

Energy Statement

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Project: Residential Annex at
Langata, Tregadillett,
Launceston, PL15 7EX,
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 a residential annex at Langata, Tregadillett, Launceston, PL15 7EX, 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 The annex has the following U-values:

Element	U-value (W/m ² .K)	Construction
Ground floor	0.13	Suspended timber floor
External walls	0.15	Timber-clad 140mm timber frame with insulated service void.
Roof	0.11	Timber rafters with insulation between.
Windows/Doors	0.80	Triple glazed

C.1.02 Timber studwork partitions internally, insulated as required.

C.1.03 Thermal bridging values have been calculated for each relevant bridge type in accordance with psi (ψ) values shown in Table K1 or the TRADA Calculated ψ -values.

C.2 Ventilation

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

Manufacturer and model	Efficiency	No. of wetrooms
EnviroVent energiSava 210	87.0%	2

C.2.02 Design airtightness (AP50) value of 1.0 m³/h/m².

C.3 Orientation and site layout

C.3.01 The layout is informed by the alignment of the main house, with the annex facing South-east onto the proposed parking area.

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 NVC Mercury LED downlights, energy-efficient at 130 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 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	Winter efficiency	Summer efficiency
Viessmann Vitocal 151-A	327.20%	304.19%

D.2 Secondary space heating

D.2.01 There will not be any secondary space heating.

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.
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	8.17 l/kg	To be confirmed.

E RENEWABLE ENERGY GENERATION

E.01 The development will incorporate on-site renewable energy generation, but the site has limited potential for installing low or zero-carbon technologies on roof spaces or elsewhere.

E.1 Proposed on-site installation

E.1.01 A photovoltaic (PV) array will be installed on the roof of the residential annex to the following specification:

Manufacturer and model	No. off	Orientation	Pitch	Peak generation kWp
AIKO N-Type ABC White Hole Series (72 Cells) 610Wp	8	South-east	20°	4.88

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
Annex	28.4	36.6	57%	983

F.1.03 Due to site and design constraints, the renewable energy generation is less than 100% of total energy consumption. As such, it will be necessary to agree an offsetting arrangement for the shortfall. The figures for this are calculated below, assuming:

- a renewable project lifetime of 30 years; and
- an offset rate of £0.10/kWh.

	GIA m ²	Total energy use kWh/m ² _{GIA} /yr	Renewable generation kWh/yr	Renewable generation rate kWh/m ²	Renewable deficit over lifetime kWh	Offsetting payment payable at £0.10/kWh
Annex	63.10	36.60	1246.15	19.75	31,899.21	£3,189.92
						£3,189.92

F.1 Clause 5: Water consumption

F.1.01 Compliance with the requirements has been calculated using the Water Efficiency Calculation for New Dwellings (<http://wrcpartgcalculator.co.uk>).

F.1.02 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
Annex	102.04	0.00	0.00	97.90

F.2 Clause 6: Materials and waste

F.2.01 Refer to the Design & Access Statement for details of materials and waste.

G CONCLUSION

G.01 The thresholds of the Climate Emergency DPD for space heat demand and total energy use are shown to be met in the calculations presented above. Due to the constraints of the site limiting on-site energy generation to less than 100% of consumption, offsetting payments will be agreed upon with the local authority. 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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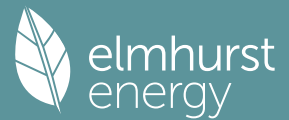
Installation Type	Unit of Measure	Capacity/Flow rate (1)	Use Factor (2)	Fixed use (litres/person/day) (3)	Litres/person/day = [(1)x(2)] + (3) (4)
WC (single flush)	Flush Volume (litres)		4.42	0.00	0
WC (dual flush)	Full flush Volume (litres)	4	1.46	0.00	5.84
	Part flush Volume (litres)	2.6	2.96	0.00	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)		0.11	0.00	0
Shower (where bath also present)	Flow Rate(litres / minute)		4.37	0.00	0
Bath Only	Capacity to overflow(litres)		0.50	0.00	0
Shower Only	Flow Rate (litres/minute)	8.00	5.60	0.00	44.80
Kitchen/Utility room sink taps	Flow rate (litres/minute)	5.00	0.44	10.36	12.56
Washing Machine	(Litres/kg dry load)	8.17	2.1	0.00	17.157
Dishwasher	(Litres/place setting)	1.25	3.6	0.00	4.5
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)				102.04
(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)				92.85
(10)	External water use				5.0
(11)	Total water consumption (Building Regulation 17.K) =(9)+(10)(litres/person/day)				97.9

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
Showers Only	Ideal Standard shower outlet regulator.	44.80
Kitchen Taps	Ideal Standard Cerasprint B5344AA single lever monoblock mixer with flow regulator.	12.56
Washing Machines		17.157
Dishwasher		4.5



H.3 Full SAP Calculation Printout

Full SAP Calculation Printout



Property Reference	Annex		Issued on Date	02/01/2024	
Assessment Reference	01_DesignReview	Prop Type Ref			
Property	Langata, Tregadille, Launceston, Cornwall, PL15 7EX				
SAP Rating	98 A	DER	0.66	TER	10.39
Environmental	100 A	% DER < TER	93.65		
CO ₂ Emissions (t/year)	0.02	DFEE	35.59	TFEE	45.15
Compliance Check	See BREL	% DFEE < TFEE	21.18		
% DPER < TPER	89.46	DPER	5.85	TPER	55.49
Assessor Details	Mr. Stuart Foster			Assessor ID	CK03-0001
Client	CL2312011, Carl Jeffery				

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	63.1000 (1b)	2.7500 (2b)	173.5250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.1000		173.5250 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 173.5250 (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		0 (19)

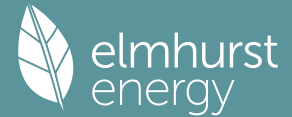
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0500 (21)

	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	0.0638	0.0625	0.0613	0.0550	0.0537	0.0475	0.0475	0.0463	0.0500	0.0537	0.0563	0.0588 (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) =												78.3000 (23c)
Effective ac	0.1723	0.1710	0.1698	0.1635	0.1623	0.1560	0.1560	0.1548	0.1585	0.1623	0.1648	0.1673 (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
Windows (Uw = 0.80)			12.8500	0.7752	9.9612		(27)
Ground Floor			63.1000	0.1300	8.2030	20.0000	1262.0000 (28a)
External Walls	78.4700	12.8500	65.6200	0.1500	9.8430	9.0000	590.5800 (29a)
External Roof	66.6200		66.6200	0.1100	7.3282	9.0000	599.5800 (30)
Total net area of external elements Aum(A, m ²)			208.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.3354		(33)
Internal Walls			60.9700			9.0000	548.7300 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	3000.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							47.5577 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				9.8400	0.0650	0.6396	
E3 Sill				9.8400	0.0320	0.3149	
E4 Jamb				17.7000	0.0450	0.7965	

Full SAP Calculation Printout



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	16.5358	16.5593	16.5829	16.7018	16.7258	16.8467	16.8467	16.8711	16.7981	16.7258	16.6779	16.6302
alpha	2.1024	2.1040	2.1055	2.1135	2.1151	2.1231	2.1231	2.1247	2.1199	2.1151	2.1119	2.1087
util living area	0.7941	0.7438	0.6765	0.5834	0.4739	0.3581	0.2678	0.2937	0.4352	0.6176	0.7473	0.8088 (86)
Living	18.7966	19.1689	19.6568	20.1816	20.5859	20.8380	20.9372	20.9215	20.7423	20.2114	19.4152	18.7000
Non living	18.2249	18.5836	19.0521	19.5519	19.9248	20.1502	20.2296	20.2196	20.0719	19.5920	18.8336	18.1347
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	19.8728	19.1689	19.6568	20.1816	20.5859	20.8380	20.9372	20.9215	20.7423	20.2114	19.4152	19.0217 (87)
Th 2	20.2543	20.2553	20.2563	20.2612	20.2622	20.2671	20.2671	20.2681	20.2651	20.2622	20.2602	20.2582 (88)
util rest of house	0.7815	0.7291	0.6585	0.5608	0.4455	0.3228	0.2265	0.2511	0.3982	0.5913	0.7304	0.7969 (89)
MIT 2	19.2161	18.5836	19.0521	19.5519	19.9248	20.1502	20.2296	20.2196	20.0719	19.5920	18.8336	18.4317 (90)
Living area fraction									FLA = Living area / (4) =			0.4117 (91)
MIT	19.4865	18.8246	19.3011	19.8112	20.1970	20.4334	20.5209	20.5086	20.3479	19.8470	19.0731	18.6746 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4865	18.8246	19.3011	19.8112	20.1970	20.4334	20.5209	20.5086	20.3479	19.8470	19.0731	18.6746 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7674	0.6974	0.6334	0.5462	0.4429	0.3310	0.2410	0.2654	0.4025	0.5755	0.6998	0.7678 (94)
Useful gains	442.6615	461.0960	463.6680	432.5900	366.1521	266.8265	186.1760	193.1041	275.4736	355.7038	393.1637	420.1403 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.0000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	765.5633	700.9521	643.4795	544.5732	423.4750	288.6386	194.0088	203.0005	310.0426	460.8532	598.4304	725.5335 (97)
Space heating kWh	240.2390	161.1833	133.7797	80.6279	42.6483	0.0000	0.0000	0.0000	0.0000	78.2311	147.7920	227.2125 (98a)
Space heating requirement - total per year (kWh/year)												1111.7139
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	240.2390	161.1833	133.7797	80.6279	42.6483	0.0000	0.0000	0.0000	0.0000	78.2311	147.7920	227.2125 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1111.7139
Space heating per m2												(98c) / (4) = 17.6183 (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 %) 327.1995 (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	240.2390	161.1833	133.7797	80.6279	42.6483	0.0000	0.0000	0.0000	0.0000	78.2311	147.7920	227.2125 (98)
Space heating efficiency (main heating system 1)	327.1995	327.1995	327.1995	327.1995	327.1995	0.0000	0.0000	0.0000	0.0000	327.1995	327.1995	327.1995 (210)
Space heating fuel (main heating system)	73.4228	49.2615	40.8863	24.6418	13.0343	0.0000	0.0000	0.0000	0.0000	23.9093	45.1688	69.4416 (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	207.9311	183.6121	194.4237	169.4760	163.2799	146.0435	143.3672	149.6783	152.0022	170.7949	183.1953	205.4723 (64)
Efficiency of water heater	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900 (216)
Fuel for water heating, kWh/month	68.3557	60.3610	63.9152	55.7139	53.6769	48.0106	47.1308	49.2055	49.9695	56.1475	60.2240	67.5473 (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	18.4295	16.6460	18.4295	17.8350	18.4295	17.8350	18.4295	18.4295	17.8350	18.4295	17.8350	18.4295 (231)
Lighting	18.5694	14.8970	13.4131	9.8270	7.5907	6.2017	6.9245	9.0007	11.6910	15.3392	17.3256	19.0855 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-63.4574	-86.9115	-121.0037	-128.1591	-130.1947	-115.4665	-114.0657	-111.0416	-102.9792	-94.9775	-68.1376	-54.8059 (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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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												339.7664 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												304.1900
Water heating fuel used												680.2579 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0250)												
mechanical ventilation fans (SFP = 1.0250)												216.9930 (230a)
Total electricity for the above, kWh/year												216.9930 (231)
Electricity for lighting (calculated in Appendix L)												149.8655 (232)

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

PV generation	-1191.2005	(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	195.6822	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	339.7664	16.4900	56.0275 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	680.2579	16.4900	112.1745 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	216.9930	16.4900	35.7821 (249)
Energy for lighting	149.8655	16.4900	24.7128 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1191.2005	16.4900	-196.4290
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-196.4290 (252)
Total energy cost			32.2680 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.1075 (257)
SAP value		98.2581
SAP rating (Section 12)		98 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	339.7664	0.1552	52.7408 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	680.2579	0.1411	95.9714 (264)
Space and water heating			148.7122 (265)
Pumps, fans and electric keep-hot	216.9930	0.1387	30.0996 (267)
Energy for lighting	149.8655	0.1443	21.6302 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1191.2005	0.1359	-161.9319
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-161.9319 (269)
Total CO2, kg/year			38.5101 (272)
CO2 emissions per m2			0.6100 (273)
EI value			99.5226
EI rating			100 (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	63.1000 (1b)	x 2.7500 (2b)	= 173.5250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	173.5250 (5)

2. Ventilation rate

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

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Pressure Test Method													Blower Door
Measured/design AP50													1.0000 (17)
Infiltration rate													0.0500 (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) = 0.0500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.4000	5.0000	5.0000	4.5000	4.4000	3.9000	4.0000	3.8000	4.0000	4.6000	4.7000	5.1000	(22)
Wind factor	1.3500	1.2500	1.2500	1.1250	1.1000	0.9750	1.0000	0.9500	1.0000	1.1500	1.1750	1.2750	(22a)
Adj infiltr rate	0.0675	0.0625	0.0625	0.0563	0.0550	0.0488	0.0500	0.0475	0.0500	0.0575	0.0588	0.0638	(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) =													78.3000 (23c)
Effective ac	0.1760	0.1710	0.1710	0.1648	0.1635	0.1573	0.1585	0.1560	0.1585	0.1660	0.1673	0.1723	(25)

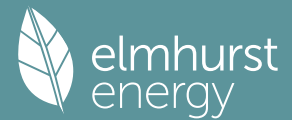
3. Heat losses and heat loss parameter

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						
Windows (Uw = 0.80)			12.8500	0.7752	9.9612			(27)					
Ground Floor			63.1000	0.1300	8.2030	20.0000	1262.0000	(28a)					
External Walls	78.4700	12.8500	65.6200	0.1500	9.8430	9.0000	590.5800	(29a)					
External Roof	66.6200		66.6200	0.1100	7.3282	9.0000	599.5800	(30)					
Total net area of external elements Aum(A, m2)			208.1900					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 35.3354			(33)					
Internal Walls			60.9700			9.0000	548.7300	(32c)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3000.8900	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							47.5577	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E1 Steel lintel with perforated steel base plate				9.8400	0.0650	0.6396							
E3 Sill				9.8400	0.0320	0.3149							
E4 Jamb				17.7000	0.0450	0.7965							
E5 Ground floor (normal)				32.4240	0.0430	1.3942							
E11 Eaves (insulation at rafter level)				19.4440	0.0460	0.8944							
E13 Gable (insulation at rafter level)				13.7040	0.0470	0.6441							
E16 Corner (normal)				8.8000	0.0600	0.5280							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2117	(36)					
Point Thermal bridges							0.0000	(36a) =					
Total fabric heat loss							(33) + (36) + (36a) = 40.5472	(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	10.0783	9.7920	9.7920	9.4341	9.3625	9.0046	9.0762	8.9331	9.0762	9.5057	9.5773	9.8636	(38)
Average = Sum(39)m / 12 =	50.6255	50.3392	50.3392	49.9813	49.9097	49.5518	49.6234	49.4802	49.6234	50.0529	50.1244	50.4108	(39)
	50.0051											50.0051	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.8023	0.7978	0.7978	0.7921	0.7910	0.7853	0.7864	0.7842	0.7864	0.7932	0.7944	0.7989	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0678	(42)
Hot water usage for mixer showers														
	75.6124	74.4761	72.8203	69.6522	67.3142	64.7069	63.2249	64.8682	66.6695	69.4690	72.7051	75.3227	75.3227	(42a)
Hot water usage for baths														
	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	(42b)
Hot water usage for other uses														
	35.8062	34.5042	33.2022	31.9001	30.5981	29.2960	29.2960	30.5981	31.9001	33.2022	34.5042	35.8062	35.8062	(42c)
Average daily hot water use (litres/day)													102.2632	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	111.4186	108.9803	106.0224	101.5523	97.9122	94.0029	92.5209	95.4662	98.5696	102.6711	107.2093	111.1289	(44)	
Energy content (annual)	176.4599	155.1865	162.9525	139.0200	131.8087	115.5875	111.8960	118.2071	121.5462	139.3237	152.7393	174.0011	(45)	
Distribution loss (46)m = 0.15 x (45)m														
	26.4690	23.2780	24.4429	20.8530	19.7713	17.3381	16.7844	17.7311	18.2319	20.8986	22.9109	26.1002	(46)	
Water storage loss:														
Store volume													190.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8800	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													1.0152	(55)
Total storage loss														
	31.4712	28.4256	31.4712	30.4560	31.4712	30.4560	31.4712	31.4712	30.4560	31.4712	30.4560	31.4712	(56)	
If cylinder contains dedicated solar storage														
	31.4712	28.4256	31.4712	30.4560	31.4712	30.4560	31.4712	31.4712	30.4560	31.4712	30.4560	31.4712	(57)	
Primary 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	(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														
	207.9311	183.6121	194.4237	169.4760	163.2799	146.0435	143.3672	149.6783	152.0022	170.7949	183.1953	205.4723	(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	207.9311	183.6121	194.4237	169.4760	163.2799	146.0435	143.3672	149.6783	152.0022	170.7949	183.1953	205.4723	(64)	
													2069.2765	(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)	
													0.0000	(64a)
Heat gains from water heating, kWh/month														
	58.6729	51.5995	54.1817	46.2241	43.8264	38.4328	37.2054	39.3039	40.4141	46.3251	50.7858	57.8554	(65)	

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.2150	18.8430	15.3241	11.6014	8.6722	7.3214	7.9110	10.2831	13.8019	17.5247	20.4539	21.8046
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	269.6896	272.4882	265.4360	250.4226	231.4710	213.6591	201.7597	198.9612	206.0134	221.0267	239.9784	257.7902
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745
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
Losses e.g. evaporation (negative values) (Table 5)	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116
Water heating gains (Table 5)	78.8614	76.7850	72.8249	64.2002	58.9064	53.3789	50.0073	52.8278	56.1307	62.2650	70.5359	77.7626
Total internal gains	460.5964	458.9465	444.4153	417.0545	389.8799	365.1898	350.5083	352.9023	366.7763	391.6467	421.7985	448.1878

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						
Southeast	7.8600	46.0405	0.6300	0.7000	0.7700	110.5946 (77)						
Southwest	1.3700	46.0405	0.6300	0.7000	0.7700	19.2767 (79)						
Northwest	3.6200	15.0290	0.6300	0.7000	0.7700	16.6269 (81)						
Solar gains	146.4982	214.6148	298.8952	395.8572	438.4311	472.8159	409.8477	394.2351	340.6915	242.5917	170.9042	123.5046
Total gains	607.0946	673.5613	743.3105	812.9117	828.3111	838.0057	760.3560	747.1374	707.4678	634.2385	592.7026	571.6924

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	16.4656	16.5593	16.5593	16.6779	16.7018	16.8224	16.7981	16.8467	16.7981	16.6540	16.6302	16.5358
alpha	2.0977	2.1040	2.1040	2.1119	2.1135	2.1215	2.1199	2.1231	2.1199	2.1103	2.1087	2.1024
util living area	0.7610	0.7178	0.6571	0.5744	0.4811	0.3651	0.3106	0.3147	0.4337	0.5882	0.7022	0.7721
Living	19.1221	19.4106	19.7862	20.2054	20.5634	20.8207	20.9020	20.9000	20.7366	20.3234	19.7312	19.1061
Non living	18.5392	18.8175	19.1749	19.5724	19.9035	20.1339	20.2013	20.2018	20.0660	19.6930	19.1349	18.5282
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	20.0393	19.4106	19.7862	20.2054	20.5634	20.8207	20.9020	20.9000	20.7366	20.3234	19.7312	19.3710
Th 2	20.2513	20.2553	20.2553	20.2602	20.2612	20.2661	20.2651	20.2671	20.2651	20.2592	20.2582	20.2543
util rest of house	0.7462	0.7013	0.6379	0.5517	0.4531	0.3315	0.2704	0.2741	0.3978	0.5600	0.6821	0.7575
MIT 2	19.3755	18.8175	19.1749	19.5724	19.9035	20.1339	20.2013	20.2018	20.0660	19.6930	19.1349	18.7696
Living area fraction	19.6488	19.0617	19.4266	19.8331	20.1752	20.4167	20.4898	20.4893	20.3421	19.9525	19.3804	19.0172
MIT	19.6488	19.0617	19.4266	19.8331	20.1752	20.4167	20.4898	20.4893	20.3421	19.9525	19.3804	19.0172
Temperature adjustment												0.0000
adjusted MIT	19.6488	19.0617	19.4266	19.8331	20.1752	20.4167	20.4898	20.4893	20.3421	19.9525	19.3804	19.0172

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7334	0.6722	0.6150	0.5380	0.4497	0.3385	0.2829	0.2866	0.4017	0.5476	0.6560	0.7303
Useful gains	445.2672	452.7861	457.1094	437.3195	372.4924	283.6661	215.0765	214.1559	284.1722	347.3108	388.8277	417.4867
Ext temp.	5.4000	5.9000	7.1000	8.9000	11.5000	14.2000	15.9000	15.9000	13.9000	11.2000	8.3000	5.7000
Heat loss rate W	721.3531	662.5500	620.5123	546.4481	432.9768	308.0493	227.7601	227.0789	319.6788	438.0898	555.3995	671.3320
Space heating kWh	205.4079	140.9613	121.5718	78.5726	45.0003	0.0000	0.0000	0.0000	0.0000	67.5396	119.9317	188.8609
Space heating requirement - total per year (kWh/year)												967.8461
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
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	205.4079	140.9613	121.5718	78.5726	45.0003	0.0000	0.0000	0.0000	0.0000	67.5396	119.9317	188.8609
Space heating requirement after solar contribution - total per year (kWh/year)												967.8461
Space heating per m2										(98c) / (4) =		15.3383

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

Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Efficiency of main space heating system 1 (in %)												0.0000
Efficiency of main space heating system 2 (in %)												1.0000
Efficiency of secondary/supplementary heating system, %												327.0910
Space heating requirement	205.4079	140.9613	121.5718	78.5726	45.0003	0.0000	0.0000	0.0000	0.0000	67.5396	119.9317	188.8609
Space heating efficiency (main heating system 1)	327.0910	327.0910	327.0910	327.0910	327.0910	0.0000	0.0000	0.0000	0.0000	327.0910	327.0910	327.0910
Space heating fuel (main heating system)	62.7984	43.0954	37.1676	24.0216	13.7577	0.0000	0.0000	0.0000	0.0000	20.6486	36.6662	57.7396
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
Space heating fuel (main heating system 2)												0.0000

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	207.9311	183.6121	194.4237	169.4760	163.2799	146.0435	143.3672	149.6783	152.0022	170.7949	183.1953	205.4723	205.4723	(64)
Efficiency of water heater (217)m	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	(216)
Fuel for water heating, kWh/month	68.3557	60.3610	63.9152	55.7139	53.6769	48.0106	47.1308	49.2055	49.9695	56.1475	60.2240	67.5473	67.5473	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.4295	16.6460	18.4295	17.8350	18.4295	17.8350	18.4295	18.4295	17.8350	18.4295	17.8350	18.4295	18.4295	(231)
Lighting	18.5694	14.8970	13.4131	9.8270	7.5907	6.2017	6.9245	9.0007	11.6910	15.3392	17.3256	19.0855	19.0855	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-75.8878	-91.1569	-124.1390	-131.1619	-130.8317	-117.0475	-113.5240	-112.7855	-106.2745	-99.3926	-78.5440	-65.4077	-65.4077	(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	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	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	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	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	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	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													295.8950	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													304.1900	(216)
Water heating fuel used													680.2579	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0250) mechanical ventilation fans (SFP = 1.0250)													216.9930	(230a)
Total electricity for the above, kWh/year													216.9930	(231)
Electricity for lighting (calculated in Appendix L)													149.8655	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1246.1531	(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													96.8583	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	295.8950	21.5100	63.6470	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	680.2579	21.5100	146.3235	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	216.9930	21.5100	46.6752	(249)
Energy for lighting	149.8655	21.5100	32.2361	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1246.1531	21.5100	-268.0475	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-268.0475	(252)
Total energy cost			20.8342	(255)

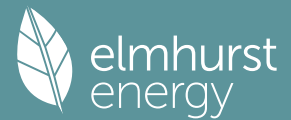
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	295.8950	0.1549	45.8255	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	680.2579	0.1411	95.9714	(264)
Space and water heating			141.7969	(265)
Pumps, fans and electric keep-hot	216.9930	0.1387	30.0996	(267)
Energy for lighting	149.8655	0.1443	21.6302	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1246.1531	0.1366	-170.2573	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-170.2573	(269)
Total CO2, kg/year			23.2694	(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	295.8950	1.5733	465.5392	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	680.2579	1.5217	1035.1313	(278)
Space and water heating			1500.6705	(279)
Pumps, fans and electric keep-hot	216.9930	1.5128	328.2670	(281)
Energy for lighting	149.8655	1.5338	229.8686	(282)
Energy saving/generation technologies				

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PV Unit electricity used in dwelling	-1246.1531	1.5051	-1875.5235
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1875.5235 (283)
Total Primary energy kWh/year			183.2827 (286)

SAP 10 EPC IMPROVEMENTS

01_DesignReview

Current energy efficiency rating: A 98
 Current environmental impact rating: A 100

N Solar water heating			SAP increase too small
U Solar photovoltaic panels			Already installed
V2 Wind turbine			Recommended
Recommended measures:	SAP change	Cost change	CO2 change
V2 Wind turbine	+ 22.3	-£ 538	-347 kg (1492.0%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.6	-£ 18	-10 kg (43.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Wind turbine	£538	5.50 kg/m ²	A 121 A 104
Total Savings	£538	5.50 kg/m ²	
Potential energy efficiency rating:			A 121
Potential environmental impact rating:			A 104

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	Potential	Saving
Electricity	£289	£289	£0
Space heating	£110	£110	£0
Water heating	£146	£146	£0
Lighting	£32	£32	£0
Generated (PV)	-£268	-£268	£0
Generated (wind)	-£0	-£538	£538
Total cost of fuels	£21	-£517	£538
Total cost of uses	£20	-£518	£538
Delivered energy	2 kWh/m ²	-38 kWh/m ²	40 kWh/m ²
Carbon dioxide emissions	0.0 tonnes	-0.3 tonnes	0.3 tonnes
CO2 emissions per m ²	0 kg/m ²	-5 kg/m ²	6 kg/m ²
Primary energy	3 kWh/m ²	-57 kWh/m ²	60 kWh/m ²

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

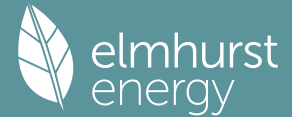
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.1000 (1b)	x 2.7500 (2b)	= 173.5250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.1000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 173.5250 (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	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.0500 (21)

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	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	0.0638	0.0625	0.0613	0.0550	0.0537	0.0475	0.0475	0.0463	0.0500	0.0537	0.0563	0.0588	(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) =													78.3000 (23c)
Effective ac	0.1723	0.1710	0.1698	0.1635	0.1623	0.1560	0.1560	0.1548	0.1585	0.1623	0.1648	0.1673	(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	
Windows (Uw = 0.80)			12.8500	0.7752	9.9612			(27)
Ground Floor			63.1000	0.1300	8.2030	20.0000	1262.0000	(28a)
External Walls	78.4700	12.8500	65.6200	0.1500	9.8430	9.0000	590.5800	(29a)
External Roof	66.6200		66.6200	0.1100	7.3282	9.0000	599.5800	(30)
Total net area of external elements Aum(A, m2)			208.1900					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	35.3354		(33)
Internal Walls			60.9700			9.0000	548.7300	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 3000.8900 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 47.5577 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	9.8400	0.0650	0.6396
E3 Sill	9.8400	0.0320	0.3149
E4 Jamb	17.7000	0.0450	0.7965
E5 Ground floor (normal)	32.4240	0.0430	1.3942
E11 Eaves (insulation at rafter level)	19.4440	0.0460	0.8944
E13 Gable (insulation at rafter level)	13.7040	0.0470	0.6441
E16 Corner (normal)	8.8000	0.0600	0.5280

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2117 (36)
 Point Thermal bridges 0.0000 (36a) =
 Total fabric heat loss (33) + (36) + (36a) = 40.5472 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.8636	9.7920	9.7204	9.3625	9.2910	8.9331	8.9331	8.8615	9.0762	9.2910	9.4341	9.5773	(38)
Heat transfer coeff	50.4108	50.3392	50.2676	49.9097	49.8381	49.4802	49.4802	49.4087	49.6234	49.8381	49.9813	50.1244	(39)
Average = Sum(39)m / 12 =													49.8918

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7989	0.7978	0.7966	0.7910	0.7898	0.7842	0.7842	0.7830	0.7864	0.7898	0.7921	0.7944	(40)
HLP (average)													0.7907
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

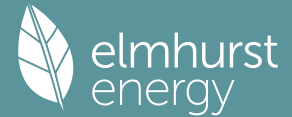
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0678 (42)
Hot water usage for mixer showers													
75.6124	74.4761	72.8203	69.6522	67.3142	64.7069	63.2249	64.8682	66.6695	69.4690	72.7051	75.3227	75.3227	(42a)
Hot water usage for baths													
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	(42b)
Hot water usage for other uses													
35.8062	34.5042	33.2022	31.9001	30.5981	29.2960	29.2960	30.5981	31.9001	33.2022	34.5042	35.8062	35.8062	(42c)
Average daily hot water use (litres/day)													102.2632 (43)
Daily hot water use	111.4186	108.9803	106.0224	101.5523	97.9122	94.0029	92.5209	95.4662	98.5696	102.6711	107.2093	111.1289	(44)
Energy conte	176.4599	155.1865	162.9525	139.0200	131.8087	115.5875	111.8960	118.2071	121.5462	139.3237	152.7393	174.0011	(45)
Energy content (annual)													Total = Sum(45)m = 1698.7285
Distribution loss (46)m = 0.15 x (45)m													
26.4690	23.2780	24.4429	20.8530	19.7713	17.3381	16.7844	17.7311	18.2319	20.8986	22.9109	26.1002	26.1002	(46)
Water storage loss:													
Store volume													190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8800 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0152 (55)
Total storage loss													
31.4712	28.4256	31.4712	30.4560	31.4712	30.4560	31.4712	31.4712	31.4712	30.4560	31.4712	30.4560	31.4712	(56)
If cylinder contains dedicated solar storage													
31.4712	28.4256	31.4712	30.4560	31.4712	30.4560	31.4712	31.4712	31.4712	30.4560	31.4712	30.4560	31.4712	(57)
Primary 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	(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													
207.9311	183.6121	194.4237	169.4760	163.2799	146.0435	143.3672	149.6783	152.0022	170.7949	183.1953	205.4723	205.4723	(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	207.9311	183.6121	194.4237	169.4760	163.2799	146.0435	143.3672	149.6783	152.0022	170.7949	183.1953	205.4723	(64)
Total per year (kWh/year) = Sum(64)m =													2069.2765 (64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	58.6729	51.5995	54.1817	46.2241	43.8264	38.4328	37.2054	39.3039	40.4141	46.3251	50.7858	57.8554	(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	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	(66)

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.2150	18.8430	15.3241	11.6014	8.6722	7.3214	7.9110	10.2831	13.8019	17.5247	20.4539	21.8046 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	269.6896	272.4882	265.4360	250.4226	231.4710	213.6591	201.7597	198.9612	206.0134	221.0267	239.9784	257.7902 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745 (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)	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116 (71)
Water heating gains (Table 5)	78.8614	76.7850	72.8249	64.2002	58.9064	53.3789	50.0073	52.8278	56.1307	62.2650	70.5359	77.7626 (72)
Total internal gains	460.5964	458.9465	444.4153	417.0545	389.8799	365.1898	350.5083	352.9023	366.7763	391.6467	421.7985	448.1878 (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						
Southeast	7.8600	36.7938	0.6300	0.7000	0.7700	88.3831 (77)						
Southwest	1.3700	36.7938	0.6300	0.7000	0.7700	15.4052 (79)						
Northwest	3.6200	11.2829	0.6300	0.7000	0.7700	12.4825 (81)						
Solar gains	116.2709	202.1985	287.6698	374.8964	436.7642	441.0171	422.1033	374.8140	317.6989	226.4418	140.0208	99.0151 (83)
Total gains	576.8673	661.1450	732.0852	791.9509	826.6441	806.2069	772.6116	727.7164	684.4753	618.0885	561.8192	547.2028 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	16.5358	16.5593	16.5829	16.7018	16.7258	16.8467	16.8467	16.8711	16.7981	16.7258	16.6779	16.6302	
tau	2.1024	2.1040	2.1055	2.1135	2.1151	2.1231	2.1231	2.1247	2.1199	2.1151	2.1119	2.1087	
alpha	0.7941	0.7438	0.6765	0.5834	0.4739	0.3581	0.2678	0.2937	0.4352	0.6176	0.7473	0.8088 (86)	
util living area	18.7966	19.1689	19.6568	20.1816	20.5859	20.8380	20.9372	20.9215	20.7423	20.2114	19.4152	18.7000	
Living	18.2249	18.5836	19.0521	19.5519	19.9248	20.1502	20.2296	20.2196	20.0719	19.5920	18.8336	18.1347	
Non living	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 16	3	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
16 / 9	19.8728	19.1689	19.6568	20.1816	20.5859	20.8380	20.9372	20.9215	20.7423	20.2114	19.4152	19.0217 (87)	
MIT	20.2543	20.2553	20.2563	20.2612	20.2622	20.2671	20.2671	20.2681	20.2651	20.2622	20.2602	20.2582 (88)	
Th 2	0.7815	0.7291	0.6585	0.5608	0.4455	0.3228	0.2265	0.2511	0.3982	0.5913	0.7304	0.7969 (89)	
util rest of house	19.2161	18.5836	19.0521	19.5519	19.9248	20.1502	20.2296	20.2196	20.0719	19.5920	18.8336	18.4317 (90)	
MIT 2	19.4865	18.8246	19.3011	19.8112	20.1970	20.4334	20.5209	20.5086	20.3479	19.8470	19.0731	18.6746 (92)	
Living area fraction	19.4865	18.8246	19.3011	19.8112	20.1970	20.4334	20.5209	20.5086	20.3479	19.8470	19.0731	18.6746 (92)	
MIT	19.4865	18.8246	19.3011	19.8112	20.1970	20.4334	20.5209	20.5086	20.3479	19.8470	19.0731	18.6746 (92)	
Temperature adjustment	19.4865	18.8246	19.3011	19.8112	20.1970	20.4334	20.5209	20.5086	20.3479	19.8470	19.0731	18.6746 (92)	
adjusted MIT	19.4865	18.8246	19.3011	19.8112	20.1970	20.4334	20.5209	20.5086	20.3479	19.8470	19.0731	18.6746 (92)	

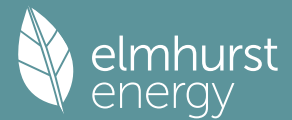
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7674	0.6974	0.6334	0.5462	0.4429	0.3310	0.2410	0.2654	0.4025	0.5755	0.6998	0.7678 (94)	
Useful gains	442.6615	461.0960	463.6680	432.5900	366.1521	266.8265	186.1760	193.1041	275.4736	355.7038	393.1637	420.1403 (95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.0000	14.1000	10.6000	7.1000	4.2000 (96)	
Heat loss rate W	765.5633	700.9521	643.4795	544.5732	423.4750	288.6386	194.0088	203.0005	310.0426	460.8532	598.4304	725.5335 (97)	
Space heating kWh	240.2390	161.1833	133.7797	80.6279	42.6483	0.0000	0.0000	0.0000	0.0000	78.2311	147.7920	227.2125 (98a)	
Space heating requirement - total per year (kWh/year)												1111.7139	
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	240.2390	161.1833	133.7797	80.6279	42.6483	0.0000	0.0000	0.0000	0.0000	78.2311	147.7920	227.2125 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1111.7139	
Space heating per m2												17.6183 (99)	

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

Fraction of space heat from secondary/supplementary system (Table 11)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	0.0000 (201)
Fraction of space heat from main system(s)	327.1995	327.1995	327.1995	327.1995	327.1995	0.0000	0.0000	0.0000	0.0000	327.1995	327.1995	327.1995	1.0000 (202)
Efficiency of main space heating system 1 (in %)	73.4228	49.2615	40.8863	24.6418	13.0343	0.0000	0.0000	0.0000	0.0000	23.9093	45.1688	69.4416	327.1995 (206)
Efficiency of main space heating system 2 (in %)	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 (207)
Efficiency of secondary/supplementary heating system, %	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 (208)
Space heating requirement	240.2390	161.1833	133.7797	80.6279	42.6483	0.0000	0.0000	0.0000	0.0000	78.2311	147.7920	227.2125 (98)	
Space heating efficiency (main heating system 1)	327.1995	327.1995	327.1995	327.1995	327.1995	0.0000	0.0000	0.0000	0.0000	327.1995	327.1995	327.1995	327.1995 (210)
Space heating fuel (main heating system)	73.4228	49.2615	40.8863	24.6418	13.0343	0.0000	0.0000	0.0000	0.0000	23.9093	45.1688	69.4416	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating	207.9311	183.6121	194.4237	169.4760	163.2799	146.0435	143.3672	149.6783	152.0022	170.7949	183.1953	205.4723 (64)	
Water heating requirement												304.1900 (216)	
Efficiency of water heater													

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(217)m	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	(217)
Fuel for water heating, kWh/month	68.3557	60.3610	63.9152	55.7139	53.6769	48.0106	47.1308	49.2055	49.9695	56.1475	60.2240	67.5473	(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	18.4295	16.6460	18.4295	17.8350	18.4295	17.8350	18.4295	18.4295	17.8350	18.4295	17.8350	18.4295	(221)
Lighting	18.5694	14.8970	13.4131	9.8270	7.5907	6.2017	6.9245	9.0007	11.6910	15.3392	17.3256	19.0855	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-63.4574	-86.9115	-121.0037	-128.1591	-130.1947	-115.4665	-114.0657	-111.0416	-102.9792	-94.9775	-68.1376	-54.8059	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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												339.7664	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												304.1900	(219)
Water heating fuel used												680.2579	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0250)													
mechanical ventilation fans (SFP = 1.0250)												216.9930	(230a)
Total electricity for the above, kWh/year												216.9930	(231)
Electricity for lighting (calculated in Appendix L)												149.8655	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1191.2005	(233)
Wind generation												-3575.5408	(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												-2307.1963	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	339.7664	16.4900	56.0275	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	680.2579	16.4900	112.1745	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	216.9930	16.4900	35.7821	(249)
Energy for lighting	149.8655	16.4900	24.7128	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1191.2005	16.4900	-196.4290	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-196.4290	(252)
Wind Turbine electricity used in dwelling	-2502.8785	16.4900	-412.7247	
Wind Turbine electricity exported	0.0000	5.5900	0.0000	
Total			-412.7247	(252)
Total energy cost			-380.4567	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	-1.2670	(257)
SAP value		120.5383	
SAP rating (Section 12)		121	(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	339.7664	0.1552	52.7408	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	680.2579	0.1411	95.9714	(264)
Space and water heating			148.7122	(265)
Pumps, fans and electric keep-hot	216.9930	0.1387	30.0996	(267)
Energy for lighting	149.8655	0.1443	21.6302	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1191.2005	0.1359	-161.9319	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-161.9319	(269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801	
Wind Turbine electricity exported	0.0000	0.0000	0.0000	
Total			-347.1801	(269)
Total CO2, kg/year			-308.6700	(272)
CO2 emissions per m2			-4.8900	(273)
EI value			103.8263	
EI rating			104	(274)
EI band			A	

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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

Ground floor		Area (m2)	63.1000 (1b)	x	Storey height (m)	2.7500 (2b)	=	Volume (m3)	173.5250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.1000								173.5250 (4)
Dwelling volume									(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 173.5250 (5)

2. Ventilation rate

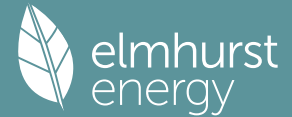
												m3 per hour	
Number of open chimneys												0 * 80 = 0.0000 (6a)	
Number of open flues												0 * 20 = 0.0000 (6b)	
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)	
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)	
Number of flues 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)	
												Air changes per hour	
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												0 (19)	
Shelter factor												(20) = 1 - [0.075 x (19)] = 1.0000 (20)	
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.0500 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.4000	5.0000	5.0000	4.5000	4.4000	3.9000	4.0000	3.8000	4.0000	4.6000	4.7000	5.1000	(22)
Wind factor	1.3500	1.2500	1.2500	1.1250	1.1000	0.9750	1.0000	0.9500	1.0000	1.1500	1.1750	1.2750	(22a)
Adj infilt rate	0.0675	0.0625	0.0625	0.0563	0.0550	0.0488	0.0500	0.0475	0.0500	0.0575	0.0588	0.0638	(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) =													78.3000 (23c)
Effective ac	0.1760	0.1710	0.1710	0.1648	0.1635	0.1573	0.1585	0.1560	0.1585	0.1660	0.1673	0.1723	(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						
Windows (Uw = 0.80)			12.8500	0.7752	9.9612			(27)					
Ground Floor			63.1000	0.1300	8.2030	20.0000	1262.0000	(28a)					
External Walls	78.4700	12.8500	65.6200	0.1500	9.8430	9.0000	590.5800	(29a)					
External Roof	66.6200		66.6200	0.1100	7.3282	9.0000	599.5800	(30)					
Total net area of external elements Aum(A, m2)			208.1900					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	35.3354				(33)					
Internal Walls			60.9700			9.0000	548.7300	(32c)					
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =			3000.8900 (34)							
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							47.5577 (35)						
List of Thermal Bridges					Length	Psi-value	Total						
K1 Element													
E1 Steel lintel with perforated steel base plate					9.8400	0.0650	0.6396						
E3 Sill					9.8400	0.0320	0.3149						
E4 Jamb					17.7000	0.0450	0.7965						
E5 Ground floor (normal)					32.4240	0.0430	1.3942						
E11 Eaves (insulation at rafter level)					19.4440	0.0460	0.8944						
E13 Gable (insulation at rafter level)					13.7040	0.0470	0.6441						
E16 Corner (normal)					8.8000	0.0600	0.5280						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2117 (36)						
Point Thermal bridges							(36a) = 0.0000						
Total fabric heat loss							(33) + (36) + (36a) = 40.5472 (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	
	10.0783	9.7920	9.7920	9.4341	9.3625	9.0046	9.0762	8.9331	9.0762	9.5057	9.5773	9.8636	(38)
Heat transfer coeff	50.6255	50.3392	50.3392	49.9813	49.9097	49.5518	49.6234	49.4802	49.6234	50.0529	50.1244	50.4108	(39)
Average = Sum(39)m / 12 =	50.0051												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8023	0.7978	0.7978	0.7921	0.7910	0.7853	0.7864	0.7842	0.7864	0.7932	0.7944	0.7989	(40)
HLP (average)	0.7925												
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

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Assumed occupancy												2.0678 (42)	
Hot water usage for mixer showers													
75.6124	74.4761	72.8203	69.6522	67.3142	64.7069	63.2249	64.8682	66.6695	69.4690	72.7051	75.3227	(42a)	
Hot water usage for baths													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)	
Hot water usage for other uses													
35.8062	34.5042	33.2022	31.9001	30.5981	29.2960	29.2960	30.5981	31.9001	33.2022	34.5042	35.8062	(42c)	
Average daily hot water use (litres/day)												102.2632 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	111.4186	108.9803	106.0224	101.5523	97.9122	94.0029	92.5209	95.4662	98.5696	102.6711	107.2093	111.1289	(44)
Energy content (annual)	176.4599	155.1865	162.9525	139.0200	131.8087	115.5875	111.8960	118.2071	121.5462	139.3237	152.7393	174.0011	(45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1698.7285	
Water storage loss:													
Store volume												190.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.8800 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												1.0152 (55)	
Total storage loss													
31.4712	28.4256	31.4712	30.4560	31.4712	30.4560	31.4712	31.4712	30.4560	31.4712	30.4560	31.4712	30.4560	(56)
If cylinder contains dedicated solar storage													
31.4712	28.4256	31.4712	30.4560	31.4712	30.4560	31.4712	31.4712	30.4560	31.4712	30.4560	31.4712	30.4560	(57)
Primary loss												0.0000 (59)	
Combi loss												0.0000 (61)	
Total heat required for water heating calculated for each month													
207.9311	183.6121	194.4237	169.4760	163.2799	146.0435	143.3672	149.6783	152.0022	170.7949	183.1953	205.4723	(62)	
WWHRS												0.0000 (63a)	
PV diverter												-0.0000 (63b)	
Solar input												0.0000 (63c)	
FGHRS												0.0000 (63d)	
Output from w/h													
207.9311	183.6121	194.4237	169.4760	163.2799	146.0435	143.3672	149.6783	152.0022	170.7949	183.1953	205.4723	(64)	
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)	
Heat gains from water heating, kWh/month													
58.6729	51.5995	54.1817	46.2241	43.8264	38.4328	37.2054	39.3039	40.4141	46.3251	50.7858	57.8554	(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	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	124.0674	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
21.2150	18.8430	15.3241	11.6014	8.6722	7.3214	7.9110	10.2831	13.8019	17.5247	20.4539	21.8046	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
269.6896	272.4882	265.4360	250.4226	231.4710	213.6591	201.7597	198.9612	206.0134	221.0267	239.9784	257.7902	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	49.4745	(69)	
Pumps, fans												0.0000 (70)	
Losses e.g. evaporation (negative values) (Table 5)													
-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	-82.7116	(71)
Water heating gains (Table 5)													
78.8614	76.7850	72.8249	64.2002	58.9064	53.3789	50.0073	52.8278	56.1307	62.2650	70.5359	77.7626	(72)	
Total internal gains	460.5964	458.9465	444.4153	417.0545	389.8799	365.1898	350.5083	352.9023	366.7763	391.6467	421.7985	448.1878	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
Southeast	7.8600	46.0405	0.6300	0.7000	0.7700	110.5946 (77)							
Southwest	1.3700	46.0405	0.6300	0.7000	0.7700	19.2767 (79)							
Northwest	3.6200	15.0290	0.6300	0.7000	0.7700	16.6269 (81)							
Solar gains	146.4982	214.6148	298.8952	395.8572	438.4311	472.8159	409.8477	394.2351	340.6915	242.5917	170.9042	123.5046	(83)
Total gains	607.0946	673.5613	743.3105	812.9117	828.3111	838.0057	760.3560	747.1374	707.4678	634.2385	592.7026	571.6924	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	16.4656	16.5593	16.5593	16.6779	16.7018	16.8224	16.7981	16.8467	16.7981	16.6540	16.6302	16.5358	
util living area	2.0977	2.1040	2.1040	2.1119	2.1135	2.1215	2.1199	2.1231	2.1199	2.1103	2.1087	2.1024	
0.7610	0.7178	0.6571	0.5744	0.4811	0.3651	0.3106	0.3147	0.4337	0.5882	0.7022	0.7721	(86)	
Living	19.1221	19.4106	19.7862	20.2054	20.5634	20.8207	20.9020	20.9000	20.7366	20.3234	19.7312	19.1061	
Non living	18.5392	18.8175	19.1749	19.5724	19.9035	20.1339	20.2013	20.2018	20.0660	19.6930	19.1349	18.5282	
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	20.0393	19.4106	19.7862	20.2054	20.5634	20.8207	20.9020	20.9000	20.7366	20.3234	19.7312	19.3710	(87)
Th 2	20.2513	20.2553	20.2553	20.2602	20.2612	20.2661	20.2651	20.2671	20.2651	20.2592	20.2582	20.2543	(88)
util rest of house													
0.7462	0.7013	0.6379	0.5517	0.4531	0.3315	0.2704	0.2741	0.3978	0.5600	0.6821	0.7575	(89)	
MIT 2	19.3755	18.8175	19.1749	19.5724	19.9035	20.1339	20.2013	20.2018	20.0660	19.6930	19.1349	18.7696	(90)
Living area fraction												fLA = Living area / (4) = 0.4117 (91)	
MIT	19.6488	19.0617	19.4266	19.8331	20.1752	20.4167	20.4898	20.4893	20.3421	19.9525	19.3804	19.0172	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6488	19.0617	19.4266	19.8331	20.1752	20.4167	20.4898	20.4893	20.3421	19.9525	19.3804	19.0172	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7334	0.6722	0.6150	0.5380	0.4497	0.3385	0.2829	0.2866	0.4017	0.5476	0.6560	0.7303	(94)
Useful gains	445.2672	452.7861	457.1094	437.3195	372.4924	283.6661	215.0765	214.1559	284.1722	347.3108	388.8277	417.4867	(95)
Ext temp.	5.4000	5.9000	7.1000	8.9000	11.5000	14.2000	15.9000	15.9000	13.9000	11.2000	8.3000	5.7000	(96)
Heat loss rate W	721.3531	662.5500	620.5123	546.4481	432.9768	308.0493	227.7601	227.0789	319.6788	438.0898	555.3995	671.3320	(97)
Space heating kWh	205.4079	140.9613	121.5718	78.5726	45.0003	0.0000	0.0000	0.0000	0.0000	67.5396	119.9317	188.8609	(98a)
Space heating requirement - total per year (kWh/year)												967.8461	
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	205.4079	140.9613	121.5718	78.5726	45.0003	0.0000	0.0000	0.0000	0.0000	67.5396	119.9317	188.8609	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												967.8461	
Space heating per m2										(98c) / (4) =		15.3383	(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 %)													327.0910	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	205.4079	140.9613	121.5718	78.5726	45.0003	0.0000	0.0000	0.0000	0.0000	67.5396	119.9317	188.8609	98	
Space heating efficiency (main heating system 1)	327.0910	327.0910	327.0910	327.0910	327.0910	0.0000	0.0000	0.0000	0.0000	327.0910	327.0910	327.0910	(210)	
Space heating fuel (main heating system)	62.7984	43.0954	37.1676	24.0216	13.7577	0.0000	0.0000	0.0000	0.0000	20.6486	36.6662	57.7396	(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	207.9311	183.6121	194.4237	169.4760	163.2799	146.0435	143.3672	149.6783	152.0022	170.7949	183.1953	205.4723	(64)	
Efficiency of water heater (217)m	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	304.1900	(216)	
Fuel for water heating, kWh/month	68.3557	60.3610	63.9152	55.7139	53.6769	48.0106	47.1308	49.2055	49.9695	56.1475	60.2240	67.5473	(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	18.4295	16.6460	18.4295	17.8350	18.4295	17.8350	18.4295	18.4295	17.8350	18.4295	17.8350	18.4295	(231)	
Lighting	18.5694	14.8970	13.4131	9.8270	7.5907	6.2017	6.9245	9.0007	11.6910	15.3392	17.3256	19.0855	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-75.8878	-91.1569	-124.1390	-131.1619	-130.8317	-117.0475	-113.5240	-112.7855	-106.2745	-99.3926	-78.5440	-65.4077	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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													295.8950	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													304.1900	
Water heating fuel used													680.2579	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0250) mechanical ventilation fans (SFP = 1.0250)													216.9930	(230a)
Total electricity for the above, kWh/year													216.9930	(231)
Electricity for lighting (calculated in Appendix L)													149.8655	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1246.1531	(233)
Wind generation													-3575.5408	(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													-2406.0202	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	295.8950	21.5100	63.6470	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	680.2579	21.5100	146.3235	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	216.9930	21.5100	46.6752	(249)
Energy for lighting	149.8655	21.5100	32.2361	(250)
Additional standing charges			0.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1246.1531	21.5100	-268.0475
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-268.0475 (252)
Wind Turbine electricity used in dwelling	-2502.8785	21.5100	-538.3692
Wind Turbine electricity exported	0.0000	5.5900	0.0000
Total			-538.3692 (252)
Total energy cost			-517.5349 (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	295.8950	0.1549	45.8255 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	680.2579	0.1411	95.9714 (264)
Space and water heating			141.7969 (265)
Pumps, fans and electric keep-hot	216.9930	0.1387	30.0996 (267)
Energy for lighting	149.8655	0.1443	21.6302 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1246.1531	0.1366	-170.2573
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-170.2573 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-347.1801 (269)
Total CO2, kg/year			-323.9107 (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	295.8950	1.5733	465.5392 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	680.2579	1.5217	1035.1313 (278)
Space and water heating			1500.6705 (279)
Pumps, fans and electric keep-hot	216.9930	1.5128	328.2670 (281)
Energy for lighting	149.8655	1.5338	229.8686 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1246.1531	1.5051	-1875.5235
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1875.5235 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.5128	-3786.3546
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-3786.3546 (283)
Total Primary energy kWh/year			-3603.0719 (286)