEATING & VENTILATION STRATEGY

- Air Source Heat Pump
- Mechanical ventilation with heat recovery

OVERHEATING MITIGATION

- Low g values

RENEWABLE ENERGY

- 2kW peak southwest; 1kW Peak southeast, 2.5kW Peak northeast

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.

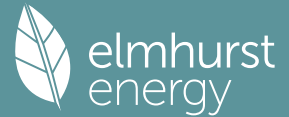
	DPD Policy kWh/m2/yr	Proposed Dwelling kWh/m2/yr (avg)
Space Heating Demand	<30	7.3
Predicted Total Energy Use	<40	38.7
Renewable Energy Generation	> Total Energy	43.6
Annual Renewable Energy Deficit	-454.9kWh/yr for total development	

The proposals are therefore compliant with the Climate Emergency DPD.

Report completed on 13th August 2023.

By Sophie Oakland - Accredited Assessor EES/011881.

Full SAP Calculation Printout



Property Reference	_23.SAP.141 Alma SW Ltd		Issued on Date	13/09/2023	
Assessment Reference	AS DESIGNED	Prop Type Ref			
Property	Bryher Cottage, Trethosa, ST. AUSTELL, PL26 7QH				
SAP Rating	101 A	DER	-1.92	TER	12.05
Environmental	102 A	% DER < TER	115.93		
CO ₂ Emissions (t/year)	-0.28	DFEE	31.16	TFEE	42.83
Compliance Check	See BREL	% DFEE < TFEE	27.23		
% DPER < TPER	95.96	DPER	2.54	TPER	63.00
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	45.9400 (1b)	x 2.4000 (2b)	= 110.2560 (1b)
First floor	45.9400 (1c)	x 2.7000 (2c)	= 124.0380 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.2940 (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		1.0000 (17)										
Infiltration rate		0.0500 (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) =	0.0425 (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	0.0542	0.0531	0.0521	0.0468	0.0457	0.0404	0.0404	0.0393	0.0425	0.0457	0.0478	0.0499 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												84.6000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.1312	0.1301	0.1291	0.1237	0.1227	0.1174	0.1174	0.1163	0.1195	0.1227	0.1248	0.1269 (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 TRIPLE WINDOWS (Uw = 0.90)			14.3400	0.8687	12.4575		(27)
NEW PAT/ BIFOLD DOORS (Uw = 0.90)			5.0400	0.8687	4.3784		(27)

Full SAP Calculation Printout



DOOR			2.1000	0.9000	1.8900							(26)
Heat Loss Floor 1			45.9400	0.1200	5.5128	75.0000	3445.5000					(28a)
External Walls	151.2660	21.4800	129.7860	0.1500	19.4679	60.0000	7787.1600					(29a)
Main Roof	45.9400		45.9400	0.0800	3.6752	9.0000	413.4600					(30)
Total net area of external elements Aum(A, m2)			243.1460									(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	47.3818								(33)
TF			88.4200			9.0000	795.7800					(32c)
BK			93.2600			75.0000	6994.5000					(32c)
Internal Floor 1			45.9400			18.0000	826.9200					(32d)
Internal Ceiling 1			45.9400			9.0000	413.4600					(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 20676.7800 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.0411 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.0000	0.0280	0.3920
E3 Sill	13.0000	0.0160	0.2080
E4 Jamb	31.4000	0.0180	0.5652
E5 Ground floor (normal)	29.6600	0.0520	1.5423
E6 Intermediate floor within a dwelling	29.6600	0.0010	0.0297
E10 Eaves (insulation at ceiling level)	15.1600	0.0540	0.8186
E12 Gable (insulation at ceiling level)	14.5000	0.0510	0.7395
E16 Corner (normal)	25.5000	0.0400	1.0200
E17 Corner (inverted - internal area greater than external area)	5.1000	-0.0680	-0.3468

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.9685 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 52.3503 (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	10.1430	10.0609	9.9787	9.5680	9.4858	9.0751	9.0751	8.9929	9.2394	9.4858	9.6501	9.8144 (38)
Average = Sum(39)m / 12 =	62.4934	62.4112	62.3291	61.9183	61.8362	61.4254	61.4254	61.3433	61.5897	61.8362	62.0005	62.1648 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6802	0.6793	0.6784	0.6739	0.6730	0.6685	0.6685	0.6676	0.6703	0.6730	0.6748	0.6766 (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 2.6506 (42)

Hot water usage for mixer showers 68.6614 67.6296 66.1260 63.2491 61.1260 58.7584 57.4127 58.9049 60.5406 63.0827 66.0214 68.3983 (42a)

Hot water usage for baths 29.6499 29.2095 28.5894 27.4461 26.5900 25.6407 25.1279 25.7437 26.4141 27.4299 28.5968 29.5496 (42b)

Hot water usage for other uses 41.7747 40.2556 38.7365 37.2174 35.6984 34.1793 34.1793 35.6984 37.2174 38.7365 40.2556 41.7747 (42c)

Average daily hot water use (litres/day) 128.7706 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	140.0860	137.0947	133.4519	127.9126	123.4144	118.5784	116.7198	120.3469	124.1722	129.2492	134.8738	139.7227 (44)
Energy content (annual)	221.8619	195.2210	205.1106	175.1060	166.1395	145.8059	141.1625	149.0146	153.1167	175.3899	192.1524	218.7719 (45)
Distribution loss (46)m = 0.15 x (45)m	33.2793	29.2832	30.7666	26.2659	24.9209	21.8709	21.1744	22.3522	22.9675	26.3085	28.8229	32.8158 (46)

Water storage loss:

Store volume 210.0000 (47)

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

Temperature factor from Table 2b 1.5000 (48)

Enter (49) or (54) in (55) 0.5400 (49)

Total storage loss 0.8100 (55)

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100 (56)
If cylinder contains dedicated solar storage												
25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100 (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												
270.2343	238.9122	253.4830	221.9180	214.5119	192.6179	189.5349	197.3870	199.9287	223.7623	238.9644	267.1443	267.1443 (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	270.2343	238.9122	253.4830	221.9180	214.5119	192.6179	189.5349	197.3870	199.9287	223.7623	238.9644	267.1443 (64)
Total per year (kWh/year) = Sum(64)m = 2708.3990 (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	112.4670	99.8640	106.8972	95.6723	93.9393	85.9301	85.6345	88.2453	88.3609	97.0151	101.3403	111.4396 (65)

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

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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(66)m	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.4006	24.3370	19.7922	14.9840	11.2007	9.4561	10.2176	13.2813	17.8261	22.6343	26.4176	28.1622	28.1622	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.9317	365.6874	356.2231	336.0748	310.6411	286.7370	270.7676	267.0119	276.4762	296.6245	322.0582	345.9623	345.9623	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	(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	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	(71)
Water heating gains (Table 5)	151.1653	148.6071	143.6790	132.8783	126.2625	119.3473	115.1001	118.6092	122.7235	130.3966	140.7504	149.7844	149.7844	(72)
Total internal gains	647.0635	645.1974	626.2602	590.5029	554.6701	522.1063	502.6512	505.4683	523.5917	556.2213	595.7921	630.4748	630.4748	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	2.3100	11.2829	0.5700	0.7000	0.7700	7.2068	(75)
Southeast	1.3200	36.7938	0.5700	0.7000	0.7700	13.4294	(77)
Southwest	7.3500	36.7938	0.5700	0.7000	0.7700	74.7771	(79)
Northwest	3.3600	11.2829	0.5700	0.7000	0.7700	10.4826	(81)
Northeast	5.0400	11.2829	0.5700	0.7000	0.7700	15.7239	(75)

Solar gains	121.6196	218.2617	328.1148	455.9626	555.8174	571.6366	542.8627	465.3336	371.9108	249.1742	147.6934	102.7732	102.7732	(83)
Total gains	768.6832	863.4591	954.3751	1046.4654	1110.4875	1093.7429	1045.5140	970.8019	895.5025	805.3955	743.4855	733.2480	733.2480	(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	91.9066	92.0275	92.1488	92.7601	92.8834	93.5045	93.5045	93.6297	93.2550	92.8834	92.6372	92.3924			
alpha	7.1271	7.1352	7.1433	7.1840	7.1922	7.2336	7.2336	7.2420	7.2170	7.1922	7.1758	7.1595			
util living area	0.9675	0.9327	0.8520	0.6962	0.5157	0.3593	0.2585	0.2906	0.4734	0.7606	0.9321	0.9749			(86)
Living	20.6422	20.7475	20.8615	20.9351	20.9542	20.9568	20.9570	20.9570	20.9558	20.9248	20.7797	20.6112			
Non living	19.9459	20.0741	20.2068	20.2887	20.3073	20.3134	20.3135	20.3144	20.3111	20.2810	20.1186	19.9105			
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	20.8170	20.7475	20.8615	20.9351	20.9542	20.9568	20.9570	20.9570	20.9558	20.9248	20.7797	20.6656			(87)
Th 2	20.3584	20.3592	20.3600	20.3639	20.3647	20.3687	20.3687	20.3695	20.3671	20.3647	20.3631	20.3616			(88)
util rest of house	0.9605	0.9200	0.8294	0.6643	0.4812	0.3239	0.2214	0.2508	0.4305	0.7236	0.9171	0.9693			(89)
MIT 2	20.1940	20.0741	20.2068	20.2887	20.3073	20.3134	20.3135	20.3144	20.3111	20.2810	20.1186	19.9918			(90)
Living area fraction									fLA = Living area / (4) =			0.1289			(91)
MIT	20.2742	20.1609	20.2912	20.3720	20.3906	20.3964	20.3964	20.3972	20.3942	20.3639	20.2038	20.0786			(92)
Temperature adjustment												0.0000			
adjusted MIT	20.2742	20.1609	20.2912	20.3720	20.3906	20.3964	20.3964	20.3972	20.3942	20.3639	20.2038	20.0786			(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Useful gains	0.9594	0.9156	0.8268	0.6647	0.4826	0.3255	0.2230	0.2526	0.4323	0.7236	0.9129	0.9664			(94)
Ext temp.	737.5098	790.5797	789.0589	695.6003	535.8921	355.9717	233.1949	245.1923	387.1360	582.7539	678.7399	708.6255			(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000			(96)
Space heating kWh	998.2842	952.4508	859.5925	710.3245	537.3953	356.0433	233.1984	245.2009	387.6588	603.7631	812.4391	987.0898			(97)
Solar heating kWh	194.0161	108.7774	52.4770	10.6015	1.1184	0.0000	0.0000	0.0000	0.0000	15.6309	96.2634	207.1774			(98a)
Space heating requirement - total per year (kWh/year)												686.0620			
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	194.0161	108.7774	52.4770	10.6015	1.1184	0.0000	0.0000	0.0000	0.0000	15.6309	96.2634	207.1774			(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												686.0620			
Space heating per m2										(98c) / (4) =		7.4669			(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 %)	166.4859	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

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Efficiency of secondary/supplementary heating system, %												0.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	194.0161	108.7774	52.4770	10.6015	1.1184	0.0000	0.0000	0.0000	0.0000	15.6309	96.2634	207.1774	(98)
Space heating efficiency (main heating system 1)	166.4859	166.4859	166.4859	166.4859	166.4859	0.0000	0.0000	0.0000	0.0000	166.4859	166.4859	166.4859	(210)
Space heating fuel (main heating system)	116.5360	65.3373	31.5204	6.3678	0.6717	0.0000	0.0000	0.0000	0.0000	9.3887	57.8208	124.4414	(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	270.2343	238.9122	253.4830	221.9180	214.5119	192.6179	189.5349	197.3870	199.9287	223.7623	238.9644	267.1443	(64)
Efficiency of water heater	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438	(216)
Fuel for water heating, kWh/month	139.9135	123.6965	131.2406	114.8978	111.0633	99.7277	98.1315	102.1969	103.5129	115.8527	123.7236	138.3137	(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	16.6902	15.0751	16.6902	16.1518	16.6902	16.1518	16.6902	16.6902	16.1518	16.6902	16.1518	16.6902	(231)
Lighting	23.9836	19.2406	17.3240	12.6923	9.8039	8.0099	8.9434	11.6250	15.0998	19.8117	22.3773	24.6502	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-62.2491	-91.0553	-135.1344	-152.8512	-164.9605	-153.8841	-151.3594	-143.1182	-125.2980	-102.3784	-68.3960	-53.1896	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-30.7625	-73.3203	-170.3008	-295.2341	-423.6062	-439.4778	-427.9185	-339.3703	-223.2711	-114.5642	-43.7116	-23.4568	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													412.0841 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													193.1438
Water heating fuel used													1402.2707 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)													
mechanical ventilation fans (SFP = 0.6875)													196.5141 (230a)
Total electricity for the above, kWh/year													196.5141 (231)
Electricity for lighting (calculated in Appendix L)													193.5616 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-4008.8683 (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													-1804.4378 (238)

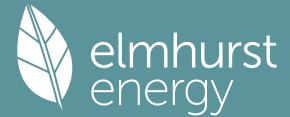
10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	412.0841	16.4900	67.9527	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1402.2707	16.4900	231.2344	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	196.5141	16.4900	32.4052	(249)
Energy for lighting	193.5616	16.4900	31.9183	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1403.8741	16.4900	-231.4988	
PV Unit electricity exported	-2604.9942	5.5900	-145.6192	
Total			-377.1180	(252)
Total energy cost			-13.6074	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
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Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = -0.0358 (257)
 SAP value 100.5801
 SAP rating (Section 12) 101 (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	412.0841	0.1591	65.5630 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1402.2707	0.1410	197.6858 (264)
Space and water heating			263.2488 (265)
Pumps, fans and electric keep-hot	196.5141	0.1387	27.2589 (267)
Energy for lighting	193.5616	0.1443	27.9369 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1403.8741	0.1343	-188.5272
PV Unit electricity exported	-2604.9942	0.1226	-319.4715
Total			-507.9987 (269)
Total CO2, kg/year			-189.5541 (272)
CO2 emissions per m2			-2.0600 (273)
EI value			101.8557
EI rating			102 (274)
EI band			A

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

 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	45.9400 (1b)	x 2.4000 (2b)	= 110.2560 (1b) -
First floor	45.9400 (1c)	x 2.7000 (2c)	= 124.0380 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.8800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 234.2940 (5)

 2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	1.0000 (17)
Infiltration rate	0.0500 (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) = 0.0425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.6000	6.3000	6.2000	5.5000	5.4000	4.8000	4.8000	4.7000	5.2000	6.0000	6.1000	6.5000 (22)
Wind factor	1.6500	1.5750	1.5500	1.3750	1.3500	1.2000	1.2000	1.1750	1.3000	1.5000	1.5250	1.6250 (22a)
Adj infilt rate	0.0701	0.0669	0.0659	0.0584	0.0574	0.0510	0.0510	0.0499	0.0553	0.0638	0.0648	0.0691 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												84.6000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.1471	0.1439	0.1429	0.1354	0.1344	0.1280	0.1280	0.1269	0.1322	0.1407	0.1418	0.1461 (25)

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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 TRIPLE WINDOWS (Uw = 0.90)			14.3400	0.8687	12.4575		(27)
NEW PAT/ BIFOLD DOORS (Uw = 0.90)			5.0400	0.8687	4.3784		(27)
DOOR			2.1000	0.9000	1.8900		(26)
Heat Loss Floor 1			45.9400	0.1200	5.5128	75.0000	3445.5000 (28a)
External Walls	151.2660	21.4800	129.7860	0.1500	19.4679	60.0000	7787.1600 (29a)
Main Roof	45.9400		45.9400	0.0800	3.6752	9.0000	413.4600 (30)
Total net area of external elements Aum(A, m2)			243.1460				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 47.3818		(33)
TF			88.4200			9.0000	795.7800 (32c)
BK			93.2600			75.0000	6994.5000 (32c)
Internal Floor 1			45.9400			18.0000	826.9200 (32d)
Internal Ceiling 1			45.9400			9.0000	413.4600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 20676.7800 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.0411 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.0000	0.0280	0.3920
E3 Sill	13.0000	0.0160	0.2080
E4 Jamb	31.4000	0.0180	0.5652
E5 Ground floor (normal)	29.6600	0.0520	1.5423
E6 Intermediate floor within a dwelling	29.6600	0.0010	0.0297
E10 Eaves (insulation at ceiling level)	15.1600	0.0540	0.8186
E12 Gable (insulation at ceiling level)	14.5000	0.0510	0.7395
E16 Corner (normal)	25.5000	0.0400	1.0200
E17 Corner (inverted - internal area greater than external area)	5.1000	-0.0680	-0.3468

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.9685 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 52.3503 (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	11.3753	11.1288	11.0467	10.4716	10.3895	9.8966	9.8966	9.8144	10.2252	10.8824	10.9645	11.2931 (38)
Average = Sum(39)m / 12 =	63.7256	63.4791	63.3970	62.8220	62.7398	62.2469	62.2469	62.1648	62.5755	63.2327	63.3148	63.6434 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6936	0.6909	0.6900	0.6837	0.6828	0.6775	0.6775	0.6766	0.6811	0.6882	0.6891	0.6927 (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													2.6506 (42)
Hot water usage for mixer showers	68.6614	67.6296	66.1260	63.2491	61.1260	58.7584	57.4127	58.9049	60.5406	63.0827	66.0214	68.3983 (42a)	
Hot water usage for baths	29.6499	29.2095	28.5894	27.4461	26.5900	25.6407	25.1279	25.7437	26.4141	27.4299	28.5968	29.5496 (42b)	
Hot water usage for other uses	41.7747	40.2556	38.7365	37.2174	35.6984	34.1793	34.1793	35.6984	37.2174	38.7365	40.2556	41.7747 (42c)	
Average daily hot water use (litres/day)	33.2793	29.2832	30.7666	26.2659	24.9209	21.8709	21.1744	22.3522	22.9675	26.3085	28.8229	32.8158 (43)	

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	140.0860	137.0947	133.4519	127.9126	123.4144	118.5784	116.7198	120.3469	124.1722	129.2492	134.8738	139.7227 (44)
Energy content (annual)	221.8619	195.2210	205.1106	175.1060	166.1395	145.8059	141.1625	149.0146	153.1167	175.3899	192.1524	218.7719 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2138.8530

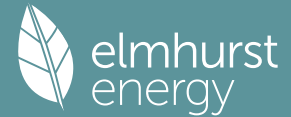
Water storage loss:													210.0000 (47)
Store volume													1.5000 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.8100 (55)
Enter (49) or (54) in (55)													
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100 (56)

If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100 (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	270.2343	238.9122	253.4830	221.9180	214.5119	192.6179	189.5349	197.3870	199.9287	223.7623	238.9644	267.1443 (62)
WVHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	270.2343	238.9122	253.4830	221.9180	214.5119	192.6179	189.5349	197.3870	199.9287	223.7623	238.9644	267.1443 (64)
Total per year (kWh/year) = Sum(64)m =												2708.3990 (64)

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

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Heat gains from water heating, kWh/month
 112.4670 99.8640 106.8972 95.6723 93.9393 85.9301 85.6345 88.2453 88.3609 97.0151 101.3403 111.4396 (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	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.4006	24.3370	19.7922	14.9840	11.2007	9.4561	10.2176	13.2813	17.8261	22.6343	26.4176	28.1622 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.9317	365.6874	356.2231	336.0748	310.6411	286.7370	270.7676	267.0119	276.4762	296.6245	322.0582	345.9623 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541 (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)	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235 (71)
Water heating gains (Table 5)	151.1653	148.6071	143.6790	132.8783	126.2625	119.3473	115.1001	118.6092	122.7235	130.3966	140.7504	149.7844 (72)
Total internal gains	647.0635	645.1974	626.2602	590.5029	554.6701	522.1063	502.6512	505.4683	523.5917	556.2213	595.7921	630.4748 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
Northeast	2.3100	15.4448	0.5700	0.7000	0.7000	0.7700	9.8651 (75)					
Southeast	1.3200	46.9996	0.5700	0.7000	0.7000	0.7700	17.1543 (77)					
Southwest	7.3500	46.9996	0.5700	0.7000	0.7000	0.7700	95.5185 (79)					
Northwest	3.3600	15.4448	0.5700	0.7000	0.7000	0.7700	14.3492 (81)					
Northeast	5.0400	15.4448	0.5700	0.7000	0.7000	0.7700	21.5238 (75)					
Solar gains	158.4109	241.3080	361.6582	514.8353	590.3895	653.4024	552.9476	519.2282	419.8948	280.4798	185.5791	137.9071 (83)
Total gains	805.4745	886.5054	987.9184	1105.3381	1145.0596	1175.5087	1055.5989	1024.6965	943.4865	836.7011	781.3712	768.3819 (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	90.1294	90.4793	90.5966	91.4258	91.5456	92.2704	92.2704	92.3924	91.7859	90.8320	90.7141	90.2457
alpha	7.0086	7.0320	7.0398	7.0951	7.1030	7.1514	7.1514	7.1595	7.1191	7.0555	7.0476	7.0164
util living area	0.9418	0.9045	0.8165	0.6719	0.5234	0.3652	0.3125	0.3154	0.4567	0.7092	0.8813	0.9468 (86)
Living	20.7297	20.7987	20.8845	20.9378	20.9531	20.9563	20.9565	20.9565	20.9554	20.9351	20.8484	20.7251
Non living	20.0422	20.1252	20.2221	20.2824	20.2974	20.3048	20.3049	20.3058	20.3010	20.2772	20.1859	20.0381
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	20.8617	20.7987	20.8845	20.9378	20.9531	20.9563	20.9565	20.9565	20.9554	20.9351	20.8484	20.7635 (87)
Th 2	20.3465	20.3489	20.3497	20.3552	20.3560	20.3608	20.3608	20.3616	20.3576	20.3513	20.3505	20.3473 (88)
util rest of house	0.9296	0.8870	0.7903	0.6399	0.4891	0.3314	0.2748	0.2767	0.4146	0.6685	0.8573	0.9350 (89)
MIT 2	20.2252	20.1252	20.2221	20.2824	20.2974	20.3048	20.3049	20.3058	20.3010	20.2772	20.1859	20.0938 (90)
Living area fraction	flA = Living area / (4) =											
MIT	20.3072	20.2120	20.3074	20.3669	20.3819	20.3888	20.3889	20.3896	20.3853	20.3620	20.2713	20.1801 (92)
Temperature adjustment	0.0000											
adjusted MIT	20.3072	20.2120	20.3074	20.3669	20.3819	20.3888	20.3889	20.3896	20.3853	20.3620	20.2713	20.1801 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9288	0.8830	0.7885	0.6405	0.4905	0.3329	0.2765	0.2784	0.4164	0.6692	0.8541	0.9316 (94)
Useful gains	748.1062	782.8078	778.9767	707.9542	561.6552	391.3570	291.8478	285.2925	392.8525	559.8990	667.3591	715.8305 (95)
Ext temp.	5.7000	6.0000	7.2000	8.9000	11.4000	14.1000	15.7000	15.8000	14.1000	11.3000	8.5000	6.1000 (96)
Heat loss rate W	930.8542	902.1659	830.9709	720.3715	563.5211	391.4575	291.8692	285.3143	393.3050	573.0155	745.2977	896.1061 (97)
Space heating kWh	135.9644	80.2087	38.6837	8.9404	1.3883	0.0000	0.0000	0.0000	0.0000	9.7587	56.1159	134.1250 (98a)
Space heating requirement - total per year (kWh/year)	465.1851											
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	135.9644	80.2087	38.6837	8.9404	1.3883	0.0000	0.0000	0.0000	0.0000	9.7587	56.1159	134.1250 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	465.1851											
Space heating per m ²	(98c) / (4) = 5.0630 (99)											

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													168.1689 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	135.9644	80.2087	38.6837	8.9404	1.3883	0.0000	0.0000	0.0000	0.0000	9.7587	56.1159	134.1250	(98)
Space heating efficiency (main heating system 1)	168.1689	168.1689	168.1689	168.1689	168.1689	0.0000	0.0000	0.0000	0.0000	168.1689	168.1689	168.1689	(210)
Space heating fuel (main heating system)	80.8499	47.6953	23.0029	5.3163	0.8255	0.0000	0.0000	0.0000	0.0000	5.8029	33.3687	79.7562	(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	270.2343	238.9122	253.4830	221.9180	214.5119	192.6179	189.5349	197.3870	199.9287	223.7623	238.9644	267.1443	(64)
Efficiency of water heater (217)m	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559	(216)
Fuel for water heating, kWh/month	139.9047	123.6888	131.2323	114.8906	111.0563	99.7215	98.1253	102.1905	103.5064	115.8454	123.7158	138.3050	(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	16.6902	15.0751	16.6902	16.1518	16.6902	16.1518	16.6902	16.6902	16.1518	16.6902	16.1518	16.6902	(231)
Lighting	23.9836	19.2406	17.3240	12.6923	9.8039	8.0099	8.9434	11.6250	15.0998	19.8117	22.3773	24.6502	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-77.3930	-98.6636	-143.9445	-162.0173	-168.9719	-160.1793	-152.6123	-149.6080	-133.8863	-111.6523	-81.6041	-67.8942	(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	-48.0937	-89.3383	-202.1250	-352.8101	-462.4518	-522.8639	-442.3268	-396.3470	-269.0691	-140.5205	-64.2938	-38.6215	(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													276.6178 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													193.1559
Water heating fuel used													1402.1826 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)													
mechanical ventilation fans (SFP = 0.6875)													196.5141 (230a)
Total electricity for the above, kWh/year													196.5141 (231)
Electricity for lighting (calculated in Appendix L)													193.5616 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-4537.2883 (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													-2468.4122 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	276.6178	21.5100	59.5005 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1402.1826	21.5100	301.6095 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	196.5141	21.5100	42.2702 (249)
Energy for lighting	193.5616	21.5100	41.6351 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1508.4269	21.5100	-324.4626
PV Unit electricity exported	-3028.8614	5.5900	-169.3134

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Total -493.7760 (252)
 Total energy cost -48.7607 (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	276.6178	0.1592	44.0266 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1402.1826	0.1410	197.6734 (264)
Space and water heating			241.6999 (265)
Pumps, fans and electric keep-hot	196.5141	0.1387	27.2589 (267)
Energy for lighting	193.5616	0.1443	27.9369 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1508.4269	0.1351	-203.7229
PV Unit electricity exported	-3028.8614	0.1241	-375.8502
Total			-579.5731 (269)
Total CO2, kg/year			-282.6773 (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	276.6178	1.5891	439.5752 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1402.1826	1.5213	2133.1123 (278)
Space and water heating			2572.6876 (279)
Pumps, fans and electric keep-hot	196.5141	1.5128	297.2865 (281)
Energy for lighting	193.5616	1.5338	296.8913 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1508.4269	1.4992	-2261.3731
PV Unit electricity exported	-3028.8614	0.4555	-1379.5014
Total			-3640.8745 (283)
Total Primary energy kWh/year			-474.0092 (286)

SAP 10 EPC IMPROVEMENTS

AS DESIGNED

Current energy efficiency rating: A 101
 Current environmental impact rating: A 102

	Recommended
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	+ 1.6	-£ 55	-40 kg (14.2%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£55	0.44 kg/m ²	A 102	A 102
Total Savings	£55	0.44 kg/m²		

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

Fuel prices for cost data on this page from database revision number 524 TEST (01 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	Potential	Saving
Electricity	£445	£375	£70
Space heating	£102	£119	-£17
Water heating	£302	£214	£87
Lighting	£42	£42	£0
Generated (PV)	-£494	-£479	-£15
Total cost of fuels	-£49	-£104	£55
Total cost of uses	-£48	-£104	£55
Delivered energy	-27 kWh/m ²	-30 kWh/m ²	4 kWh/m ²
Carbon dioxide emissions	-0.3 tonnes	-0.3 tonnes	0.0 tonnes
CO2 emissions per m ²	-3 kg/m ²	-4 kg/m ²	0 kg/m ²
Primary energy	-5 kWh/m ²	-9 kWh/m ²	4 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	45.9400 (1b)	x 2.4000 (2b)	= 110.2560 (1b) -
First floor	45.9400 (1c)	x 2.7000 (2c)	= 124.0380 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.2940 (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		1.0000 (17)
Infiltration rate		0.0500 (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) =	0.0425 (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	0.0542 0.0531 0.0521 0.0468 0.0457 0.0404 0.0404 0.0393 0.0425 0.0457 0.0478 0.0499	(22b)
Balanced mechanical ventilation with heat recovery		0.5000 (23a)
If mechanical ventilation		0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		84.6000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		
Effective ac	0.1312 0.1301 0.1291 0.1237 0.1227 0.1174 0.1174 0.1163 0.1195 0.1227 0.1248 0.1269	(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 TRIPLE WINDOWS (Uw = 0.90)			14.3400	0.8687	12.4575		(27)
NEW PAT/ BIFOLD DOORS (Uw = 0.90)			5.0400	0.8687	4.3784		(27)
DOOR			2.1000	0.9000	1.8900		(26)
Heat Loss Floor 1			45.9400	0.1200	5.5128	75.0000	3445.5000 (28a)
External Walls	151.2660	21.4800	129.7860	0.1500	19.4679	60.0000	7787.1600 (29a)
Main Roof	45.9400		45.9400	0.0800	3.6752	9.0000	413.4600 (30)
Total net area of external elements Aum(A, m ²)			243.1460				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.3818		(33)
TF			88.4200			9.0000	795.7800 (32c)
BK			93.2600			75.0000	6994.5000 (32c)
Internal Floor 1			45.9400			18.0000	826.9200 (32d)
Internal Ceiling 1			45.9400			9.0000	413.4600 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		20676.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							225.0411 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				14.0000	0.0280	0.3920	
E3 Sill				13.0000	0.0160	0.2080	
E4 Jamb				31.4000	0.0180	0.5652	
E5 Ground floor (normal)				29.6600	0.0520	1.5423	

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E6 Intermediate floor within a dwelling	29.6600	0.0010	0.0297
E10 Eaves (insulation at ceiling level)	15.1600	0.0540	0.8186
E12 Gable (insulation at ceiling level)	14.5000	0.0510	0.7395
E16 Corner (normal)	25.5000	0.0400	1.0200
E17 Corner (inverted - internal area greater than external area)	5.1000	-0.0680	-0.3468
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			4.9685 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	52.3503 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	10.1430	10.0609	9.9787	9.5680	9.4858	9.0751	9.0751	8.9929	9.2394	9.4858	9.6501	9.8144 (38)
Heat transfer coeff	62.4934	62.4112	62.3291	61.9183	61.8362	61.4254	61.4254	61.3433	61.5897	61.8362	62.0005	62.1648 (39)
Average = Sum(39)m / 12 =												61.8978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6802	0.6793	0.6784	0.6739	0.6730	0.6685	0.6685	0.6676	0.6703	0.6730	0.6748	0.6766 (40)
HLP (average)												0.6737
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

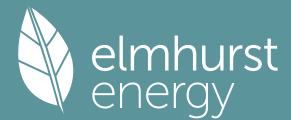
Assumed occupancy													2.6506 (42)
Hot water usage for mixer showers	68.6614	67.6296	66.1260	63.2491	61.1260	58.7584	57.4127	58.9049	60.5406	63.0827	66.0214	68.3983 (42a)	
Hot water usage for baths	29.6499	29.2095	28.5894	27.4461	26.5900	25.6407	25.1279	25.7437	26.4141	27.4299	28.5968	29.5496 (42b)	
Hot water usage for other uses	41.7747	40.2556	38.7365	37.2174	35.6984	34.1793	34.1793	35.6984	37.2174	38.7365	40.2556	41.7747 (42c)	
Average daily hot water use (litres/day)													128.7706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.0860	137.0947	133.4519	127.9126	123.4144	118.5784	116.7198	120.3469	124.1722	129.2492	134.8738	139.7227 (44)	
Energy conte	221.8619	195.2210	205.1106	175.1060	166.1395	145.8059	141.1625	149.0146	153.1167	175.3899	192.1524	218.7719 (45)	
Energy content (annual)													Total = Sum(45)m = 2138.8530
Distribution loss (46)m = 0.15 x (45)m	33.2793	29.2832	30.7666	26.2659	24.9209	21.8709	21.1744	22.3522	22.9675	26.3085	28.8229	32.8158 (46)	
Water storage loss:													210.0000 (47)
Store volume													1.5000 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.8100 (55)
Enter (49) or (54) in (55)													
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100 (56)	
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100 (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	270.2343	238.9122	252.0873	215.1644	201.7175	180.0112	176.5080	185.2906	194.5258	222.3665	238.9644	267.1443 (62)	
MWHR	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													620.5951 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													620.5951
Solar input	-0.0000	-16.2094	-58.3199	-80.0961	-104.4548	-96.1859	-95.4172	-83.5320	-57.7119	-28.6679	-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	270.2343	222.7028	193.7674	135.0683	97.2627	83.8253	81.0908	101.7586	136.8140	193.6986	238.9644	267.1443 (64)	
													Total per year (kWh/year) = Sum(64)m = 2022.3315 (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	112.4670	99.8640	105.7806	90.2695	83.7038	75.8447	75.2129	78.5681	84.0386	95.8985	101.3403	111.4396 (65)	

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

Metabolic gains (Table 5), Watts													
(66)m	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.4006	24.3370	19.7922	14.9840	11.2007	9.4561	10.2176	13.2813	17.8261	22.6343	26.4176	28.1622 (67)	

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.9317	365.6874	356.2231	336.0748	310.6411	286.7370	270.7676	267.0119	276.4762	296.6245	322.0582	345.9623	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	(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)	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	(71)
Water heating gains (Table 5)	151.1653	148.6071	142.1782	125.3743	112.5052	105.3399	101.0926	105.6023	116.7203	128.8958	140.7504	149.7844	(72)
Total internal gains	647.0635	645.1974	624.7594	582.9989	540.9128	508.0988	488.6438	492.4614	517.5885	554.7205	595.7921	630.4748	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	2.3100	11.2829	0.5700	0.7000	0.7700	7.2068 (75)
Southeast	1.3200	36.7938	0.5700	0.7000	0.7700	13.4294 (77)
Southwest	7.3500	36.7938	0.5700	0.7000	0.7700	74.7771 (79)
Northwest	3.3600	11.2829	0.5700	0.7000	0.7700	10.4826 (81)
Northeast	5.0400	11.2829	0.5700	0.7000	0.7700	15.7239 (75)

Solar gains	121.6196	218.2617	328.1148	455.9626	555.8174	571.6366	542.8627	465.3336	371.9108	249.1742	147.6934	102.7732	(83)
Total gains	768.6832	863.4591	952.8743	1038.9614	1096.7302	1079.7354	1031.5065	957.7950	889.4993	803.8947	743.4855	733.2480	(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	91.9066	92.0275	92.1488	92.7601	92.8834	93.5045	93.5045	93.6297	93.2550	92.8834	92.6372	92.3924	
alpha	7.1271	7.1352	7.1433	7.1840	7.1922	7.2336	7.2336	7.2420	7.2170	7.1922	7.1758	7.1595	
util living area	0.9675	0.9327	0.8528	0.7005	0.5219	0.3639	0.2620	0.2946	0.4766	0.7617	0.9321	0.9749 (86)	
Living	20.6422	20.7475	20.8609	20.9342	20.9540	20.9568	20.9570	20.9570	20.9558	20.9245	20.7797	20.6112	
Non living	19.9459	20.0741	20.2062	20.2879	20.3071	20.3134	20.3135	20.3144	20.3111	20.2807	20.1186	19.9105	
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	20.8170	20.7475	20.8609	20.9342	20.9540	20.9568	20.9570	20.9570	20.9558	20.9245	20.7797	20.6656 (87)	
Th 2	20.3584	20.3592	20.3600	20.3639	20.3647	20.3687	20.3687	20.3695	20.3671	20.3647	20.3631	20.3616 (88)	
util rest of house	0.9605	0.9200	0.8302	0.6685	0.4871	0.3281	0.2244	0.2542	0.4333	0.7247	0.9171	0.9693 (89)	
MIT 2	20.1940	20.0741	20.2062	20.2879	20.3071	20.3134	20.3135	20.3144	20.3111	20.2807	20.1186	19.9918 (90)	
Living area fraction	flA = Living area / (4) =												
MIT	20.2742	20.1609	20.2906	20.3712	20.3905	20.3963	20.3964	20.3972	20.3942	20.3636	20.2038	20.0786 (92)	
Temperature adjustment	0.0000												
adjusted MIT	20.2742	20.1609	20.2906	20.3712	20.3905	20.3963	20.3964	20.3972	20.3942	20.3636	20.2038	20.0786 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9594	0.9156	0.8276	0.6689	0.4885	0.3297	0.2261	0.2560	0.4352	0.7246	0.9129	0.9664 (94)
Ext temp.	737.5098	790.5797	788.5766	694.9728	535.7599	355.9646	233.1945	245.1914	387.1108	582.5420	678.7399	708.6255 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	998.2842	952.4508	859.5537	710.2756	537.3850	356.0427	233.1983	245.2008	387.6568	603.7464	812.4391	987.0898 (97)
Space heating requirement - total per year (kWh/year)	194.0161	108.7774	52.8069	11.0180	1.2091	0.0000	0.0000	0.0000	0.0000	15.7761	96.2634	207.1774 (98a)
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Space heating requirement after solar contribution - total per year (kWh/year)	194.0161	108.7774	52.8069	11.0180	1.2091	0.0000	0.0000	0.0000	0.0000	15.7761	96.2634	207.1774 (98c)
Space heating per m2												(98c) / (4) = 7.4776 (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 %)													166.4859 (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	

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Space heating requirement	194.0161	108.7774	52.8069	11.0180	1.2091	0.0000	0.0000	0.0000	0.0000	15.7761	96.2634	207.1774 (98)
Space heating efficiency (main heating system 1)	166.4859	166.4859	166.4859	166.4859	166.4859	0.0000	0.0000	0.0000	0.0000	166.4859	166.4859	166.4859 (210)
Space heating fuel (main heating system)	116.5360	65.3373	31.7186	6.6180	0.7262	0.0000	0.0000	0.0000	0.0000	9.4759	57.8208	124.4414 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	270.2343	222.7028	193.7674	135.0683	97.2627	83.8253	81.0908	101.7586	136.8140	193.6986	238.9644	267.1443 (64)
Efficiency of water heater (217)m	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438	193.1438 (216)
Fuel for water heating, kWh/month	139.9135	115.3042	100.3228	69.9314	50.3577	43.4005	41.9847	52.6854	70.8353	100.2873	123.7236	138.3137 (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	23.4848	21.2120	23.4848	22.7272	23.4848	22.7272	23.4848	23.4848	22.7272	23.4848	22.7272	23.4848 (231)
Lighting	23.9836	19.2406	17.3240	12.6923	9.8039	8.0099	8.9434	11.6250	15.0998	19.8117	22.3773	24.6502 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-62.3965	-90.9272	-132.2475	-144.6580	-149.0955	-137.7471	-135.4847	-131.5441	-120.2435	-101.5159	-68.6358	-53.3051 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-30.6151	-73.4484	-173.1876	-303.4274	-439.4712	-455.6148	-443.7932	-350.9444	-228.3256	-115.4267	-43.4718	-23.3413 (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												412.6742 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												193.1438
Water heating fuel used												1047.0600 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875) mechanical ventilation fans (SFP = 0.6875) pump for solar water heating												196.5141 (230a)
Total electricity for the above, kWh/year												80.0000 (230g)
Electricity for lighting (calculated in Appendix L)												276.5141 (231)
Electricity for lighting (calculated in Appendix L)												193.5616 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-4008.8683 (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												-2079.0585 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	412.6742	16.4900	68.0500 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1047.0600	16.4900	172.6602 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	196.5141	16.4900	32.4052 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	193.5616	16.4900	31.9183 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1327.8007	16.4900	-218.9543
PV Unit electricity exported	-2681.0676	5.5900	-149.8717
Total			-368.8260 (252)
Total energy cost			-50.6004 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	-0.1331 (257)

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SAP value 102.1572
 SAP rating (Section 12) 102 (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	412.6742	0.1591	65.6481 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1047.0600	0.1457	152.5289 (264)
Space and water heating			218.1770 (265)
Pumps, fans and electric keep-hot	276.5141	0.1387	38.3559 (267)
Energy for lighting	193.5616	0.1443	27.9369 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1327.8007	0.1349	-179.1495
PV Unit electricity exported	-2681.0676	0.1224	-328.1314
Total			-507.2809 (269)
Total CO2, kg/year			-222.8111 (272)
CO2 emissions per m2			-2.4300 (273)
EI value			102.1812
EI rating			102 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	45.9400 (1b)	x 2.4000 (2b)	= 110.2560 (1b) -
First floor	45.9400 (1c)	x 2.7000 (2c)	= 124.0380 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.2940 (5)

2. Ventilation rate

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	1.0000	(17)
Infiltration rate	0.0500	(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) =	0.0425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.6000	6.3000	6.2000	5.5000	5.4000	4.8000	4.8000	4.7000	5.2000	6.0000	6.1000	6.5000 (22)
Wind factor	1.6500	1.5750	1.5500	1.3750	1.3500	1.2000	1.2000	1.1750	1.3000	1.5000	1.5250	1.6250 (22a)
Adj infilt rate	0.0701	0.0669	0.0659	0.0584	0.0574	0.0510	0.0510	0.0499	0.0553	0.0638	0.0648	0.0691 (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) =												84.6000 (23c)
Effective ac	0.1471	0.1439	0.1429	0.1354	0.1344	0.1280	0.1280	0.1269	0.1322	0.1407	0.1418	0.1461 (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 TRIPLE WINDOWS (Uw = 0.90)			14.3400	0.8687	12.4575		(27)
NEW PAT/ BIFOLD DOORS (Uw = 0.90)			5.0400	0.8687	4.3784		(27)
DOOR			2.1000	0.9000	1.8900		(26)
Heat Loss Floor 1			45.9400	0.1200	5.5128	75.0000	3445.5000 (28a)
External Walls	151.2660	21.4800	129.7860	0.1500	19.4679	60.0000	7787.1600 (29a)
Main Roof	45.9400		45.9400	0.0800	3.6752	9.0000	413.4600 (30)
Total net area of external elements Aum(A, m2)			243.1460				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	47.3818	(33)
TF			88.4200			9.0000	795.7800 (32c)
BK			93.2600			75.0000	6994.5000 (32c)
Internal Floor 1			45.9400			18.0000	826.9200 (32d)
Internal Ceiling 1			45.9400			9.0000	413.4600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 20676.7800 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.0411 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.0000	0.0280	0.3920
E3 Sill	13.0000	0.0160	0.2080
E4 Jamb	31.4000	0.0180	0.5652
E5 Ground floor (normal)	29.6600	0.0520	1.5423
E6 Intermediate floor within a dwelling	29.6600	0.0010	0.0297
E10 Eaves (insulation at ceiling level)	15.1600	0.0540	0.8186
E12 Gable (insulation at ceiling level)	14.5000	0.0510	0.7395
E16 Corner (normal)	25.5000	0.0400	1.0200
E17 Corner (inverted - internal area greater than external area)	5.1000	-0.0680	-0.3468
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			4.9685 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 52.3503 (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	11.3753	11.1288	11.0467	10.4716	10.3895	9.8966	9.8966	9.8144	10.2252	10.8824	10.9645	11.2931 (38)
Average = Sum(39)m / 12 =	63.7256	63.4791	63.3970	62.8220	62.7398	62.2469	62.2469	62.1648	62.5755	63.2327	63.3148	63.6434 (39)
HLP	0.6936	0.6909	0.6900	0.6837	0.6828	0.6775	0.6775	0.6766	0.6811	0.6882	0.6891	0.6927 (40)
HLP (average)												0.6853
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6506 (42)
Hot water usage for mixer showers	68.6614	67.6296	66.1260	63.2491	61.1260	58.7584	57.4127	58.9049	60.5406	63.0827	66.0214	68.3983 (42a)
Hot water usage for baths	29.6499	29.2095	28.5894	27.4461	26.5900	25.6407	25.1279	25.7437	26.4141	27.4299	28.5968	29.5496 (42b)
Hot water usage for other uses	41.7747	40.2556	38.7365	37.2174	35.6984	34.1793	34.1793	35.6984	37.2174	38.7365	40.2556	41.7747 (42c)
Average daily hot water use (litres/day)												128.7706 (43)
Daily hot water use	140.0860	137.0947	133.4519	127.9126	123.4144	118.5784	116.7198	120.3469	124.1722	129.2492	134.8738	139.7227 (44)
Energy conte	221.8619	195.2210	205.1106	175.1060	166.1395	145.8059	141.1625	149.0146	153.1167	175.3899	192.1524	218.7719 (45)
Energy content (annual)												Total = Sum(45)m = 2138.8530
Distribution loss (46)m = 0.15 x (45)m	33.2793	29.2832	30.7666	26.2659	24.9209	21.8709	21.1744	22.3522	22.9675	26.3085	28.8229	32.8158 (46)
Water storage loss:												210.0000 (47)
Store volume												1.5000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8100 (55)
Enter (49) or (54) in (55)												
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100 (56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100 (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	270.2343	238.9122	252.0873	215.1644	201.7175	180.0112	176.5080	185.2906	194.5258	222.3665	238.9644	267.1443 (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)

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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												719.3761 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												719.3761
Solar input	-6.4610	-23.8567	-68.9015	-92.9418	-110.2466	-109.4257	-95.3812	-93.8102	-69.0605	-39.1105	-10.1803	-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	263.7733	215.0555	183.1858	122.2226	91.4709	70.5855	81.1268	91.4804	125.4654	183.2560	228.7841	267.1443 (64)
											Total per year (kWh/year) = Sum(64)m =	1923.5506 (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	112.4670	99.8640	105.7806	90.2695	83.7038	75.8447	75.2129	78.5681	84.0386	95.8985	101.3403	111.4396 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353	159.0353 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.4006	24.3370	19.7922	14.9840	11.2007	9.4561	10.2176	13.2813	17.8261	22.6343	26.4176	28.1622 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.9317	365.6874	356.2231	336.0748	310.6411	286.7370	270.7676	267.0119	276.4762	296.6245	322.0582	345.9623 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541	53.5541 (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)	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235	-106.0235 (71)
Water heating gains (Table 5)	151.1653	148.6071	142.1782	125.3743	112.5052	105.3399	101.0926	105.6023	116.7203	128.8958	140.7504	149.7844 (72)
Total internal gains	647.0635	645.1974	624.7594	582.9989	540.9128	508.0988	488.6438	492.4614	517.5885	554.7205	595.7921	630.4748 (73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
Northeast		2.3100	15.4448	0.5700	0.7000	0.7700	9.8651 (75)					
Southeast		1.3200	46.9996	0.5700	0.7000	0.7700	17.1543 (77)					
Southwest		7.3500	46.9996	0.5700	0.7000	0.7700	95.5185 (79)					
Northwest		3.3600	15.4448	0.5700	0.7000	0.7700	14.3492 (81)					
Northeast		5.0400	15.4448	0.5700	0.7000	0.7700	21.5238 (75)					
Solar gains	158.4109	241.3080	361.6582	514.8353	590.3895	653.4024	552.9476	519.2282	419.8948	280.4798	185.5791	137.9071 (83)
Total gains	805.4745	886.5054	986.4176	1097.8341	1131.3023	1161.5013	1041.5914	1011.6896	937.4833	835.2003	781.3712	768.3819 (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, n _{l,m} (see Table 9a)												
tau	90.1294	90.4793	90.5966	91.4258	91.5456	92.2704	92.2704	92.3924	91.7859	90.8320	90.7141	90.2457
alpha	7.0086	7.0320	7.0398	7.0951	7.1030	7.1514	7.1514	7.1595	7.1191	7.0555	7.0476	7.0164
util living area	0.9418	0.9045	0.8173	0.6759	0.5296	0.3696	0.3167	0.3195	0.4596	0.7103	0.8813	0.9468 (86)
Living	20.7297	20.7987	20.8841	20.9372	20.9529	20.9563	20.9564	20.9565	20.9553	20.9349	20.8484	20.7251
Non living	20.0422	20.1252	20.2216	20.2818	20.2972	20.3048	20.3049	20.3058	20.3009	20.2771	20.1859	20.0381
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	20.8617	20.7987	20.8841	20.9372	20.9529	20.9563	20.9564	20.9565	20.9553	20.9349	20.8484	20.7635 (87)
Th 2	20.3465	20.3489	20.3497	20.3552	20.3560	20.3608	20.3608	20.3616	20.3576	20.3513	20.3505	20.3473 (88)
util rest of house	0.9296	0.8870	0.7911	0.6438	0.4949	0.3354	0.2785	0.2803	0.4172	0.6695	0.8573	0.9350 (89)
MIT 2	20.2252	20.1252	20.2216	20.2818	20.2972	20.3048	20.3049	20.3058	20.3009	20.2771	20.1859	20.0938 (90)
Living area fraction												f _{LA} = Living area / (4) =
MIT	20.3072	20.2120	20.3069	20.3662	20.3817	20.3888	20.3889	20.3896	20.3853	20.3618	20.2713	20.1801 (92)
Temperature adjustment												0.0000
adjusted MIT	20.3072	20.2120	20.3069	20.3662	20.3817	20.3888	20.3889	20.3896	20.3853	20.3618	20.2713	20.1801 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation	0.9288	0.8830	0.7893	0.6444	0.4963	0.3369	0.2802	0.2820	0.4190	0.6702	0.8541	0.9316 (94)
Useful gains	748.1062	782.8078	778.6076	707.4471	561.4992	391.3480	291.8455	285.2904	392.8320	559.7649	667.3591	715.8305 (95)
Ext temp.	5.7000	6.0000	7.2000	8.9000	11.4000	14.1000	15.7000	15.8000	14.1000	11.3000	8.5000	6.1000 (96)
Heat loss rate W	930.8542	902.1659	830.9410	720.3316	563.5088	391.4567	291.8691	285.3141	393.3033	573.0048	745.2977	896.1061 (97)
Space heating kWh	135.9644	80.2087	38.9360	9.2768	1.4952	0.0000	0.0000	0.0000	0.0000	9.8505	56.1159	134.1250 (98a)
Space heating requirement - total per year (kWh/year)												465.9725
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	135.9644	80.2087	38.9360	9.2768	1.4952	0.0000	0.0000	0.0000	0.0000	9.8505	56.1159	134.1250 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												465.9725
Space heating per m2												(98c) / (4) = 5.0715 (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 %)												168.1689 (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	135.9644	80.2087	38.9360	9.2768	1.4952	0.0000	0.0000	0.0000	0.0000	9.8505	56.1159	134.1250 (98)
Space heating efficiency (main heating system 1)	168.1689	168.1689	168.1689	168.1689	168.1689	0.0000	0.0000	0.0000	0.0000	168.1689	168.1689	168.1689 (210)
Space heating fuel (main heating system)	80.8499	47.6953	23.1529	5.5164	0.8891	0.0000	0.0000	0.0000	0.0000	5.8575	33.3687	79.7562 (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	263.7733	215.0555	183.1858	122.2226	91.4709	70.5855	81.1268	91.4804	125.4654	183.2560	228.7841	267.1443 (64)
Efficiency of water heater (217)m	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559	193.1559 (217)
Fuel for water heating, kWh/month	136.5598	111.3378	94.8383	63.2767	47.3560	36.5433	42.0007	47.3609	64.9555	94.8747	118.4453	138.3050 (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	23.4848	21.2120	23.4848	22.7272	23.4848	22.7272	23.4848	23.4848	22.7272	23.4848	22.7272	23.4848 (231)
Lighting	23.9836	19.2406	17.3240	12.6923	9.8039	8.0099	8.9434	11.6250	15.0998	19.8117	22.3773	24.6502 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-77.5127	-98.2283	-139.7735	-150.9466	-151.1737	-139.5589	-136.4058	-135.0532	-126.7125	-109.9653	-81.6750	-68.0911 (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	-47.9740	-89.7736	-206.2960	-363.8809	-480.2500	-543.4842	-458.5332	-410.9019	-276.2429	-142.2075	-64.2228	-38.4246 (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												277.0860 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												193.1559
Water heating fuel used												995.8537 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)												
mechanical ventilation fans (SFP = 0.6875)												196.5141 (230a)
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												276.5141 (231)
Electricity for lighting (calculated in Appendix L)												193.5616 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-4537.2883 (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												-2794.2729 (238)

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10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	277.0860	21.5100	59.6012 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	995.8537	21.5100	214.2081 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	196.5141	21.5100	42.2702 (249)
Pump for solar water heating	80.0000	21.5100	17.2080 (249)
Energy for lighting	193.5616	21.5100	41.6351 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1415.0968	21.5100	-304.3873
PV Unit electricity exported	-3122.1915	5.5900	-174.5305
Total			-478.9178 (252)
Total energy cost			-103.9952 (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	277.0860	0.1591	44.0939 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	995.8537	0.1461	145.4912 (264)
Space and water heating			189.5852 (265)
Pumps, fans and electric keep-hot	276.5141	0.1387	38.3559 (267)
Energy for lighting	193.5616	0.1443	27.9369 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1415.0968	0.1358	-192.1368
PV Unit electricity exported	-3122.1915	0.1238	-386.6306
Total			-578.7674 (269)
Total CO2, kg/year			-322.8894 (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	277.0860	1.5890	440.2932 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	995.8537	1.5404	1534.0595 (278)
Space and water heating			1974.3526 (279)
Pumps, fans and electric keep-hot	276.5141	1.5128	418.3105 (281)
Energy for lighting	193.5616	1.5338	296.8913 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1415.0968	1.5019	-2125.2904
PV Unit electricity exported	-3122.1915	0.4545	-1419.0393
Total			-3544.3297 (283)
Total Primary energy kWh/year			-854.7753 (286)

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

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



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