

Energy Statement

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Architect: Ben White Architecture

Project: New Dwelling,
Plot 4A Trevarrick Road
St. Austell
PL25 5JN
Cornwall

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A INTRODUCTION

- A.01 This Energy Statement has been prepared by Stuart Foster to demonstrate compliance with Policy SEC1 – Sustainable Energy and Construction of the Cornwall Council Climate Emergency Development Plan Document.
- A.02 The proposed development is for one new residential dwelling at Plot 4A, Trevarrick Road, St Austell, PL25 5JN, Cornwall.
- A.03 This Energy Statement provides an assessment of space heating demand, total energy consumption and on-site renewable energy generation arising from the development.
- A.04 This document is to be read in conjunction with the Architect’s drawings and specifications, and the appendices to this document.

B POLICIES AND GUIDANCE

- B.01 The key national policies directly concerning this proposal are:
- Chapter 2 of the National Planning Policy Framework which outlines the national policies that aim to achieve sustainable development. It divides this objective into three parts: economic, social and environmental. One of the environmental objectives is to mitigate and adapt to climate change, including moving towards a low-carbon economy. This is an essential element of achieving sustainable development, which is a crucial goal of the planning system.
 - Paragraph 20 of the National Planning Policy Framework which sets out the strategic matters that should be addressed through strategic policies, including *“planning measures to address climate change mitigation and adaptation.”*
- B.02 The key local policy directly concerning this proposal is:
- Objective 9 of the Cornwall Local Plan 2010–2030 which sets out to *“make best use of our resources by: ... reducing energy consumption while increasing renewable and low carbon energy production, ... and ... increasing resilience to climate change.”*
 - Policy 12: Design of the Cornwall Local Plan 2010–2030, which requires designs to incorporate the fundamental principles of “adaptability, inclusiveness, resilience and diversity” to “respond to climate change”.
 - Policy 13: Development Standards of the Cornwall Local Plan 2010–2030, which requires designs to utilise “opportunities for natural lighting, ventilation and heating by design, layout and orientation” and to consider “connection to an existing or planned heat network”.

- Policy 14: Renewable and low carbon energy of the Cornwall Local Plan 2010–2030, which requires developments to “increase use and production of renewable and low carbon energy generation”.

B.03 The key planning policy within the Climate Emergency DPD is Policy SEC1: Sustainable Energy and Construction:

- Clause 2b, which requires new dwellings to meet the following criteria:
 - space heating demand less than 30kWh/m²/annum;
 - total energy consumption less than 40kWh/m²/annum; and
 - on-site renewable energy generation to match the total energy consumption.
- Clause 5, which requires all dwellings to “achieve an estimated water consumption of no more than 110 litres/person/day through the incorporation of water saving features”.
- Clause 6, which requires development proposals to “minimise use of materials and creation of waste and promote opportunities for a circular economy”.

C DEVELOPMENT PROPOSAL

C.01 The development proposal has been designed to include passive and operational energy efficiency measures to reduce heat loss, energy and water consumption.

C.1 Massing and thermal envelope

C.1.01 All house types typically have the following U-values:

Element	U-value (W/m ² .K)	Construction
Ground floor	0.11	Concrete bearing slab with insulation over.
External walls	0.16	Masonry cavity wall with 100mm insulation.
Roof (flat)	0.13	Timber rafters with insulation between.
Roof (sloped)	0.12	Timber rafters with insulation between.
Windows	1.00	Triple glazed windows & French doors
Doors	0.80	Triple glazed doorsets.

C.1.02 Blockwork internal partitions to ground floor and load-bearing partitions. Timber studwork elsewhere.

C.1.03 Thermal bridging values have been calculated for each relevant bridge type in accordance with ψ (ψ) values shown in Table K1 or the Recognised Construction Details.

C.2 Ventilation

C.2.01 The house will be ventilated by a Mechanical Ventilation with Heat Recovery system (MVHR) as per the following specification:

- Manufacturer and model: Titon HRV1.65 Q Plus Eco
- Efficiency: 82%
- No. of wetrooms: 6

C.2.02 Design airtightness (n50) value of 2.0 m³/h/m².

C.3 Orientation and site layout

C.3.01 The layout has been optimised for solar gain with the house facing South-east.

C.3.02 Windows have been sized to provide appropriate levels of daylighting to public rooms to reduce reliance on artificial lighting.

C.4 Energy-efficient design

C.4.01 All fixed internal light fittings within each dwelling are energy-efficient at 80 lm/W.

C.4.02 All external light fittings are to be low energy types, either:

- a) rated at no more than 100 lamp-watts per light fitting with automatic PIR and photocell control and manual override switching; or
- b) rated as having an efficacy of at least 45 lumens per circuit-watt with automatic PIR and photocell control and manual override switching.

C.4.03 All integrated whitegoods in kitchens and utilities are generally to be A-rated or better under the EU energy labelling scheme.

D ENERGY AND WATER CONSUMPTION

D.01 The proposal includes a number of design measures which are intended to reduce the use of energy and water.

D.1 Primary space heating and domestic hot water (DHW)

D.1.01 Space heating and domestic hot water shall be provided by an Air Source Heat Pump (ASHP) as per the following specification:

- Manufacturer and model: Mitsubishi EcoDan 8.5kW PUZ-WM85VAA.

- Efficiency (winter): 313.76%
- Efficiency (summer): 178.07%

D.2 Secondary space heating

D.2.01 Wood-burning stove located within Dining Room as per the following specification:

- Manufacturer and model: Stovax 'Riva Studio Edge' (Studio 1)
- Type: Wood Logs RWM Closed room heat
- Rated output: 5.0 kW
- Efficiency: 75.0%

D.3 Water consumption

D.3.01 Sanitaryware has been selected to meet the target less than 110 l/person/day as per the following specification:

Appliance	Consumption	Manufacturer and model
WC	4 / 2.6 l flush	Armitage Shanks Profile 21 S3095 with Conceala cistern.
Bath	161 l to overflow	Cleargreen Baths ENVIRO R1.
Shower	8 l/min	Ideal Standard shower outlet regulator.
Basin taps	5 l/min	Ideal Standard Connect Air Grande A7063AA single lever basin mixer with pop-up waste, chrome.
Sink taps	5 l/min	Ideal Standard Cerasprint B5344AA single lever monoblock mixer with flow regulator.
Dishwasher	1.25 l/place setting	To be confirmed.
Washing machine	8 l/kg	To be confirmed.

E RENEWABLE ENERGY GENERATION

E.01 The development will incorporate on-site renewable energy generation.

E.1 Proposed on-site installation

E.1.01 A photovoltaic array will be installed on the main roof, to the following specification.

- Manufacturer and model: Marley M10 405 Wp PV panels
- No. off: 16
- PV array peak generation: 6.48 kWp
- Roof pitch: 6° (assumed horizontal for calculation)
- Orientation: South-east

F COMPLIANCE RESULTS

F.01 The design measures and technologies outlined above will ensure that the proposed development meets the requirements of the Climate Emergency DPD.

F.1 Clause 2b: Space heating & energy demand & energy generation

F.1.01 Compliance with the requirements has been calculated using the Climate Emergency DPD Policy SEC1 part 2b Energy Summary Tool (SAP V2.0).

F.1.02 The results of the calculation are as follows:

	Space heat demand kWh/m ² _{TFA} /yr	Total energy use kWh/m ² _{GIA} /yr	Renewable generation % total energy	Renewable deficit kWh/yr
Required	<30.0	<40.0	100%	0
House	29.7	18.4	105%	0

F.2 Clause 5: Water consumption

F.2.01 Compliance with the requirements has been calculated using the Water Efficiency Calculation for New Dwellings (<http://wrcpartgcalculator.co.uk>).

F.2.02 The results of the calculation are as follows:

	Total calculated use l/person/day	Contribution from greywater l/person/day	Contribution from rainwater l/person/day	Total water consumption l/person/day
Required				<110.00
House	109.55	0.00	0.00	104.70

F.3 Clause 6: Materials and waste

F.3.01 Refer to the Design & Access Statement for details of materials and waste.

G CONCLUSION

G.01 The thresholds of the Climate Emergency DPD are shown to be met in the calculations presented above. The applicant's proposals therefore meet policy requirements.

H APPENDICES

H.01 Detailed calculations are appended to this document.

H.2 Water Efficiency Calculation for New Dwellings

The Water Efficiency Calculator for New Dwellings

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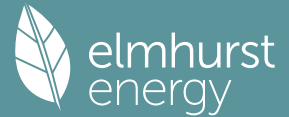
Installation Type	Unit of Measure	Capacity/Flow rate (1)	Use Factor (2)	Fixed use (litres/person/day) (3)	Litres/person/day = [(1)x(2)] + (3) (4)
WC (single flush)	Flush Volume (litres)		4.42	0.00	0
WC (dual flush)	Full flush Volume (litres)	4	1.46	0.00	5.84
	Part flush Volume (litres)	2.6	2.96	0.00	7.70
WC (multiple fittings)	Average effective flushing Volume (litres)		4.42	0.00	0
Taps (excluding kitchen/utility room taps)	Flow rate (litres/min)	5.00	1.58	1.58	9.48
Bath (where shower also present)	Capacity to overflow(litres)	161.00	0.11	0.00	17.71
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)	5.00	0.44	10.36	12.56
Washing Machine	(Litres/kg dry load)	8.00	2.1	0.00	16.80
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)			109.55
	(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)			99.69
	(10)	External water use			5.0
	(11)	Total water consumption (Building Regulation 17.K) = (9)+(10)(litres/person/day)			104.7

Installation Type	Make/Model (mandatory)	Litres/Person/Day
WC (dual flush)	Armitage Shanks Profile 21 S3095 with Conceala cistern.	13.54
Taps	Ideal Standard Connect Air Grande A7063AA single lever basin mixer with pop-up waste, chrome.	9.48
Baths (shower(s) present)	Cleargreen Baths ENVIRO R1.	17.71
Showers (bath(s) present)	Ideal Standard shower outlet regulator.	34.96
Kitchen Taps	Ideal Standard Cerasprint B5344AA single lever monoblock mixer with flow regulator.	12.56
Washing Machines		16.80
Dishwasher		4.50



H.3 Full SAP Calculation Printout

Full SAP Calculation Printout



Property Reference	House		Issued on Date	18/12/2023	
Assessment Reference	03_BWA specification	Prop Type Ref			
Property	Plot 4A, Trevarrick Road, St Austell, Cornwall, PL25 5JN				
SAP Rating	95 A	DER	1.06	TER	10.08
Environmental	99 A	% DER < TER			89.48
CO ₂ Emissions (t/year)	0.09	DFEE	36.52	TFEE	44.95
Compliance Check	See BREL	% DFEE < TFEE			18.75
% DPER < TPER	80.04	DPER	10.59	TPER	53.04
Assessor Details	Mr. Stuart Foster			Assessor ID	CK03-0001
Client	CL2310006, Andrew Phillimore				

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)
Basement floor	83.9300 (1a)	x 2.5200 (2a)	= 211.5036 (1a) - (3a)
Ground floor	90.4700 (1b)	x 2.7500 (2b)	= 248.7925 (1b) - (3b)
First floor	72.3100 (1c)	x 2.6700 (2c)	= 193.0677 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	246.7100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 653.3638 (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	1 * 10 =											10.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =											0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =											0.0000 (6e)	
Number of blocked chimneys	0 * 20 =											0.0000 (6f)	
Number of intermittent extract fans	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) =											10.0000 / (5) =	0.0153 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												2.0000 (17)	
Infiltration rate												0.1153 (18)	
Number of sides sheltered												0 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											1.0000 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.1153 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)
Adj infilt rate	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)
Balanced mechanical ventilation with heat recovery	0.1470	0.1441	0.1412	0.1268	0.1240	0.1095	0.1095	0.1067	0.1153	0.1240	0.1297	0.1355	(22b)
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) =												73.8000 (23c)	
Effective ac	0.2780	0.2751	0.2722	0.2578	0.2550	0.2405	0.2405	0.2377	0.2463	0.2550	0.2607	0.2665	(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
Typical Window (Uw = 1.00)			43.4700	0.9615	41.7981		(27)
Entrance Door			3.7800	1.0000	3.7800		(26a)
Lower Ground Floor			83.9300	0.1100	9.2323	110.0000	9232.3000 (28a)
Ground Floor			7.6900	0.1100	0.8459	110.0000	845.9000 (28a)
Typical External Wall	317.3323	47.2500	270.0823	0.1600	43.2132	110.0000	29709.0530 (29a)
LGF Exposed Roof	3.7100		3.7100	0.1300	0.4823	9.0000	33.3900 (30)
GF Exposed Roof (Living Room)	5.3900		5.3900	0.1300	0.7007	9.0000	48.5100 (30)
GF Exposed Roof (Kitchen)	5.0800		5.0800	0.1300	0.6604	9.0000	45.7200 (30)
GF Exposed Roof (Breakfast)	7.6900		7.6900	0.1300	0.9997	9.0000	69.2100 (30)
FF Main Roof	49.4500		49.4500	0.1200	5.9340	9.0000	445.0500 (30)
FF Parapet Roof	22.8600		22.8600	0.1300	2.9718	9.0000	205.7400 (30)
Total net area of external elements Aum(A, m ²)			503.1323				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	110.6183	(33)

Full SAP Calculation Printout



LGF Blockwork	54.4100	75.0000	4080.7500 (32c)
LGF Studwork	92.0400	9.0000	828.3600 (32c)
GF Blockwork	51.6500	75.0000	3873.7500 (32c)
FF Blockwork	17.0900	75.0000	1281.7500 (32c)
GF Studwork	91.1800	9.0000	820.6200 (32c)
FF Studwork	87.2900	9.0000	785.6100 (32c)
GF Floor	82.7900	18.0000	1490.2200 (32d)
FF Floor	72.3100	18.0000	1301.5800 (32d)
LGF Internal Ceiling	80.2300	9.0000	722.0700 (32e)
GF Internal Ceiling	72.3100	9.0000	650.7900 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 56470.3730 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 228.8937 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	31.3500	0.0280	0.8778
E3 Sill	29.5500	0.0270	0.7979
E4 Jamb	81.6800	0.0210	1.7153
E5 Ground floor (normal)	45.9890	0.1610	7.4042
E6 Intermediate floor within a dwelling	73.7030	0.0020	0.1474
E8 Balcony within a dwelling, wall insulation continuous	17.6590	0.1000	1.7659
E14 Flat roof	51.9530	0.1600	8.3125
E15 Flat roof with parapet	13.6590	0.3000	4.0977
E16 Corner (normal)	43.1900	0.0480	2.0731
E17 Corner (inverted - internal area greater than external area)	10.9300	-0.0810	-0.8853
E22 Basement floor	25.9780	0.2200	5.7152
E24 Eaves (insulation at ceiling level - inverted)	18.7760	0.1500	2.8164

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 34.8380 (36)
 Point Thermal bridges 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 145.4563 (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	59.9427	59.3212	58.6996	55.5920	54.9705	51.8629	51.8629	51.2413	53.1059	54.9705	56.2135	57.4566 (38)
Average = Sum(39)m / 12 =	205.3990	204.7775	204.1560	201.0484	200.4268	197.3192	197.3192	196.6977	198.5623	200.4268	201.6699	202.9129 (39)
												200.8930

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8326	0.8300	0.8275	0.8149	0.8124	0.7998	0.7998	0.7973	0.8048	0.8124	0.8174	0.8225 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.8143

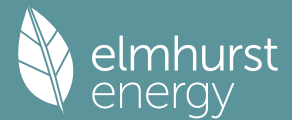
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0627 (42)
Hot water usage for mixer showers	25.1902	24.8116	24.2600	23.2045	22.4256	21.5570	21.0633	21.6107	22.2109	23.1435	24.2216	25.0937 (42a)	
Hot water usage for baths	32.6210	32.1365	31.4543	30.1964	29.2545	28.2101	27.6459	28.3234	29.0610	30.1786	31.4624	32.5107 (42b)	
Hot water usage for other uses	45.9946	44.3221	42.6496	40.9770	39.3045	37.6320	37.6320	39.3045	40.9770	42.6496	44.3221	45.9946 (42c)	
Average daily hot water use (litres/day)													95.2826 (43)
Daily hot water use	103.8058	101.2702	98.3638	94.3779	90.9846	87.3990	86.3412	89.2386	92.2489	95.9716	100.0061	103.5990 (44)	
Energy content (annual)	164.4030	144.2075	151.1816	129.1987	122.4828	107.4673	104.4221	110.4960	113.7521	130.2326	142.4770	162.2110 (45)	
Distribution loss (46)m = 0.15 x (45)m	24.6605	21.6311	22.6772	19.3798	18.3724	16.1201	15.6633	16.5744	17.0628	19.5349	21.3716	24.3317 (46)	
Water storage loss:													300.0000 (47)
Store volume													1.9000 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.0260 (55)
Enter (49) or (54) in (55)													
Total storage loss	31.8060	28.7280	31.8060	30.7800	31.8060	30.7800	31.8060	31.8060	30.7800	31.8060	30.7800	31.8060 (56)	
If cylinder contains dedicated solar storage	31.8060	28.7280	31.8060	30.7800	31.8060	30.7800	31.8060	31.8060	30.7800	31.8060	30.7800	31.8060 (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	219.4714	193.9467	206.2500	182.4907	177.5512	160.7593	159.4905	165.5644	167.0441	185.3010	195.7690	217.2794 (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	219.4714	193.9467	206.2500	182.4907	177.5512	160.7593	159.4905	165.5644	167.0441	185.3010	195.7690	217.2794 (64)	
Total per year (kWh/year) = Sum(64)m =													2230.9177 (64)
Electric shower(s)	40.3463	35.9488	39.2548	37.4603	38.1633	36.4041	37.6175	38.1633	37.4603	39.2548	38.5166	40.3463 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													458.9363 (64a)
Heat gains from water heating, kWh/month	108.8053	96.7276	104.1363	94.9572	94.3211	87.4675	88.1795	90.3355	89.8213	97.1707	99.6364	108.0764 (65)	

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

Metabolic gains (Table 5), Watts												
(66)m	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.7687	56.6388	46.0618	34.8717	26.0670	22.0069	23.7792	30.9091	41.4862	52.6762	61.4809	65.5411 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	617.1973	623.6019	607.4625	573.1038	529.7321	488.9688	461.7364	455.3319	471.4712	505.8299	549.2016	589.9649 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061 (71)
Water heating gains (Table 5)	146.2437	143.9398	139.9681	131.8851	126.7756	121.4826	118.5208	121.4186	124.7517	130.6058	138.3838	145.2640 (72)
Total internal gains	944.9013	941.8721	911.1841	857.5523	800.2664	750.1500	721.7281	725.3513	755.4007	806.8036	866.7580	918.4616 (73)

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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					1.8700	11.2829	0.5700	1.0000	0.7700	8.3344 (75)		
Southeast					26.8300	36.7938	0.5700	1.0000	0.7700	389.9454 (77)		
Southwest					9.9900	36.7938	0.5700	1.0000	0.7700	145.1940 (79)		
Northwest					4.7800	11.2829	0.5700	1.0000	0.7700	21.3039 (81)		
Solar gains	564.7776	971.8698	1355.9037	1723.8602	1970.8730	1974.2179	1896.0336	1709.0607	1482.9097	1081.1736	678.2662	482.1718 (83)
Total gains	1509.6789	1913.7419	2267.0878	2581.4125	2771.1394	2724.3679	2617.7616	2434.4120	2238.3105	1887.9772	1545.0242	1400.6335 (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	76.3695	76.6013	76.8345	78.0221	78.2640	79.4966	79.4966	79.7478	78.9990	78.2640	77.7816	77.3051
alpha	6.0913	6.1068	6.1223	6.2015	6.2176	6.2998	6.2998	6.3165	6.2666	6.2176	6.1854	6.1537
util living area	0.9962	0.9845	0.9462	0.8343	0.6528	0.4616	0.3314	0.3712	0.6008	0.9002	0.9886	0.9975 (86)
Living	20.0440	20.2984	20.5950	20.8610	20.9726	20.9973	20.9997	20.9995	20.9874	20.8082	20.3648	19.9994
Non living	19.3474	19.6004	19.8879	20.1365	20.2257	20.2523	20.2534	20.2555	20.2429	20.0992	19.6766	19.3101
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	20.5109	20.2984	20.5950	20.8610	20.9726	20.9973	20.9997	20.9995	20.9874	20.8082	20.3648	20.1394 (87)
Th 2	20.2252	20.2274	20.2296	20.2404	20.2426	20.2535	20.2535	20.2557	20.2491	20.2426	20.2382	20.2339 (88)
util rest of house	0.9951	0.9804	0.9331	0.8024	0.6056	0.4086	0.2753	0.3114	0.5399	0.8713	0.9849	0.9968 (89)
MIT 2	19.7761	19.6004	19.8879	20.1365	20.2257	20.2523	20.2534	20.2555	20.2429	20.0992	19.6766	19.4393 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.9518	19.7673	20.0570	20.3097	20.4043	20.4304	20.4318	20.4334	20.4208	20.2687	19.8411	19.6067 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.9518	19.7673	20.0570	20.3097	20.4043	20.4304	20.4318	20.4334	20.4208	20.2687	19.8411	19.6067 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9947	0.9774	0.9297	0.8055	0.6159	0.4212	0.2888	0.3257	0.5541	0.8724	0.9824	0.9960 (94)
Useful gains	1501.6270	1870.4155	2107.7385	2079.4274	1706.8557	1147.5383	755.8807	792.9055	1240.1724	1647.1221	1517.8275	1395.0887 (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	3214.8642	3044.4908	2767.7360	2293.9096	1744.5731	1150.4542	756.0959	793.3549	1255.0821	1937.8741	2569.5057	3126.2161 (97)
Space heating kWh	1274.6485	788.9786	491.0382	154.4272	28.0617	0.0000	0.0000	0.0000	0.0000	216.3194	757.2083	1287.9588 (98a)
Space heating requirement - total per year (kWh/year)	4998.6408											
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	1274.6485	788.9786	491.0382	154.4272	28.0617	0.0000	0.0000	0.0000	0.0000	216.3194	757.2083	1287.9588 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4998.6408											
Space heating per m2	(98c) / (4) = 20.2612 (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 %)	313.7572 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	65.0000 (208)											
Space heating requirement	1274.6485	788.9786	491.0382	154.4272	28.0617	0.0000	0.0000	0.0000	0.0000	216.3194	757.2083	1287.9588 (98)
Space heating efficiency (main heating system 1)	313.7572	313.7572	313.7572	313.7572	313.7572	0.0000	0.0000	0.0000	0.0000	313.7572	313.7572	313.7572 (210)
Space heating fuel (main heating system)	406.2531	251.4615	156.5026	49.2187	8.9438	0.0000	0.0000	0.0000	0.0000	68.9448	241.3357	410.4953 (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	219.4714	193.9467	206.2500	182.4907	177.5512	160.7593	159.4905	165.5644	167.0441	185.3010	195.7690	217.2794 (64)
Efficiency of water heater (217)m	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713 (216)
Fuel for water heating, kWh/month	123.2492	108.9152	115.8244	102.4818	99.7079	90.2781	89.5656	92.9765	93.8074	104.0600	109.9386	122.0182 (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	120.3692	108.7206	120.3692	116.4864	120.3692	116.4864	120.3692	120.3692	116.4864	120.3692	116.4864	120.3692 (231)
Lighting	55.8164	44.7780	40.3176	29.5384	22.8163	18.6411	20.8138	27.0546	35.1412	46.1072	52.0780	57.3677 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-79.9554	-148.8888	-287.7555	-418.3998	-529.2759	-523.3952	-513.0779	-439.1992	-323.2467	-199.0752	-97.9380	-64.6316 (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)												

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(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)
(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)
(233b)m	-0.2680	-1.6048	-8.4541	-29.4978	-63.1433	-73.8016	-70.0847	-45.2269	-20.1415	-4.5689	-0.5994	-0.1643	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													(234b)
(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)
(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)
(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												1593.1555	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												178.0713	
Water heating fuel used												1252.8229	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7780)													
mechanical ventilation fans (SFP = 1.7780)												1417.2506	(230a)
Total electricity for the above, kWh/year												1417.2506	(231)
Electricity for lighting (calculated in Appendix L)												450.4704	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3942.3947	(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												1230.2410	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1593.1555	16.4900	262.7113	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1252.8229	16.4900	206.5905	(247)
Energy for instantaneous electric shower(s)	458.9363	16.4900	75.6786	(247a)
Pumps, fans and electric keep-hot	1417.2506	16.4900	233.7046	(249)
Energy for lighting	450.4704	16.4900	74.2826	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3624.8392	16.4900	-597.7360	
PV Unit electricity exported	-317.5555	5.5900	-17.7514	
Total			-615.4873	(252)
Total energy cost			237.4803	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.2931	(257)
SAP value		95.2493	
SAP rating (Section 12)		95	(258)
SAP band		A	

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

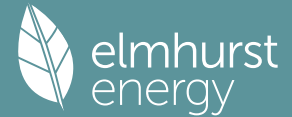
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1593.1555	0.1578	251.3458	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1252.8229	0.1407	176.3284	(264)
Energy for instantaneous electric shower(s)	458.9363	0.1391	63.8482	(264a)
Space and water heating			427.6742	(265)
Pumps, fans and electric keep-hot	1417.2506	0.1387	196.5901	(267)
Energy for lighting	450.4704	0.1443	65.0168	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3624.8392	0.1300	-471.3604	
PV Unit electricity exported	-317.5555	0.1132	-35.9522	
Total			-507.3126	(269)
Total CO2, kg/year			245.8167	(272)
CO2 emissions per m2			1.0000	(273)
EI value			98.8708	
EI rating			99	(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)
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4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0627 (42)
Hot water usage for mixer showers												25.0937 (42a)
Hot water usage for baths												32.5107 (42b)
Hot water usage for other uses												45.9946 (42c)
Average daily hot water use (litres/day)												95.2826 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	103.8058	101.2702	98.3638	94.3779	90.9846	87.3990	86.3412	89.2386	92.2489	95.9716	100.0061	103.5990 (44)
Distribution loss (46)m = 0.15 x (45)m	164.4030	144.2075	151.1816	129.1987	122.4828	107.4673	104.4221	110.4960	113.7521	130.2326	142.4770	162.2110 (45)
Water storage loss:												1582.5317
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0260 (55)
Total storage loss												31.8060 (56)
If cylinder contains dedicated solar storage												31.8060 (57)
Primary loss												23.2624 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												219.4714 (62)
WWHRS												0.0000 (63a)
PV diverter												-0.0000 (63b)
Solar input												0.0000 (63c)
FGHRS												0.0000 (63d)
Output from w/h												219.4714 (64)
Electric shower(s)												40.3463 (64a)
Heat gains from water heating, kWh/month												108.8053 (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	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.7687	56.6388	46.0618	34.8717	26.0670	22.0069	23.7792	30.9091	41.4862	52.6762	61.4809	65.5411 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	617.1973	623.6019	607.4625	573.1038	529.7321	488.9688	461.7364	455.3319	471.4712	505.8299	549.2016	589.9649 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061 (71)
Water heating gains (Table 5)	146.2437	143.9398	139.9681	131.8851	126.7756	121.4826	118.5208	121.4186	124.7517	130.6058	138.3838	145.2640 (72)
Total internal gains	944.9013	941.8721	911.1841	857.5523	800.2664	750.1500	721.7281	725.3513	755.4007	806.8036	866.7580	918.4616 (73)

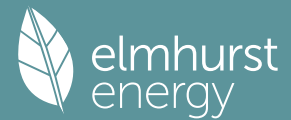
6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
Northeast	1.8700	15.8738	0.5700	1.0000	0.7700	11.7255 (75)						
Southeast	26.8300	48.3051	0.5700	1.0000	0.7700	511.9435 (77)						
Southwest	9.9900	48.3051	0.5700	1.0000	0.7700	190.6193 (79)						
Northwest	4.7800	15.8738	0.5700	1.0000	0.7700	29.9721 (81)						
Solar gains	744.2604	1069.9596	1458.7699	1911.5048	2062.0864	2237.0790	1915.3423	1864.5828	1657.6396	1205.8948	837.8939	637.6981 (83)
Total gains	1689.1617	2011.8318	2369.9540	2769.0571	2862.3528	2987.2289	2637.0704	2589.9341	2413.0404	2012.6984	1704.6519	1556.1598 (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	73.6936	74.5644	74.7854	76.1391	76.1391	77.5427	77.3051	77.5427	76.8345	75.0077	74.7854	73.6936
alpha	5.9129	5.9710	5.9857	6.0759	6.0759	6.1695	6.1537	6.1695	6.1223	6.0005	5.9857	5.9129
util living area	0.9874	0.9681	0.9119	0.7794	0.6307	0.4187	0.3536	0.3589	0.5197	0.8161	0.9626	0.9903 (86)
Living	20.2898	20.4758	20.7100	20.9055	20.9757	20.9983	20.9995	20.9995	20.9942	20.9021	20.5979	20.2693
Non living	19.5699	19.7571	19.9772	20.1558	20.2085	20.2353	20.2337	20.2359	20.2270	20.1483	19.8791	19.5502
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	20.6367	20.4758	20.7100	20.9055	20.9757	20.9983	20.9995	20.9995	20.9942	20.9021	20.5979	20.3715 (87)
Th 2	20.1992	20.2079	20.2100	20.2230	20.2230	20.2361	20.2339	20.2361	20.2296	20.2122	20.2100	20.1992 (88)
util rest of house	0.9835	0.9592	0.8908	0.7414	0.5816	0.3676	0.2949	0.2995	0.4572	0.7683	0.9498	0.9872 (89)
MIT 2	19.8773	19.7571	19.9772	20.1558	20.2085	20.2353	20.2337	20.2359	20.2270	20.1483	19.8791	19.6410 (90)

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Living area fraction										fLA = Living area / (4) =	0.2391 (91)	
MIT	20.0589	19.9289	20.1524	20.3350	20.3919	20.4177	20.4168	20.4185	20.4104	20.3285	20.0509	19.8156 (92)
Temperature adjustment											0.0000	
adjusted MIT	20.0589	19.9289	20.1524	20.3350	20.3919	20.4177	20.4168	20.4185	20.4104	20.3285	20.0509	19.8156 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9827	0.9554	0.8891	0.7472	0.5925	0.3798	0.3089	0.3137	0.4721	0.7759	0.9467	0.9853	(94)
Useful gains	1659.9376	1922.1797	2107.1867	2068.9347	1695.9826	1134.6065	814.6532	812.4598	1139.0837	1561.6332	1613.8437	1533.2098	(95)
Ext temp.	6.4000	6.7000	7.9000	9.6000	12.0000	14.8000	16.4000	14.8000	12.2000	9.3000	6.8000	6.8000	(96)
Heat loss rate W	2907.3867	2782.9881	2569.9404	2211.6392	1728.9097	1136.4200	815.0632	812.8981	1145.3979	1699.8975	2255.0020	2770.4718	(97)
Space heating kWh	928.1021	578.4633	344.2887	102.7472	24.4978	0.0000	0.0000	0.0000	0.0000	102.8687	461.6340	920.5230	(98a)
Space heating requirement - total per year (kWh/year)												3463.1248	
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	928.1021	578.4633	344.2887	102.7472	24.4978	0.0000	0.0000	0.0000	0.0000	102.8687	461.6340	920.5230	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3463.1248	
Space heating per m2										(98c) / (4) =		14.0372	(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 %)													313.6070 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement	928.1021	578.4633	344.2887	102.7472	24.4978	0.0000	0.0000	0.0000	0.0000	102.8687	461.6340	920.5230	(98)
Space heating efficiency (main heating system 1)	313.6070	313.6070	313.6070	313.6070	313.6070	0.0000	0.0000	0.0000	0.0000	313.6070	313.6070	313.6070	(210)
Space heating fuel (main heating system)	295.9443	184.4548	109.7835	32.7631	7.8116	0.0000	0.0000	0.0000	0.0000	32.8018	147.2014	293.5275	(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	219.4714	193.9467	206.2500	182.4907	177.5512	160.7593	159.4905	165.5644	167.0441	185.3010	195.7690	217.2794	(64)
Efficiency of water heater	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	(216)
Fuel for water heating, kWh/month	123.2360	108.9036	115.8120	102.4709	99.6973	90.2684	89.5560	92.9666	93.7974	104.0489	109.9268	122.0052	(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	120.3692	108.7206	120.3692	116.4864	120.3692	116.4864	120.3692	120.3692	116.4864	120.3692	116.4864	120.3692	(231)
Lighting	55.8164	44.7780	40.3176	29.5384	22.8163	18.6411	20.8138	27.0546	35.1412	46.1072	52.0780	57.3677	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-113.4590	-175.7204	-326.9286	-476.6923	-563.4918	-589.2449	-528.5923	-488.8193	-376.3174	-236.3049	-130.0197	-92.1247	(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)	-0.7052	-2.6424	-12.4782	-42.8690	-75.2102	-103.5034	-76.1690	-60.4027	-29.7764	-7.4510	-1.3636	-0.4408	(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												1104.2880	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												178.0903	
Water heating fuel used												1252.6892	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7780)													
mechanical ventilation fans (SFP = 1.7780)												1417.2506	(230a)
Total electricity for the above, kWh/year												1417.2506	(231)
Electricity for lighting (calculated in Appendix L)												450.4704	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4510.7270	(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												172.9075	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1104.2880	21.5100	237.5323 (240)

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Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1252.6892	21.5100	269.4534 (247)
Energy for instantaneous electric shower(s)	458.9363	21.5100	98.7172 (247a)
Pumps, fans and electric keep-hot	1417.2506	21.5100	304.8506 (249)
Energy for lighting	450.4704	21.5100	96.8962 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4097.7151	21.5100	-881.4185
PV Unit electricity exported	-413.0119	5.5900	-23.0874
Total			-904.5059 (252)
Total energy cost			102.9439 (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	1104.2880	0.1583	174.7983 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1252.6892	0.1407	176.3096 (264)
Energy for instantaneous electric shower(s)	458.9363	0.1391	63.8482 (264a)
Space and water heating			351.1078 (265)
Pumps, fans and electric keep-hot	1417.2506	0.1387	196.5901 (267)
Energy for lighting	450.4704	0.1443	65.0168 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4097.7151	0.1308	-536.0054
PV Unit electricity exported	-413.0119	0.1145	-47.3023
Total			-583.3077 (269)
Total CO2, kg/year			93.2552 (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	1104.2880	1.5859	1751.3149 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1252.6892	1.5204	1904.6081 (278)
Energy for instantaneous electric shower(s)	458.9363	1.5143	694.9829 (278a)
Space and water heating			3655.9230 (279)
Pumps, fans and electric keep-hot	1417.2506	1.5128	2144.0167 (281)
Energy for lighting	450.4704	1.5338	690.9465 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4097.7151	1.4832	-6077.7031
PV Unit electricity exported	-413.0119	0.4198	-173.3933
Total			-6251.0964 (283)
Total Primary energy kWh/year			934.7727 (286)

SAP 10 EPC IMPROVEMENTS

03_BWA specification

Current energy efficiency rating: A 95
 Current environmental impact rating: A 99

N Solar water heating SAP increase too small
 U Solar photovoltaic panels Already installed
 V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
 (none)

Measures omitted - SAP change or cost saving too small:

N Solar water heating + 0.9 -£ 68 -44 kg (46.8%)

Recommended measures Typical annual savings Energy Environmental efficiency impact
 (none) Total Savings £0 0.00 kg/m²

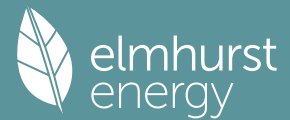
Potential energy efficiency rating: A 95
 Potential environmental impact rating: A 99

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

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

	Current £1007	Potential £1007	Saving £0
Electricity			
Space heating	£542	£542	£0
Water heating	£368	£368	£0
Lighting	£97	£97	£0
Generated (PV)	-£905	-£905	£0
Total cost of fuels	£102	£102	£0
Total cost of uses	£102	£102	£0
Delivered energy	1 kWh/m ²	1 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.1 tonnes	0.1 tonnes	0.0 tonnes
CO2 emissions per m ²	0 kg/m ²	0 kg/m ²	0 kg/m ²
Primary energy	4 kWh/m ²	4 kWh/m ²	0 kWh/m ²

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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 (m2)	Storey height (m)	Volume (m3)
Basement floor	83.9300 (1a)	x 2.5200 (2a)	= 211.5036 (1a) - (3a)
Ground floor	90.4700 (1b)	x 2.7500 (2b)	= 248.7925 (1b) - (3b)
First floor	72.3100 (1c)	x 2.6700 (2c)	= 193.0677 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	246.7100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 653.3638 (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	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) =	10.0000 / (5) =	0.0153 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		2.0000	(17)
Infiltration rate		0.1153	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.1153 (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	0.1470	0.1441	0.1412	0.1268	0.1240	0.1095	0.1095	0.1067	0.1153	0.1240	0.1297	0.1355 (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)												73.8000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2780	0.2751	0.2722	0.2578	0.2550	0.2405	0.2405	0.2377	0.2463	0.2550	0.2607	0.2665 (25)

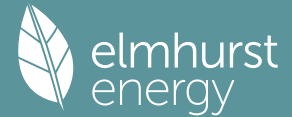
3. Heat losses and heat loss parameter

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
Typical Window (Uw = 1.00)			43.4700	0.9615	41.7981		(27)
Entrance Door			3.7800	1.0000	3.7800		(26a)
Lower Ground Floor			83.9300	0.1100	9.2323	110.0000	9232.3000 (28a)
Ground Floor			7.6900	0.1100	0.8459	110.0000	845.9000 (28a)
Typical External Wall	317.3323	47.2500	270.0823	0.1600	43.2132	110.0000	29709.0530 (29a)
LGF Exposed Roof	3.7100		3.7100	0.1300	0.4823	9.0000	33.3900 (30)
GF Exposed Roof (Living Room)	5.3900		5.3900	0.1300	0.7007	9.0000	48.5100 (30)
GF Exposed Roof (Kitchen)	5.0800		5.0800	0.1300	0.6604	9.0000	45.7200 (30)
GF Exposed Roof (Breakfast)	7.6900		7.6900	0.1300	0.9997	9.0000	69.2100 (30)
FF Main Roof	49.4500		49.4500	0.1200	5.9340	9.0000	445.0500 (30)
FF Parapet Roof	22.8600		22.8600	0.1300	2.9718	9.0000	205.7400 (30)
Total net area of external elements Aum(A, m2)			503.1323				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	110.6183	(33)
LGF Blockwork			54.4100			75.0000	4080.7500 (32c)
LGF Studwork			92.0400			9.0000	828.3600 (32c)
GF Blockwork			51.6500			75.0000	3873.7500 (32c)
FF Blockwork			17.0900			75.0000	1281.7500 (32c)
GF Studwork			91.1800			9.0000	820.6200 (32c)
FF Studwork			87.2900			9.0000	785.6100 (32c)
GF Floor			82.7900			18.0000	1490.2200 (32d)
FF Floor			72.3100			18.0000	1301.5800 (32d)
LGF Internal Ceiling			80.2300			9.0000	722.0700 (32e)
GF Internal Ceiling			72.3100			9.0000	650.7900 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 56470.3730 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							228.8937 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	31.3500	0.0280	0.8778
E3 Sill	29.5500	0.0270	0.7979
E4 Jamb	81.6800	0.0210	1.7153
E5 Ground floor (normal)	45.9890	0.1610	7.4042
E6 Intermediate floor within a dwelling	73.7030	0.0020	0.1474
E8 Balcony within a dwelling, wall insulation continuous	17.6590	0.1000	1.7659
E14 Flat roof	51.9530	0.1600	8.3125
E15 Flat roof with parapet	13.6590	0.3000	4.0977
E16 Corner (normal)	43.1900	0.0480	2.0731
E17 Corner (inverted - internal area greater than external area)	10.9300	-0.0810	-0.8853
E22 Basement floor	25.9780	0.2200	5.7152

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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	76.3695	76.6013	76.8345	78.0221	78.2640	79.4966	79.4966	79.7478	78.9990	78.2640	77.7816	77.3051
alpha	6.0913	6.1068	6.1223	6.2015	6.2176	6.2998	6.2998	6.3165	6.2666	6.2176	6.1854	6.1537
util living area	0.9962	0.9845	0.9462	0.8343	0.6528	0.4616	0.3314	0.3712	0.6008	0.9002	0.9886	0.9975 (86)
Living	20.0440	20.2984	20.5950	20.8610	20.9726	20.9973	20.9997	20.9995	20.9874	20.8082	20.3648	19.9994
Non living	19.3474	19.6004	19.8879	20.1365	20.2257	20.2523	20.2534	20.2555	20.2429	20.0992	19.6766	19.3101
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	20.5109	20.2984	20.5950	20.8610	20.9726	20.9973	20.9997	20.9995	20.9874	20.8082	20.3648	20.1394 (87)
Th 2	20.2252	20.2274	20.2296	20.2404	20.2426	20.2535	20.2535	20.2557	20.2491	20.2426	20.2382	20.2339 (88)
util rest of house	0.9951	0.9804	0.9331	0.8024	0.6056	0.4086	0.2753	0.3114	0.5399	0.8713	0.9849	0.9968 (89)
MIT 2	19.7761	19.6004	19.8879	20.1365	20.2257	20.2523	20.2534	20.2555	20.2429	20.0992	19.6766	19.4393 (90)
Living area fraction									FLA = Living area / (4) =			
MIT	19.9518	19.7673	20.0570	20.3097	20.4043	20.4304	20.4318	20.4334	20.4208	20.2687	19.8411	19.6067 (91)
Temperature adjustment												0.0000
adjusted MIT	19.9518	19.7673	20.0570	20.3097	20.4043	20.4304	20.4318	20.4334	20.4208	20.2687	19.8411	19.6067 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9947	0.9774	0.9297	0.8055	0.6159	0.4212	0.2888	0.3257	0.5541	0.8724	0.9824	0.9960 (94)
Useful gains	1501.6270	1870.4155	2107.7385	2079.4274	1706.8557	1147.5383	755.8807	792.9055	1240.1724	1647.1221	1517.8275	1395.0887 (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	3214.8642	3044.4908	2767.7360	2293.9096	1744.5731	1150.4542	756.0959	793.3549	1255.0821	1937.8741	2569.5057	3126.2161 (97)
Space heating kWh	1274.6485	788.9786	491.0382	154.4272	28.0617	0.0000	0.0000	0.0000	0.0000	216.3194	757.2083	1287.9588 (98a)
Space heating requirement - total per year (kWh/year)												4998.6408
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	1274.6485	788.9786	491.0382	154.4272	28.0617	0.0000	0.0000	0.0000	0.0000	216.3194	757.2083	1287.9588 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4998.6408
Space heating per m2												(98c) / (4) = 20.2612 (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 %)												313.7572 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
Space heating requirement	1274.6485	788.9786	491.0382	154.4272	28.0617	0.0000	0.0000	0.0000	0.0000	216.3194	757.2083	1287.9588 (98)
Space heating efficiency (main heating system 1)	313.7572	313.7572	313.7572	313.7572	313.7572	0.0000	0.0000	0.0000	0.0000	313.7572	313.7572	313.7572 (210)
Space heating fuel (main heating system)	406.2531	251.4615	156.5026	49.2187	8.9438	0.0000	0.0000	0.0000	0.0000	68.9448	241.3357	410.4953 (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	219.4714	193.9467	206.2500	182.4907	177.5512	160.7593	159.4905	165.5644	167.0441	185.3010	195.7690	217.2794 (64)
Efficiency of water heater												178.0713 (216)
(217)m	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713	178.0713 (217)
Fuel for water heating, kWh/month	123.2492	108.9152	115.8244	102.4818	99.7079	90.2781	89.5656	92.9765	93.8074	104.0600	109.9386	122.0182 (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	120.3692	108.7206	120.3692	116.4864	120.3692	116.4864	120.3692	120.3692	116.4864	120.3692	116.4864	120.3692 (231)
Lighting	55.8164	44.7780	40.3176	29.5384	22.8163	18.6411	20.8138	27.0546	35.1412	46.1072	52.0780	57.3677 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-79.9554	-148.8888	-287.7555	-418.3998	-529.2759	-523.3952	-513.0779	-439.1992	-323.2467	-199.0752	-97.9380	-64.6316 (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)	-0.2680	-1.6048	-8.4541	-29.4978	-63.1433	-73.8016	-70.0847	-45.2269	-20.1415	-4.5689	-0.5994	-0.1643 (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												1593.1555 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												178.0713
Water heating fuel used												1252.8229 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7780)												
mechanical ventilation fans (SFP = 1.7780)												1417.2506 (230a)
Total electricity for the above, kWh/year												1417.2506 (231)
Electricity for lighting (calculated in Appendix L)												450.4704 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

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PV generation	-3942.3947	(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	1230.2410	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1593.1555	16.4900	262.7113 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1252.8229	16.4900	206.5905 (247)
Energy for instantaneous electric shower(s)	458.9363	16.4900	75.6786 (247a)
Pumps, fans and electric keep-hot	1417.2506	16.4900	233.7046 (249)
Energy for lighting	450.4704	16.4900	74.2826 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3624.8392	16.4900	-597.7360
PV Unit electricity exported	-317.5555	5.5900	-17.7514
Total			-615.4873 (252)
Total energy cost			237.4803 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.2931 (257)
SAP value		95.2493
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	1593.1555	0.1578	251.3458 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1252.8229	0.1407	176.3284 (264)
Energy for instantaneous electric shower(s)	458.9363	0.1391	63.8482 (264a)
Space and water heating			427.6742 (265)
Pumps, fans and electric keep-hot	1417.2506	0.1387	196.5901 (267)
Energy for lighting	450.4704	0.1443	65.0168 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3624.8392	0.1300	-471.3604
PV Unit electricity exported	-317.5555	0.1132	-35.9522
Total			-507.3126 (269)
Total CO2, kg/year			245.8167 (272)
CO2 emissions per m2			1.0000 (273)
EI value			98.8708
EI rating			99 (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)
Basement floor	83.9300 (1a)	x 2.5200 (2a)	= 211.5036 (1a) - (3a)
Ground floor	90.4700 (1b)	x 2.7500 (2b)	= 248.7925 (1b) - (3b)
First floor	72.3100 (1c)	x 2.6700 (2c)	= 193.0677 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	246.7100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	653.3638 (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	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	10.0000 / (5) = 0.0153 (8)

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Pressure test													Yes
Pressure Test Method													Blower Door
Measured/design AP50													2.0000 (17)
Infiltration rate													0.1153 (18)
Number of sides sheltered													0 (19)
Shelter factor													(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) = 0.1153 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	6.3000	5.9000	5.8000	5.2000	5.2000	4.6000	4.7000	4.6000	4.9000	5.7000	5.8000	6.3000	(22)
Wind factor	1.5750	1.4750	1.4500	1.3000	1.3000	1.1500	1.1750	1.1500	1.2250	1.4250	1.4500	1.5750	(22a)
Adj infilt rate	0.1816	0.1701	0.1672	0.1499	0.1499	0.1326	0.1355	0.1326	0.1412	0.1643	0.1672	0.1816	(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) =													73.8000 (23c)
Effective ac	0.3126	0.3011	0.2982	0.2809	0.2809	0.2636	0.2665	0.2636	0.2722	0.2953	0.2982	0.3126	(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
Typical Window (Uw = 1.00)			43.4700	0.9615	41.7981		(27)
Entrance Door			3.7800	1.0000	3.7800		(26a)
Lower Ground Floor			83.9300	0.1100	9.2323	110.0000	9232.3000 (28a)
Ground Floor			7.6900	0.1100	0.8459	110.0000	845.9000 (28a)
Typical External Wall	317.3323	47.2500	270.0823	0.1600	43.2132	110.0000	29709.0530 (29a)
LGF Exposed Roof	3.7100		3.7100	0.1300	0.4823	9.0000	33.3900 (30)
GF Exposed Roof (Living Room)	5.3900		5.3900	0.1300	0.7007	9.0000	48.5100 (30)
GF Exposed Roof (Kitchen)	5.0800		5.0800	0.1300	0.6604	9.0000	45.7200 (30)
GF Exposed Roof (Breakfast)	7.6900		7.6900	0.1300	0.9997	9.0000	69.2100 (30)
FF Main Roof	49.4500		49.4500	0.1200	5.9340	9.0000	445.0500 (30)
FF Parapet Roof	22.8600		22.8600	0.1300	2.9718	9.0000	205.7400 (30)
Total net area of external elements Aum(A, m2)			503.1323				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	110.6183		(33)
LGF Blockwork			54.4100			75.0000	4080.7500 (32c)
LGF Studwork			92.0400			9.0000	828.3600 (32c)
GF Blockwork			51.6500			75.0000	3873.7500 (32c)
FF Blockwork			17.0900			75.0000	1281.7500 (32c)
GF Studwork			91.1800			9.0000	820.6200 (32c)
FF Studwork			87.2900			9.0000	785.6100 (32c)
GF Floor			82.7900			18.0000	1490.2200 (32d)
FF Floor			72.3100			18.0000	1301.5800 (32d)
LGF Internal Ceiling			80.2300			9.0000	722.0700 (32e)
GF Internal Ceiling			72.3100			9.0000	650.7900 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 56470.3730 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 228.8937 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	31.3500	0.0280	0.8778
E1 Steel lintel with perforated steel base plate	29.5500	0.0270	0.7979
E3 Sill	81.6800	0.0210	1.7153
E4 Jamb	45.9890	0.1610	7.4042
E6 Intermediate floor within a dwelling	73.7030	0.0020	0.1474
E8 Balcony within a dwelling, wall insulation continuous	17.6590	0.1000	1.7659
E14 Flat roof	51.9530	0.1600	8.3125
E15 Flat roof with parapet	13.6590	0.3000	4.0977
E16 Corner (normal)	43.1900	0.0480	2.0731
E17 Corner (inverted - internal area greater than external area)	10.9300	-0.0810	-0.8853
E22 Basement floor	25.9780	0.2200	5.7152
E24 Eaves (insulation at ceiling level - inverted)	18.7760	0.1500	2.8164
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			34.8380 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 145.4563 (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	
	67.4010	64.9149	64.2934	60.5642	60.5642	56.8351	57.4566	56.8351	58.6996	63.6718	64.2934	67.4010	(38)
Heat transfer coeff	212.8573	210.3712	209.7497	206.0206	206.0206	202.2914	202.9129	202.2914	204.1560	209.1282	209.7497	212.8573	(39)
Average = Sum(39)m / 12 =													207.3672

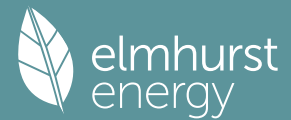
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8628	0.8527	0.8502	0.8351	0.8351	0.8200	0.8225	0.8200	0.8275	0.8477	0.8502	0.8628	(40)
HLP (average)													0.8405
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0627 (42)
Hot water usage for mixer showers	25.1902	24.8116	24.2600	23.2045	22.4256	21.5570	21.0633	21.6107	22.2109	23.1435	24.2216	25.0937	(42a)
Hot water usage for baths	32.6210	32.1365	31.4543	30.1964	29.2545	28.2101	27.6459	28.3234	29.0610	30.1786	31.4624	32.5107	(42b)
Hot water usage for other uses	45.9946	44.3221	42.6496	40.9770	39.3045	37.6320	37.6320	39.3045	40.9770	42.6496	44.3221	45.9946	(42c)
Average daily hot water use (litres/day)													95.2826 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	103.8058	101.2702	98.3638	94.3779	90.9846	87.3990	86.3412	89.2386	92.2489	95.9716	100.0061	103.5990	(44)
Energy conte	164.4030	144.2075	151.1816	129.1987	122.4828	107.4673	104.4221	110.4960	113.7521	130.2326	142.4770	162.2110	(45)
Energy content (annual)													Total = Sum(45)m = 1582.5317
Distribution loss (46)m = 0.15 x (45)m													
	24.6605	21.6311	22.6772	19.3798	18.3724	16.1201	15.6633	16.5744	17.0628	19.5349	21.3716	24.3317	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.9000 (48)
Temperature factor from Table 2b													0.5400 (49)

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Enter (49) or (54) in (55)												1.0260 (55)
Total storage loss	31.8060	28.7280	31.8060	30.7800	31.8060	30.7800	31.8060	31.8060	30.7800	31.8060	30.7800	31.8060 (56)
If cylinder contains dedicated solar storage	31.8060	28.7280	31.8060	30.7800	31.8060	30.7800	31.8060	31.8060	30.7800	31.8060	30.7800	31.8060 (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	219.4714	193.9467	206.2500	182.4907	177.5512	160.7593	159.4905	165.5644	167.0441	185.3010	195.7690	217.2794 (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	219.4714	193.9467	206.2500	182.4907	177.5512	160.7593	159.4905	165.5644	167.0441	185.3010	195.7690	217.2794 (64)
	Total per year (kWh/year) = Sum(64)m =											2230.9177 (64)
Electric shower(s)	40.3463	35.9488	39.2548	37.4603	38.1633	36.4041	37.6175	38.1633	37.4603	39.2548	38.5166	40.3463 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											458.9363 (64a)
Heat gains from water heating, kWh/month	108.8053	96.7276	104.1363	94.9572	94.3211	87.4675	88.1795	90.3355	89.8213	97.1707	99.6364	108.0764 (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	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592	183.7592 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.7687	56.6388	46.0618	34.8717	26.0670	22.0069	23.7792	30.9091	41.4862	52.6762	61.4809	65.5411 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	617.1973	623.6019	607.4625	573.1038	529.7321	488.9688	461.7364	455.3319	471.4712	505.8299	549.2016	589.9649 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386	56.4386 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061	-122.5061 (71)
Water heating gains (Table 5)	146.2437	143.9398	139.9681	131.8851	126.7756	121.4826	118.5208	121.4186	124.7517	130.6058	138.3838	145.2640 (72)
Total internal gains	944.9013	941.8721	911.1841	857.5523	800.2664	750.1500	721.7281	725.3513	755.4007	806.8036	866.7580	918.4616 (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	1.8700	15.8738	0.5700	1.0000	0.7700	11.7255 (75)						
Southeast	26.8300	48.3051	0.5700	1.0000	0.7700	511.9435 (77)						
Southwest	9.9900	48.3051	0.5700	1.0000	0.7700	190.6193 (79)						
Northwest	4.7800	15.8738	0.5700	1.0000	0.7700	29.9721 (81)						
Solar gains	744.2604	1069.9596	1458.7699	1911.5048	2062.0864	2237.0790	1915.3423	1864.5828	1657.6396	1205.8948	837.8939	637.6981 (83)
Total gains	1689.1617	2011.8318	2369.9540	2769.0571	2862.3528	2987.2289	2637.0704	2589.9341	2413.0404	2012.6984	1704.6519	1556.1598 (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	73.6936	74.5644	74.7854	76.1391	76.1391	77.5427	77.3051	77.5427	76.8345	75.0077	74.7854	73.6936
alpha	5.9129	5.9710	5.9857	6.0759	6.0759	6.1695	6.1537	6.1695	6.1223	6.0005	5.9857	5.9129
util living area	0.9874	0.9681	0.9119	0.7794	0.6307	0.4187	0.3536	0.3589	0.5197	0.8161	0.9626	0.9903 (86)
Living	20.2898	20.4758	20.7100	20.9055	20.9757	20.9983	20.9995	20.9995	20.9942	20.9021	20.5979	20.2693
Non living	19.5699	19.7571	19.9772	20.1558	20.2085	20.2353	20.2337	20.2359	20.2270	20.1483	19.8791	19.5502
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	20.6367	20.4758	20.7100	20.9055	20.9757	20.9983	20.9995	20.9995	20.9942	20.9021	20.5979	20.3715 (87)
Th 2	20.1992	20.2079	20.2100	20.2230	20.2230	20.2361	20.2339	20.2361	20.2296	20.2122	20.2100	20.1992 (88)
util rest of house	0.9835	0.9592	0.8908	0.7414	0.5816	0.3676	0.2949	0.2995	0.4572	0.7683	0.9498	0.9872 (89)
MIT 2	19.8773	19.7571	19.9772	20.1558	20.2085	20.2353	20.2337	20.2359	20.2270	20.1483	19.8791	19.6410 (90)
Living area fraction	fLA = Living area / (4) =											0.2391 (91)
MIT	20.0589	19.9289	20.1524	20.3350	20.3919	20.4177	20.4168	20.4185	20.4104	20.3285	20.0509	19.8156 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0589	19.9289	20.1524	20.3350	20.3919	20.4177	20.4168	20.4185	20.4104	20.3285	20.0509	19.8156 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1659.9376	1922.1797	2107.1867	2068.9347	1695.9826	1134.6065	814.6532	812.4598	1139.0837	1561.6332	1613.8437	1533.2098 (95)
Ext temp.	6.4000	6.7000	7.9000	9.6000	12.0000	14.8000	16.4000	16.4000	14.8000	12.2000	9.3000	6.8000 (96)
Heat loss rate W	2907.3867	2782.9881	2569.9404	2211.6392	1728.9097	1136.4200	815.0632	812.8981	1145.3979	1699.8975	2255.0020	2770.4718 (97)
Space heating kWh	928.1021	578.4633	344.2887	102.7472	24.4978	0.0000	0.0000	0.0000	0.0000	102.8687	461.6340	920.5230 (98a)
Space heating requirement - total per year (kWh/year)												3463.1248
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	928.1021	578.4633	344.2887	102.7472	24.4978	0.0000	0.0000	0.0000	0.0000	102.8687	461.6340	920.5230 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3463.1248

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Space heating per m2

(98c) / (4) = 14.0372 (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 %)													313.6070 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement	928.1021	578.4633	344.2887	102.7472	24.4978	0.0000	0.0000	0.0000	0.0000	102.8687	461.6340	920.5230	(98)
Space heating efficiency (main heating system 1)	313.6070	313.6070	313.6070	313.6070	313.6070	0.0000	0.0000	0.0000	0.0000	313.6070	313.6070	313.6070	(210)
Space heating fuel (main heating system)	295.9443	184.4548	109.7835	32.7631	7.8116	0.0000	0.0000	0.0000	0.0000	32.8018	147.2014	293.5275	(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	219.4714	193.9467	206.2500	182.4907	177.5512	160.7593	159.4905	165.5644	167.0441	185.3010	195.7690	217.2794	(64)
Efficiency of water heater (217)m	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	178.0903	(216)
Fuel for water heating, kWh/month	123.2360	108.9036	115.8120	102.4709	99.6973	90.2684	89.5560	92.9666	93.7974	104.0489	109.9268	122.0052	(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	120.3692	108.7206	120.3692	116.4864	120.3692	116.4864	120.3692	120.3692	116.4864	120.3692	116.4864	120.3692	(231)
Lighting	55.8164	44.7780	40.3176	29.5384	22.8163	18.6411	20.8138	27.0546	35.1412	46.1072	52.0780	57.3677	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-113.4590	-175.7204	-326.9286	-476.6923	-563.4918	-589.2449	-528.5923	-488.8193	-376.3174	-236.3049	-130.0197	-92.1247	(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	-0.7052	-2.6424	-12.4782	-42.8690	-75.2102	-103.5034	-76.1690	-60.4027	-29.7764	-7.4510	-1.3636	-0.4408	(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													1104.2880 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													178.0903
Water heating fuel used													1252.6892 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7780) mechanical ventilation fans (SFP = 1.7780)													1417.2506 (230a)
Total electricity for the above, kWh/year													1417.2506 (231)
Electricity for lighting (calculated in Appendix L)													450.4704 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-4510.7270 (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													172.9075 (238)

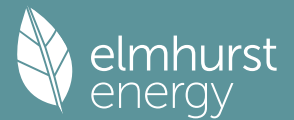
10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1104.2880	21.5100	237.5323	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1252.6892	21.5100	269.4534	(247)
Energy for instantaneous electric shower(s)	458.9363	21.5100	98.7172	(247a)
Pumps, fans and electric keep-hot	1417.2506	21.5100	304.8506	(249)
Energy for lighting	450.4704	21.5100	96.8962	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4097.7151	21.5100	-881.4185	
PV Unit electricity exported	-413.0119	5.5900	-23.0874	
Total			-904.5059	(252)
Total energy cost			102.9439	(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	1104.2880	0.1583	174.7983	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1252.6892	0.1407	176.3096	(264)
Energy for instantaneous electric shower(s)	458.9363	0.1391	63.8482	(264a)
Space and water heating			351.1078	(265)

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Pumps, fans and electric keep-hot	1417.2506	0.1387	196.5901 (267)
Energy for lighting	450.4704	0.1443	65.0168 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4097.7151	0.1308	-536.0054
PV Unit electricity exported	-413.0119	0.1145	-47.3023
Total			-583.3077 (269)
Total CO2, kg/year			93.2552 (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	1104.2880	1.5859	1751.3149 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1252.6892	1.5204	1904.6081 (278)
Energy for instantaneous electric shower(s)	458.9363	1.5143	694.9829 (278a)
Space and water heating			3655.9230 (279)
Pumps, fans and electric keep-hot	1417.2506	1.5128	2144.0167 (281)
Energy for lighting	450.4704	1.5338	690.9465 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4097.7151	1.4832	-6077.7031
PV Unit electricity exported	-413.0119	0.4198	-173.3933
Total			-6251.0964 (283)
Total Primary energy kWh/year			934.7727 (286)