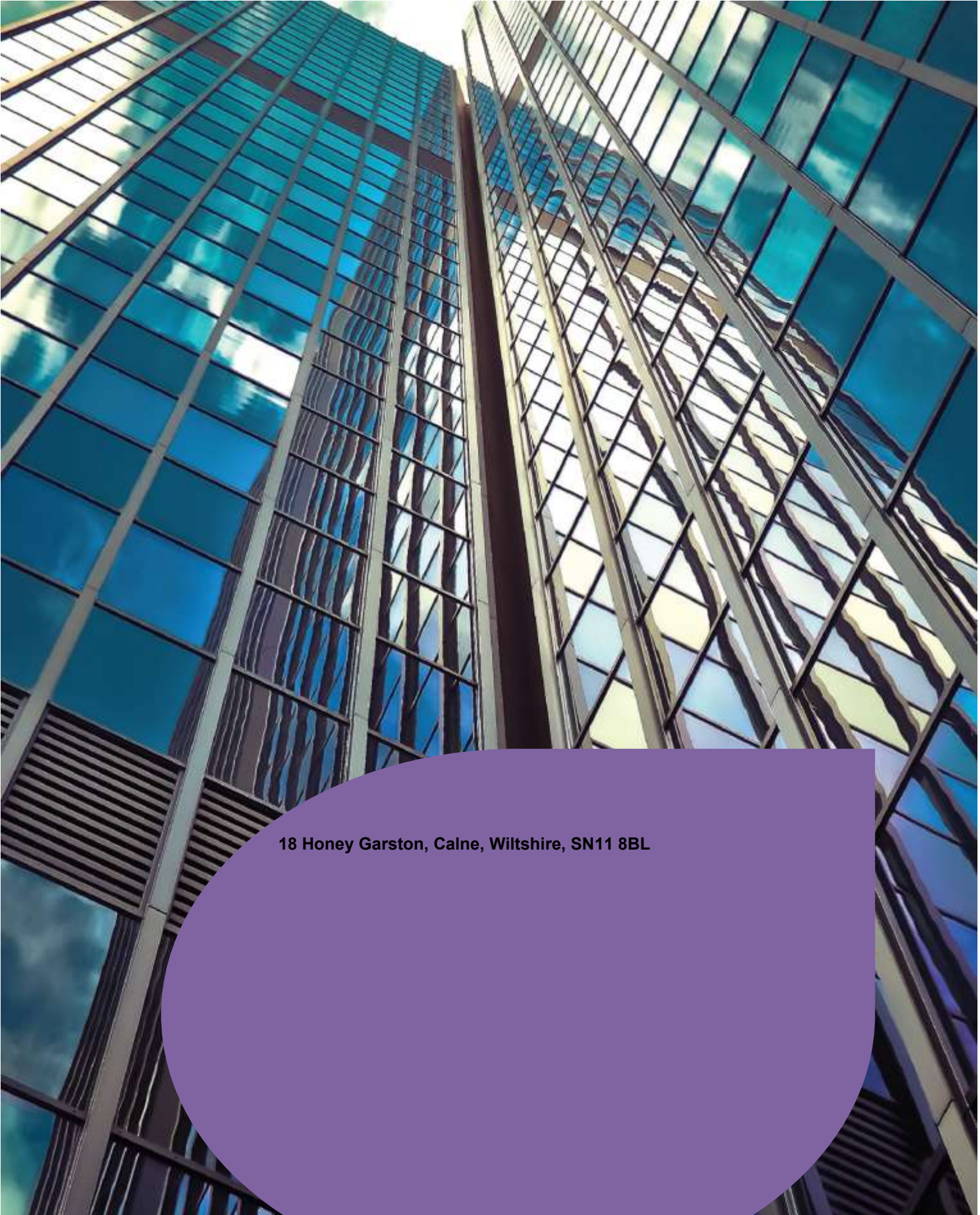


Energy Strategy & Sustainability Statement



18 Honey Garston, Calne, Wiltshire, SN11 8BL

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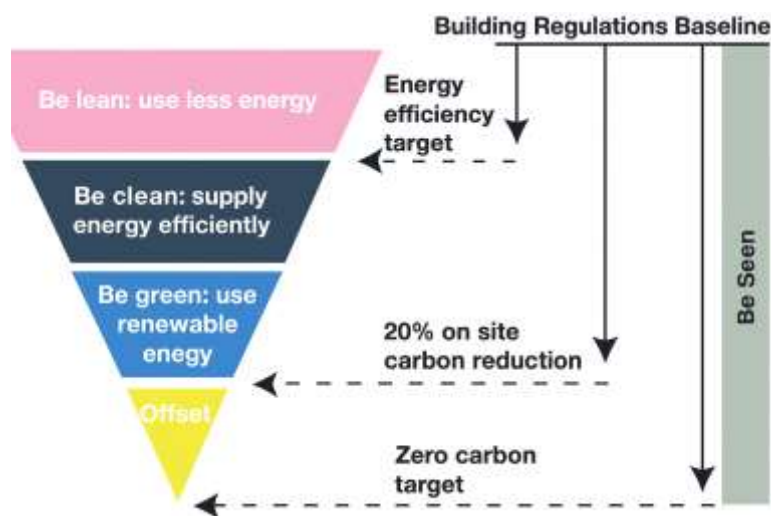
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Introduction

This Energy strategy and Sustainability Statement supports the planning application for a proposed 3 bedroom dwelling within the garden of 18 Honey Garston. The scheme has been designed to prioritise energy efficiency and sustainability, aligning with national planning policy and Wiltshire Local plan (adopted policies and emerging Local Plan Review). A fabric-first approach will deliver high thermal performance through improved insulation, airtightness, and efficient glazing. Building services will incorporate low-energy systems, including efficient lighting and heating, with space and water heating provided via a low-carbon Heat Pump. A Solar PV has been considered to reduce operational carbon emissions. The development aims to achieve reduction in CO₂ emissions compared to Part L baseline standards, and water consumption will be limited to 110 litres per person per day in line with Part G. This statement demonstrates that the development meets relevant sustainability criteria and represents a responsible, energy-conscious addition to the built environment.

The resulting recommendations for the development follow the energy hierarchy of;

- Use Less Energy
- Use Renewable Energy



This Statement will also set out how the proposed development intends to address relevant planning policy requirements regarding wider sustainability issues. A set structure has been established to address multiple policy requirements under the same topic with specific detail on key issues as and where necessary.

Development Policies & Regulations

International and national bodies have set out broad principles of sustainable development. Resolution 42/187 of the United Nations General Assembly defined sustainable development as meeting the needs of the present without compromising the ability of future generations to meet their own needs. The UK Sustainable Development Strategy Securing the Future set out five 'guiding principles of sustainable development: living within the planet's environmental limits; ensuring a strong, healthy and just society; achieving a sustainable economy; promoting good governance; and using sound science responsibly.'²

The National Planning Policy Framework sets out the Government's planning policies for England and how these should be applied. The purpose of the planning system is to contribute to the achievement of sustainable development. At a very high level, the objective of sustainable development can be summarised as meeting the needs of the present without compromising the ability of future generations to meet their own needs. Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):²

an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;²

a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and²

an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.²

²https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf

Local Development Strategy

Core Policy 41

Sustainable construction and low-carbon energy

Climate change adaptation

New development, building conversions, refurbishments and extensions will be encouraged to incorporate design measures to reduce energy demand. Development will be well insulated and designed to take advantage of natural light and heat from the sun and use natural air movement for ventilation, whilst maximising cooling in the summer.

Sustainable construction

New homes (excluding extensions and conversions) will be required to achieve at least Level 4 (in full) of the Code for Sustainable Homes⁴⁶.

Conversions of property to residential use will not be permitted unless BREEAM's Homes 'Very Good' standards are achieved⁴⁷.

All non-residential development will be required to achieve the relevant BREEAM 'Very Good' standards, rising to the relevant BREEAM 'Excellent' standards from 2019⁴⁸.

Existing buildings

Retrofitting measures to improve the energy performance of existing buildings will be encouraged in accordance with the following hierarchy:

- i. Reduce energy consumption through energy efficiency measures
- ii. Use renewable or low-carbon energy from a local/district source
- iii. Use building-integrated renewable or low-carbon technologies.

Opportunities should be sought to facilitate carbon reduction through retrofitting at whole street or neighbourhood scales to reduce individual costs, improve viability and support coordinated programmes for improvement.

Renewable and low-carbon energy

All proposals for major development⁴⁹ will be required to submit a Sustainable Energy Strategy alongside the planning application outlining the low-carbon strategy for the proposal.

Orientation



The proposed dwelling is orientated with its principal elevation facing north and the rear elevation facing south. This arrangement allows the design to maximise passive solar gain to the south-facing rear rooms while minimising heat loss through the north-facing front elevation. The roof form provides suitable south and west-facing pitches, enabling efficient integration of photovoltaic panels as shown on the proposed elevations. This orientation supports reduced heating demand, improved natural daylighting, and optimised renewable energy generation. A pergola-style shading structure is incorporated on the south-west elevation to provide passive solar control. This feature reduces summer overheating risk while maintaining winter solar access, supporting the building's passive design strategy. The dwelling has also passed the Simplified Part O Method.

Water

Water-efficient fixtures and fittings will be installed to reduce overall consumption, with the target of meeting the Building Regulations optional requirement of 110 litres per person per day. Where feasible, surface water will be managed sustainably through permeable surfaces or local attenuation.

Flood Risk and Water Management

Flood risk has been assessed in accordance with national and local planning policy. The site is not within a designated flood zone, but water management strategies will ensure that surface water runoff is effectively controlled through permeable paving or other SuDS-compatible measures.

Surface water
[More about your surface water flood risk](#)

Yearly chance of flooding

Very low
Low
Medium
High

Yearly chance of flooding between 2040 and 2060

Very low
Low
Medium
High

What surface water is

Surface water flooding is sometimes known as flash flooding. It happens when rainwater cannot drain away through normal drainage systems.

► [Why surface water flooding is a problem](#)

Rivers and the sea
[More about your rivers and sea flood risk](#)

Yearly chance of flooding

Very low
Low
Medium
High

Yearly chance of flooding between 2036 and 2069

Very low
Low
Medium
High

What makes rivers and sea flooding more likely

Low-lying areas that are close to rivers or the sea are more likely to flood when water levels rise.

This information takes into account any flood defences.

► [Why flood defences cannot completely prevent flooding](#)

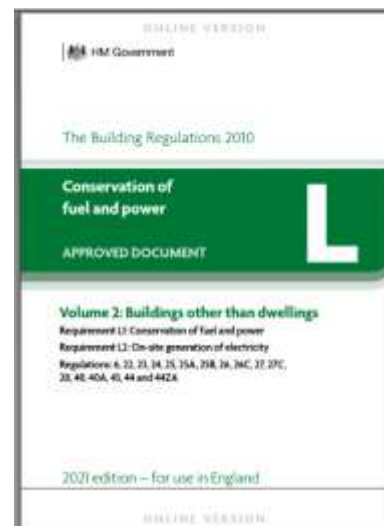
<https://check-long-term-flood-risk.service.gov.uk/risk#>

Statutory Requirements

The proposed development will be required to comply with the statutory requirements of the applicable Building Regulations. This statement will address those regulations associated with Part L of the Building Regulations, specifically.

Part L Volume 1 2021 Edition – Conservation of fuel and power in dwellings

Building Regulations Part L defines the energy efficiency standards required for buildings. This regulation controls insulation values of thermal elements, areas of glazing, doors and other openings in the façade, efficiency, insulation and controls of heating appliances and systems as well as lighting and hot water storage efficiencies.



The Development

Location



Figure 1: Site Location Plan

Assessment Methodology

All assessments have been conducted using DCLG-approved software. For this proposal, the assessments were conducted using Standard Assessment Procedure (SAP 10).

The Carbon Dioxide Emissions expressed under 'Regulated' within this report reflect those emission targets set out by Part L and are made up of the total emissions for; Heating, Hot Water, Cooling, Controls, Fans, Pumps and Lighting. These have been calculated using DCLG-approved software. Furthermore, the Latest Carbon Figures through the SAP 10 Methodology have been used meaning that the amount of carbon emissions per KWh is accurate.

Energy Review

Low Zero Carbon Feasibility Study

A low zero carbon (LZC) feasibility study has been conducted to assess and determine the appropriateness of different technologies being integrated into the design of the proposed development. The list is not exhaustive but aims to highlight the most common and commercially viable solutions to alternate and renewable energy.

Air Source Heat Pump

Pros

- **Energy efficient:** Can deliver upto 4 times more heat energy than the electricity they consume.
- **Lower carbon footprint:** Especially when paired with renewable electricity.
- **Heating and cooling:** Some models provide both functions.

Cons

- **Reduced efficiency in very cold weather:** Performance drops below $\sim 0^{\circ}\text{C}$.
- **Upfront cost:** Installation can be expensive (£7,000–£13,000 typical in the UK).



Feasibility : Yes perfect for a well-insulated house. The technology of the future as we go Carbon Neutral.

Photovoltaics

Pros

- **Free electricity from sunlight** = lower energy bills
- **Low maintenance** (panels last 25–30 years)
- **Reduces carbon footprint**

Cons

- **High upfront cost** (~£4,500–£8,500 for most UK homes)
- **Dependent on sunlight** — less effective in winter
- **Battery storage adds extra cost**
- **Roof orientation and space matter**



Feasibility: Will provide a considerable amount of regulated energy along with the unregulated energy demands of the proposed scheme.

Use Less Energy

The client has chosen to specify materials for all thermal elements below that defined by Part L. There will also be LED Low Energy lights and the thermal bridging details will be carefully considered.

Renewable Technologies

The proposed development with Climate Change, and Sustainability in mind will utilized a 3.6 Kwp Solar PV system and a 5 kwp battery storage system with an Air Source Heat Pump as a heating system.

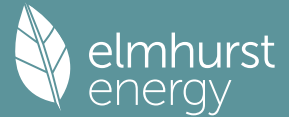
Results

TER (Target Emission Rate)	11.82 kgCO ₂ /yr/m ²
DER (Dwelling Emission Rate)	5.38 kgCO ₂ /yr/m ²
DER (Dwelling Emission Rate After PV Installation)	2.67 kgCO ₂ /yr/m ²

Conclusion

In conclusion, we consider the proposals to meet the requirements of the National Policy guidelines along with meeting the specific requirements of Wiltshire Council's Development Framework Core Strategy. This has been demonstrated by modelling the proposed development in SAP 10 and providing calculated figures for the predicted energy demand, CO₂ emissions and the reduced energy demand, CO₂ emissions after renewables. The client has chosen to opt for an Air Source Heat Pump and 3.6 KWp of Solar PV including a Battery Storage system. The proposed scheme after On site renewables gives a total reduction beyond Part L TER of 77%.

Full SAP Calculation Printout



Plot Reference	BCA401 Honey Garston				Issued on Date	08/01/2026	
Assessment Reference	After PV			Plot Type Ref			
Plot Address					SAP Version	10.2	
SAP Rating	90 B	DER	2.67	TER	11.82		
Environmental	98 A	% DER < TER				77.41	
CO ₂ Emissions (t/year)	0.2	DFEE	45.25	TFEE	45.35		
Compliance Check	See BREL	% DFEE < TFEE				0.21	
% DPER < TPER	58.24	DPER	25.85	TPER	61.90		
Assessor Details	Mr. Liam Hanley				Assessor ID	R035-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 292.7200 (5)

2. Ventilation rate

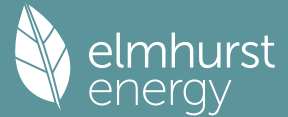
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1366 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3866 (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) = 0.3866 (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	0.4930	0.4833	0.4736	0.4253	0.4156	0.3673	0.3673	0.3577	0.3866	0.4156	0.4350	0.4543 (22b)
Effective ac	0.6215	0.6168	0.6122	0.5904	0.5864	0.5675	0.5675	0.5640	0.5747	0.5864	0.5946	0.6032 (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 kJ/m ² K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows			32.5600	1.3258	43.1667		(27)
Heatloss Floor 1			57.3100	0.1200	6.8772	110.0000	6304.1000 (28a)
External Wall 1	221.3800	32.5600	188.8200	0.1800	33.9876	60.0000	11329.2000 (29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041	9.0000	515.7900 (30)
Total net area of external elements Aum(A, m ²)			336.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	90.3356		(33)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18149.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							161.0961 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				17.0400	0.0150	0.2556	
E3 Sill				16.0100	0.0210	0.3362	
E4 Jamb				35.4000	0.0160	0.5664	
E5 Ground floor (normal)				32.1500	0.0900	2.8935	
E6 Intermediate floor within a dwelling				31.0300	0.0020	0.0621	
E10 Eaves (insulation at ceiling level)				19.6300	0.0650	1.2759	
E12 Gable (insulation at ceiling level)				11.4000	0.0000	0.0000	
E16 Corner (normal)				26.0000	0.0510	1.3260	

Full SAP Calculation Printout



E17 Corner (inverted - internal area greater than external area) 7.7000 -0.0910 -0.7007
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.0150 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 96.3506 (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	60.0367	59.5809	59.1342	57.0357	56.6431	54.8154	54.8154	54.4769	55.5194	56.6431	57.4373	58.2677 (38)
Average = Sum(39)m / 12 =	156.3873	155.9315	155.4847	153.3863	152.9936	151.1659	151.1659	150.8275	151.8699	152.9936	153.7879	154.6183 (39)
	153.3844											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3881	1.3841	1.3801	1.3615	1.3580	1.3418	1.3418	1.3388	1.3480	1.3580	1.3651	1.3724 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8299 (42)
Hot water usage for mixer showers													
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	(42a)
Hot water usage for other uses	87.0181	85.7258	83.9059	80.5503	78.0377	75.2517	73.7468	75.5539	77.5216	80.5028	83.9274	86.7239	(42b)
Average daily hot water use (litres/day)	45.9062	44.2368	42.5675	40.8982	39.2289	37.5596	37.5596	39.2289	40.8982	42.5675	44.2368	45.9062	(42c)
													122.4124 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	132.9243	129.9626	126.4734	121.4486	117.2666	112.8113	111.3064	114.7828	118.4198	123.0703	128.1643	132.6301	(44)
Energy content (annual)	210.5196	185.0650	194.3849	166.2570	157.8634	138.7146	134.6154	142.1251	146.0235	167.0053	182.5935	207.6667	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss (or HIU loss):	31.5779	27.7598	29.1577	24.9385	23.6795	20.8072	20.1923	21.3188	21.9035	25.0508	27.3890	31.1500	(46)
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2500 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.7550 (55)
Total storage loss													
If cylinder contains dedicated solar storage	54.4050	49.1400	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050	52.6500	54.4050	52.6500	54.4050	(56)
Primary loss	54.4050	49.1400	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050	52.6500	54.4050	52.6500	54.4050	(57)
Combi loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
Total heat required for water heating calculated for each month	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)
WWHRS	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293	(62)
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	(63a)
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	(63b)
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	(63c)
Output from w/h	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)
12Total per year (kWh/year)	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293	(64)
Electric shower(s)													
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)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	(64a)
Heat gains from water heating, kWh/month													
	113.8838	101.1732	108.5191	97.7509	96.3757	64.1322	63.3695	65.8665	66.5624	99.4153	103.1827	112.9352	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	138.8692	153.7480	138.8692	143.4981	138.8692	143.4981	138.8692	138.8692	143.4981	138.8692	143.4981	138.8692	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	275.3236	278.1806	270.9811	255.6541	236.3066	218.1226	205.9746	203.1176	210.3171	225.6441	244.9917	263.1756	(68)
Pumps, fans	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	(71)
Total internal gains	153.0697	150.5553	145.8590	135.7651	129.5372	89.0725	85.1741	88.5303	92.4478	133.6228	143.3094	151.7947	(72)
	632.7107	647.9322	621.1575	600.3656	570.1612	516.1415	495.4661	495.9653	511.7113	563.5843	597.2474	619.2878	(73)

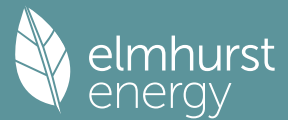
6. Solar gains

[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		
North					10.3700	10.6334	0.6300	0.7000	0.7700		33.6994 (74)		
South					21.7900	46.7521	0.6300	0.7000	0.7700		311.3364 (78)		
West					0.4000	19.6403	0.6300	0.7000	0.7700		2.4009 (80)		
Solar gains	347.4367	578.9868	766.6762	921.1440	1015.5764	1003.8143	969.4237	897.8625	819.0581	632.1973	413.6060	299.0912	(83)
Total gains	980.1475	1226.9190	1387.8337	1521.5096	1585.7376	1519.9558	1464.8898	1393.8278	1330.7695	1195.7816	1010.8534	918.3789	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Full SAP Calculation Printout



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	32.2367	32.3309	32.4238	32.8674	32.9518	33.3502	33.3502	33.4250	33.1956	32.9518	32.7816	32.6056
alpha	3.1491	3.1554	3.1616	3.1912	3.1968	3.2233	3.2233	3.2283	3.2130	3.1968	3.1854	3.1737
util living area	0.9710	0.9437	0.9044	0.8309	0.7189	0.5732	0.4339	0.4700	0.6651	0.8573	0.9493	0.9758 (86)
Living	19.3483	19.6350	19.9653	20.3461	20.6371	20.8135	20.8766	20.8681	20.7503	20.3700	19.7944	19.3042
Non living	17.8761	18.2364	18.6463	19.1131	19.4415	19.6268	19.6745	19.6723	19.5702	19.1557	18.4526	17.8293
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	20.1550	19.6350	19.9653	20.3461	20.6371	20.8135	20.8766	20.8681	20.7503	20.3700	19.7944	19.5414 (87)
Th 2	19.7724	19.7756	19.7786	19.7930	19.7957	19.8082	19.8082	19.8106	19.8034	19.7957	19.7902	19.7845 (88)
util rest of house	0.9646	0.9320	0.8845	0.7957	0.6608	0.4860	0.3247	0.3596	0.5825	0.8196	0.9367	0.9705 (89)
MIT 2	19.0164	18.2364	18.6463	19.1131	19.4415	19.6268	19.6745	19.6723	19.5702	19.1557	18.4526	18.1816 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.3747	18.6765	19.0614	19.5010	19.8177	20.0002	20.0528	20.0486	19.9416	19.5378	18.8748	0.3147 (91)
Temperature adjustment												18.6095 (92)
adjusted MIT	19.3747	18.6765	19.0614	19.5010	19.8177	20.0002	20.0528	20.0486	19.9416	19.5378	18.8748	0.0000 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9622	0.9188	0.8705	0.7861	0.6620	0.5009	0.3480	0.3827	0.5929	0.8101	0.9244	0.9638 (94)
Useful gains	943.0703	1127.3481	1208.0995	1195.9967	1049.7507	761.3970	509.7193	533.3960	789.0085	968.6751	934.4747	885.1426 (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	2357.4952	2148.1845	1953.0991	1626.0544	1241.9616	816.3299	521.9446	550.3058	887.1561	1367.4305	1810.8267	2227.9723 (97)
Space heating kWh	1052.3321	686.0020	554.2797	309.6415	143.0049	0.0000	0.0000	0.0000	0.0000	296.6740	630.9735	999.0653 (98a)
Space heating requirement - total per year (kWh/year)												4671.9731
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	1052.3321	686.0020	554.2797	309.6415	143.0049	0.0000	0.0000	0.0000	0.0000	296.6740	630.9735	999.0653 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4671.9731
Space heating per m2										(98c) / (4) =		41.4697 (99)

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)												0.0000 (201)
Efficiency of main space heating system 1 (in %)												1.0000 (202)
Efficiency of main space heating system 2 (in %)												239.5939 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (207)
												0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1052.3321	686.0020	554.2797	309.6415	143.0049	0.0000	0.0000	0.0000	0.0000	296.6740	630.9735	999.0653 (98)
Space heating efficiency (main heating system 1)	239.5939	239.5939	239.5939	239.5939	239.5939	0.0000	0.0000	0.0000	0.0000	239.5939	239.5939	239.5939 (210)
Space heating fuel (main heating system)	439.2149	286.3187	231.3414	129.2360	59.6864	0.0000	0.0000	0.0000	0.0000	123.8237	263.3512	416.9828 (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	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293 (64)
Efficiency of water heater	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044 (216)
Fuel for water heating, kWh/month	185.9151	164.9690	176.5348	158.1326	155.3019	124.3437	123.4171	127.7831	128.5929	160.6168	167.6303	184.2565 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (223)
Lighting	34.3368	27.5463	24.8024	18.1713	14.0360	11.4676	12.8041	16.6433	21.6180	28.3640	32.0370	35.2912 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-86.0355	-136.8023	-217.9988	-263.6093	-291.4820	-258.6289	-255.3484	-237.4318	-203.4640	-164.3770	-99.5567	-72.4163 (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												1949.9551 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												172.0044
Water heating fuel used												1857.4938 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

Total electricity for the above, kWh/year

Electricity for lighting (calculated in Appendix L)

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

PV generation												-2287.1510 (233)
Wind generation												0.0000 (234)

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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	1797.4159 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1949.9551	0.1558	303.7319 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1857.4938	0.1414	262.6323 (264)
Space and water heating			566.3642 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	277.1180	0.1443	39.9967 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2287.1510	0.1335	-305.4240
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-305.4240 (269)
Total CO2, kg/year			300.9368 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.6700 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1949.9551	1.5766	3074.3284 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1857.4938	1.5228	2828.6841 (278)
Space and water heating			5903.0126 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	277.1180	1.5338	425.0528 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2287.1510	1.4935	-3415.8571
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-3415.8571 (283)
Total Primary energy kWh/year			2912.2083 (286)
Dwelling Primary energy Rate (DPER)			25.8500 (287)

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

1. Overall dwelling characteristics

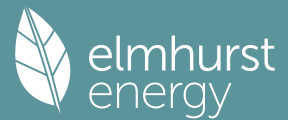
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	292.7200 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1366 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3866 (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) = 0.3866 (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	0.4930	0.4833	0.4736	0.4253	0.4156	0.3673	0.3673	0.3577	0.3866	0.4156	0.4350	0.4543 (22b)
Effective ac	0.6215	0.6168	0.6122	0.5904	0.5864	0.5675	0.5675	0.5640	0.5747	0.5864	0.5946	0.6032 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opening Type			28.1700	1.1450	32.2557			(27)
Heatloss Floor 1			57.3100	0.1300	7.4503			(28a)
External Wall 1	221.3800	28.1700	193.2100	0.1800	34.7778			(29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041			(30)
Total net area of external elements Aum(A, m2)			336.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		80.7879			(33)

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

161.0961 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	17.0400	0.0500	0.8520	
E2 Other lintels (including other steel lintels)	16.0100	0.0500	0.8005	
E3 Sill	35.4000	0.0500	1.7700	
E4 Jamb	32.1500	0.1600	5.1440	
E5 Ground floor (normal)	31.0300	0.0000	0.0000	
E6 Intermediate floor within a dwelling	19.6300	0.0600	1.1778	
E10 Eaves (insulation at ceiling level)	11.4000	0.0600	0.6840	
E12 Gable (insulation at ceiling level)	26.0000	0.0900	2.3400	
E16 Corner (normal)	7.7000	-0.0900	-0.6930	
E17 Corner (inverted - internal area greater than external area)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				12.0753 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 92.8632 (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	60.0367	59.5809	59.1342	57.0357	56.6431	54.8154	54.8154	54.4769	55.5194	56.6431	57.4373	58.2677	(38)
Average = Sum(39)m / 12 =	152.8999	152.4442	151.9974	149.8989	149.5063	147.6786	147.6786	147.3401	148.3826	149.5063	150.3005	151.1309	(39)
													149.8970
HLP	1.3572	1.3531	1.3492	1.3305	1.3271	1.3108	1.3108	1.3078	1.3171	1.3271	1.3341	1.3415	(40)
HLP (average)													1.3305
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

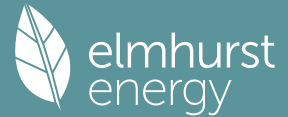
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8299 (42)
Hot water usage for mixer showers													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
82.6672	81.4395	79.7106	76.5228	74.1359	71.4891	70.0594	71.7762	73.6455	76.4777	79.7311	82.3877	82.3877	(42b)
Hot water usage for other uses													
43.6108	42.0250	40.4392	38.8533	37.2675	35.6816	35.6816	37.2675	38.8533	40.4392	42.0250	43.6108	43.6108	(42c)
Average daily hot water use (litres/day)													116.2918 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2781	123.4645	120.1497	115.3761	111.4033	107.1707	105.7411	109.0437	112.4988	116.9168	121.7561	125.9986	(44)
Energy conte	199.9936	175.8118	184.6657	157.9441	149.9703	131.7789	127.8846	135.0189	138.7223	158.6550	173.4638	197.2833	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
29.9990	26.3718	27.6999	23.6916	22.4955	19.7668	19.1827	20.2528	20.8083	23.7983	26.0196	29.5925	29.5925	(46)
Water storage loss (or HIU loss):													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1127 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1409 (55)
Total storage loss													
35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	(56)
If cylinder contains dedicated solar storage													
35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
258.6224	228.7668	243.2945	214.6817	208.5991	188.5164	186.5135	193.6477	195.4599	217.2838	230.2014	255.9121	255.9121	(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	258.6224	228.7668	243.2945	214.6817	208.5991	188.5164	186.5135	193.6477	195.4599	217.2838	230.2014	255.9121	(64)
12Total per year (kWh/year)													2621.4993 (64)
Electric shower(s)													2621 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
113.4009	100.8215	108.3044	97.9065	96.7682	89.2065	89.4247	91.7968	91.5152	99.6558	103.0668	112.4998	112.4998	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
138.8692	153.7480	138.8692	143.4981	138.8692	143.4981	138.8692	138.8692	143.4981	138.8692	143.4981	138.8692	138.8692	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
275.3236	278.1806	270.9811	255.6541	236.3066	218.1226	205.9746	203.1176	210.3171	225.6441	244.9917	263.1756	263.1756	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	(71)
Water heating gains (Table 5)													
152.4206	150.0319	145.5704	135.9812	130.0647	123.8980	120.1945	123.3828	127.1045	133.9460	143.1483	151.2094	151.2094	(72)
Total internal gains	635.0617	650.4088	623.8689	603.5817	573.6887	550.9670	530.4865	530.8179	546.3680	566.9076	600.0864	621.7024	(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			
North	8.9700				10.6334	0.6300	0.7000	0.7700	29.1498 (74)			
South	18.8500				46.7521	0.6300	0.7000	0.7700	269.3295 (78)			
West	0.3500				19.6403	0.6300	0.7000	0.7700	2.1008 (80)			
Solar gains	300.5802	500.9088	663.3009	796.9571	878.6686	868.4954	838.7396	776.8188	708.6260	546.9476	357.8269	258.7539 (83)
Total gains	935.6418	1151.3177	1287.1699	1400.5389	1452.3574	1419.4624	1369.2261	1307.6366	1254.9940	1113.8552	957.9133	880.4563 (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	32.9720	33.0706	33.1678	33.6321	33.7204	34.1377	34.1377	34.2162	33.9758	33.7204	33.5422	33.3579
alpha	3.1981	3.2047	3.2112	3.2421	3.2480	3.2758	3.2758	3.2811	3.2651	3.2480	3.2361	3.2239
util living area	0.9741	0.9510	0.9175	0.8521	0.7477	0.5946	0.4519	0.4876	0.6826	0.8733	0.9549	0.9783 (86)
MIT	18.9350	19.2887	19.7109	20.2147	20.6142	20.8714	20.9606	20.9488	20.7877	20.2625	19.5148	18.8821 (87)
Th 2	19.7963	19.7994	19.8025	19.8170	19.8197	19.8324	19.8324	19.8347	19.8275	19.8197	19.8142	19.8085 (88)
util rest of house	0.9684	0.9407	0.8998	0.8199	0.6921	0.5078	0.3414	0.3763	0.6016	0.8387	0.9436	0.9734 (89)
MIT 2	17.4349	17.8800	18.4060	19.0243	19.4803	19.7477	19.8161	19.8118	19.6730	19.0976	18.1800	17.3757 (90)
Living area fraction	17.9069	18.3233	18.8166	19.3989	19.8371	20.1013	20.1762	20.1696	20.0237	19.4642	18.6000	17.8497 (92)
MIT	17.9069	18.3233	18.8166	19.3989	19.8371	20.1013	20.1762	20.1696	20.0237	19.4642	18.6000	17.8497 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9069	18.3233	18.8166	19.3989	19.8371	20.1013	20.1762	20.1696	20.0237	19.4642	18.6000	17.8497 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9557	0.9240	0.8818	0.8067	0.6930	0.5290	0.3751	0.4096	0.6164	0.8262	0.9281	0.9621 (94)
Useful gains	894.2234	1063.7979	1134.9695	1129.8714	1006.4873	750.9177	513.5697	535.6618	773.5699	920.2991	889.0289	847.1136 (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	2080.4931	2046.3022	1872.0939	1573.7696	1216.5520	812.4232	528.1324	555.4130	878.9807	1325.2525	1728.4584	2062.8963 (97)
Space heating kWh	882.5847	660.2429	548.4206	319.6067	156.2882	0.0000	0.0000	0.0000	0.0000	301.2853	604.3893	904.5423 (98a)
Space heating requirement - total per year (kWh/year)												4377.3599
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	882.5847	660.2429	548.4206	319.6067	156.2882	0.0000	0.0000	0.0000	0.0000	301.2853	604.3893	904.5423 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4377.3599
Space heating per m2										(98c) / (4) =		38.8546 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	882.5847	660.2429	548.4206	319.6067	156.2882	0.0000	0.0000	0.0000	0.0000	301.2853	604.3893	904.5423 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	956.2131	715.3227	594.1718	346.2694	169.3263	0.0000	0.0000	0.0000	0.0000	326.4197	654.8096	980.0025 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	258.6224	228.7668	243.2945	214.6817	208.5991	188.5164	186.5135	193.6477	195.4599	217.2838	230.2014	255.9121 (64)
Efficiency of water heater	86.5869	86.2955	85.8255	84.9503	83.4214	79.8000	79.8000	79.8000	79.8000	84.7930	86.1209	79.8000 (216)
Fuel for water heating, kWh/month	298.6852	265.0969	283.4759	252.7144	250.0547	236.2361	233.7261	242.6663	244.9372	256.2521	267.3002	295.3571 (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	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	28.8543	23.1480	20.8422	15.2699	11.7949	9.6365	10.7597	13.9859	18.1662	23.8351	26.9217	29.6562 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-51.5204	-71.5884	-101.4264	-112.3258	-119.6534	-111.0970	-109.6380	-104.1571	-94.3571	-80.9559	-56.2325	-44.6589 (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)	-32.3927	-67.7348	-133.9108	-200.1300	-263.7130	-264.7037	-261.6671	-222.0389	-163.3422	-96.6292	-43.1635	-25.6536 (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)

elmhurst
energy

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

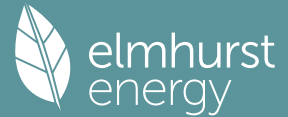
13a. Primary energy - Individual heating systems including micro-CHP

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 292.7200 (5)

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
		Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1366 (8)

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Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0000 (17)
Infiltration rate												0.3866 (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) = 0.3866 (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)
	0.4930	0.4833	0.4736	0.4253	0.4156	0.3673	0.3673	0.3577	0.3866	0.4156	0.4350	0.4543 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.6215	0.6168	0.6122	0.5904	0.5864	0.5675	0.5675	0.5640	0.5747	0.5864	0.5946	0.6032 (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
Main dwelling							
Windows			32.5600	1.3258	43.1667		(27)
Heatloss Floor 1			57.3100	0.1200	6.8772	110.0000	6304.1000 (28a)
External Wall 1	221.3800	32.5600	188.8200	0.1800	33.9876	60.0000	11329.2000 (29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041	9.0000	515.7900 (30)
Total net area of external elements Aum(A, m2)			336.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	90.3356		(33)

Heat capacity Cm = Sum(A x k) (28) ... (30) + (32) + (32a) ... (32e) = 18149.0900 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 161.0961 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	17.0400	0.0150	0.2556
E3 Sill	16.0100	0.0210	0.3362
E4 Jamb	35.4000	0.0160	0.5664
E5 Ground floor (normal)	32.1500	0.0900	2.8935
E6 Intermediate floor within a dwelling	31.0300	0.0020	0.0621
E10 Eaves (insulation at ceiling level)	19.6300	0.0650	1.2759
E12 Gable (insulation at ceiling level)	11.4000	0.0000	0.0000
E16 Corner (normal)	26.0000	0.0510	1.3260
E17 Corner (inverted - internal area greater than external area)	7.7000	-0.0910	-0.7007

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.0150 (36)

Point Thermal Bridges 0.0000

Total fabric heat loss (33) + (36) + (36a) = 96.3506 (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	60.0367	59.5809	59.1342	57.0357	56.6431	54.8154	54.8154	54.4769	55.5194	56.6431	57.4373	58.2677 (38)
Average = Sum(39)m / 12 =	156.3873	155.9315	155.4847	153.3863	152.9936	151.1659	151.1659	150.8275	151.8699	152.9936	153.7879	154.6183 (39)
												153.3844

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3881	1.3841	1.3801	1.3615	1.3580	1.3418	1.3418	1.3388	1.3480	1.3580	1.3651	1.3724 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8299 (42)
Hot water usage for mixer showers													0.0000 (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	30.9427	30.4831	29.8360	28.6428	27.7493	26.7587	26.2235	26.8661	27.5658	28.6259	29.8437	30.8381	30.8381 (42c)
Average daily hot water use (litres/day)	43.6108	42.0250	40.4392	38.8533	37.2675	35.6816	35.6816	37.2675	38.8533	40.4392	42.0250	43.6108	43.6108 (42c)
													68.3350 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	74.5535	72.5081	70.2751	67.4961	65.0168	62.4403	61.9051	64.1336	66.4191	69.0650	71.8687	74.4489 (44)
Energy content (annual)	118.0745	103.2506	108.0103	92.3988	87.5251	76.7776	74.8689	79.4108	81.9014	93.7206	102.3901	116.5690 (45)
										Total = Sum(45)m =	1134.8977	

Water storage loss (or HIU loss):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage	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 (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	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	0.0000 (61)

Total heat required for water heating calculated for each month	100.3634	87.7630	91.8087	78.5390	74.3963	65.2609	63.6386	67.4992	69.6162	79.6625	87.0316	99.0836	99.0836 (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	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h	100.3634	87.7630	91.8087	78.5390	74.3963	65.2609	63.6386	67.4992	69.6162	79.6625	87.0316	99.0836	99.0836 (64)
													964.6630 (64)

12Total per year (kWh/year) 965 (64)

Electric shower(s) 57.3939 51.1384 55.8412 53.2886 54.2885 51.7860 53.5122 54.2885 53.2886 55.8412 54.7911 57.3939 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 652.8518 (64a)

Heat gains from water heating, kWh/month	39.4393	34.7254	36.9125	32.9569	32.1712	29.2617	29.2877	30.4469	30.7262	33.8759	35.4557	39.1194	39.1194 (65)
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5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	138.8692	153.7480	138.8692	143.4981	138.8692	143.4981	138.8692	138.8692	143.4981	138.8692	143.4981	138.8692 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	275.3236	278.1806	270.9811	255.6541	236.3066	218.1226	205.9746	203.1176	210.3171	225.6441	244.9917	263.1756 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954 (71)
Water heating gains (Table 5)												
	53.0098	51.6746	49.6135	45.7734	43.2409	40.6413	39.3652	40.9233	42.6753	45.5322	49.2440	52.5798 (72)
Total internal gains												
	532.6509	549.0515	524.9121	510.3740	483.8649	467.7103	449.6572	448.3583	461.9388	475.4937	503.1821	520.0729 (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
North	10.3700	10.6334	0.6300	0.7000	0.7700	33.6994 (74)
South	21.7900	46.7521	0.6300	0.7000	0.7700	311.3364 (78)
West	0.4000	19.6403	0.6300	0.7000	0.7700	2.4009 (80)
Solar gains						
	347.4367	578.9868	766.6762	921.1440	1015.5764	1003.8143
Total gains						
	880.0876	1128.0383	1291.5883	1431.5180	1499.4413	1471.5246

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	32.2367	32.3309	32.4238	32.8674	32.9518	33.3502	33.3502	33.4250	33.1956	32.9518	32.7816	32.6056
alpha	3.1491	3.1554	3.1616	3.1912	3.1968	3.2233	3.2233	3.2283	3.2130	3.1968	3.1854	3.1737
util living area												
	0.9782	0.9542	0.9186	0.8494	0.7414	0.5872	0.4461	0.4841	0.6813	0.8778	0.9603	0.9823 (86)
MIT	18.8145	19.2081	19.6642	20.1960	20.6087	20.8696	20.9596	20.9468	20.7792	20.2220	19.4219	18.7535 (87)
Th 2	19.7724	19.7756	19.7786	19.7930	19.7957	19.8082	19.8106	19.8106	19.8034	19.7957	19.7902	19.7845 (88)
util rest of house												
	0.9733	0.9444	0.9010	0.8166	0.6846	0.4994	0.3346	0.3714	0.5991	0.8437	0.9501	0.9783 (89)
MIT 2	17.8212	18.2084	18.6518	19.1625	19.5291	19.7420	19.7955	19.7923	19.6789	19.2017	18.4339	17.7693 (90)
Living area fraction												
	fLA = Living area / (4) =											
MIT	18.1338	18.5229	18.9704	19.4877	19.8688	20.0968	20.1618	20.1556	20.0251	19.5228	18.7448	18.0790 (92)
Temperature adjustment												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
adjusted MIT												
	18.1338	18.5229	18.9704	19.4877	19.8688	20.0968	20.1618	20.1556	20.0251	19.5228	18.7448	18.0790 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9642	0.9314	0.8867	0.8070	0.6884	0.5219	0.3689	0.4055	0.6157	0.8344	0.9384	0.9704 (94)
Useful gains	848.5986	1050.6643	1145.2429	1155.2828	1032.2216	767.9699	523.4694	545.8552	788.6570	924.2905	860.3401	794.8964 (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												
Space heating	2163.4230	2124.2467	1938.9494	1624.0070	1249.7741	830.9268	538.4166	566.4426	899.8500	1365.1274	1790.8271	2145.9475 (97)
kWh	978.2294	721.4474	590.5177	337.4815	161.8590	0.0000	0.0000	0.0000	0.0000	327.9826	669.9507	1005.1820 (98a)
Space heating requirement - total per year (kWh/year)	4792.6502											
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	978.2294	721.4474	590.5177	337.4815	161.8590	0.0000	0.0000	0.0000	0.0000	327.9826	669.9507	1005.1820 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4792.6502											
Space heating per m2	(98c) / (4) = 42.5408 (99)											

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1420.9599	1118.6280	1146.2888	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8194	0.8789	0.8585	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1164.3335	983.1901	984.0556	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1663.0442	1604.4185	1522.0060	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	359.0717	462.1939	400.2351	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												
	fc = cooled area / (4) =											1.0000 (105)
Intermittency factor (Table 10b)												
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	89.7679	115.5485	100.0588	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												
												305.3752 (107)
Energy for space heating												42.5408 (99)
Energy for space cooling												2.7106 (108)
Total												45.2514 (109)
Fabric Energy Efficiency (DFEE)												45.3 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 292.7200 (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	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1366 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3866 (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) = 0.3866 (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	0.4930	0.4833	0.4736	0.4253	0.4156	0.3673	0.3673	0.3577	0.3866	0.4156	0.4350	0.4543 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.6215	0.6168	0.6122	0.5904	0.5864	0.5675	0.5675	0.5640	0.5747	0.5864	0.5946	0.6032 (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
Main dwelling							
TER Opening Type			28.1700	1.1450	32.2557		(27)
Heatloss Floor 1			57.3100	0.1300	7.4503		(28a)
External Wall 1	221.3800	28.1700	193.2100	0.1800	34.7778		(29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041		(30)
Total net area of external elements Aum (A, m ²)			336.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.7879		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 161.0961 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	17.0400	0.0500	0.8520
E3 Sill	16.0100	0.0500	0.8005
E4 Jamb	35.4000	0.0500	1.7700
E5 Ground floor (normal)	32.1500	0.1600	5.1440
E6 Intermediate floor within a dwelling	31.0300	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	19.6300	0.0600	1.1778
E12 Gable (insulation at ceiling level)	11.4000	0.0600	0.6840
E16 Corner (normal)	26.0000	0.0900	2.3400
E17 Corner (inverted - internal area greater than external area)	7.7000	-0.0900	-0.6930

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.0753 (36)

Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 92.8632 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	60.0367	59.5809	59.1342	57.0357	56.6431	54.8154	54.8154	54.4769	55.5194	56.6431	57.4373	58.2677 (38)
Heat transfer coeff	152.8999	152.4442	151.9974	149.8989	149.5063	147.6786	147.6786	147.3401	148.3826	149.5063	150.3005	151.1309 (39)
Average = Sum(39)m / 12 =												149.8970

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3572	1.3531	1.3492	1.3305	1.3271	1.3108	1.3108	1.3078	1.3171	1.3271	1.3341	1.3415 (40)
HLP (average)												1.3305
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8299 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												

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Hot water usage for other uses	30.9427	30.4831	29.8360	28.6428	27.7493	26.7587	26.2235	26.8661	27.5658	28.6259	29.8437	30.8381 (42b)
Average daily hot water use (litres/day)	43.6108	42.0250	40.4392	38.8533	37.2675	35.6816	35.6816	37.2675	38.8533	40.4392	42.0250	43.6108 (42c)
												68.3350 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	74.5535	72.5081	70.2751	67.4961	65.0168	62.4403	61.9051	64.1336	66.4191	69.0650	71.8687	74.4489 (44)
Distribution loss (46)m = 0.15 x (45)m	118.0745	103.2506	108.0103	92.3988	87.5251	76.7776	74.8689	79.4108	81.9014	93.7206	102.3901	116.5690 (45)
Water storage loss (or HIU 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 (46)
Total storage 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 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	100.3634	87.7630	91.8087	78.5390	74.3963	65.2609	63.6386	67.4992	69.6162	79.6625	87.0316	99.0836 (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	100.3634	87.7630	91.8087	78.5390	74.3963	65.2609	63.6386	67.4992	69.6162	79.6625	87.0316	99.0836 (64)
12Total per year (kWh/year)												965 (64)
Electric shower(s)	57.3939	51.1384	55.8412	53.2886	54.2885	51.7860	53.5122	54.2885	53.2886	55.8412	54.7911	57.3939 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												652.8518 (64a)
Heat gains from water heating, kWh/month	39.4393	34.7254	36.9125	32.9569	32.1712	29.2617	29.2877	30.4469	30.7262	33.8759	35.4557	39.1194 (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	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	138.8692	153.7480	138.8692	143.4981	138.8692	143.4981	138.8692	138.8692	143.4981	138.8692	143.4981	138.8692 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.3236	278.1806	270.9811	255.6541	236.3066	218.1226	205.9746	203.1176	210.3171	225.6441	244.9917	263.1756 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954 (71)
Water heating gains (Table 5)	53.0098	51.6746	49.6135	45.7734	43.2409	40.6413	39.3652	40.9233	42.6753	45.5322	49.2440	52.5798 (72)
Total internal gains	532.6509	549.0515	524.9121	510.3740	483.8649	467.7103	449.6572	448.3583	461.9388	475.4937	503.1821	520.0729 (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
North						8.9700	10.6334	0.6300	0.7000			0.7700			29.1498 (74)
South						18.8500	46.7521	0.6300	0.7000			0.7700			269.3295 (78)
West						0.3500	19.6403	0.6300	0.7000			0.7700			2.1008 (80)
Solar gains	300.5802	500.9088	663.3009	796.9571	878.6686	868.4954	838.7396	776.8188	708.6260	546.9476	357.8269	258.7539			(83)
Total gains	833.2311	1049.9604	1188.2130	1307.3311	1362.5335	1336.2057	1288.3967	1225.1771	1170.5648	1022.4413	861.0089	778.8267			(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	32.9720	33.0706	33.1678	33.6321	33.7204	34.1377	34.1377	34.2162	33.9758	33.7204	33.5422	33.3579
alpha	3.1981	3.2047	3.2112	3.2421	3.2480	3.2758	3.2758	3.2811	3.2651	3.2480	3.2361	3.2239
util living area	0.9811	0.9613	0.9315	0.8713	0.7723	0.6211	0.4763	0.5147	0.7120	0.8945	0.9658	0.9845 (86)
MIT	18.8169	19.1809	19.6176	20.1461	20.5716	20.8535	20.9540	20.9400	20.7582	20.1888	19.4096	18.7628 (87)
Th 2	19.7963	19.7994	19.8025	19.8170	19.8197	19.8324	19.8324	19.8347	19.8275	19.8197	19.8142	19.8085 (88)
util rest of house	0.9768	0.9528	0.9163	0.8419	0.7187	0.5334	0.3613	0.3994	0.6321	0.8639	0.9569	0.9810 (89)
MIT 2	17.8401	18.1996	18.6266	19.1388	19.5224	19.7561	19.8174	19.8134	19.6879	19.1924	18.4395	17.7951 (90)
Living area fraction	18.1475	18.5084	18.9385	19.4558	19.8526	20.1014	20.1750	20.1679	20.0247	19.5060	18.7448	0.3147 (91)
MIT	18.1475	18.5084	18.9385	19.4558	19.8526	20.1014	20.1750	20.1679	20.0247	19.5060	18.7448	18.0996 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1475	18.5084	18.9385	19.4558	19.8526	20.1014	20.1750	20.1679	20.0247	19.5060	18.7448	18.0996 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9686	0.9409	0.9026	0.8314	0.7204	0.5550	0.3965	0.4340	0.6469	0.8540	0.9462	0.9739 (94)
Useful gains	807.1075	987.9384	1072.5003	1086.9025	981.5300	741.5994	510.8136	531.7644	757.2344	873.1998	814.6665	758.5186 (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	2117.2768	2074.5153	1890.6150	1582.2958	1218.8600	812.4434	527.9555	555.1670	879.1182	1331.4997	1750.2133	2100.6645 (97)
Space heating kWh	974.7660	730.1797	608.6774	356.6832	176.5735	0.0000	0.0000	0.0000	0.0000	340.9751	673.5937	998.5566 (98a)

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Space heating requirement - total per year (kWh/year)	4860.0051										
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	974.7660	730.1797	608.6774	356.6832	176.5735	0.0000	0.0000	0.0000	340.9751	673.5937	998.5566 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											4860.0051
Space heating per m2	(98c) / (4) =										43.1387 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1388.1787	1092.8215	1119.7849	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7961	0.8613	0.8394	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1105.0605	941.2412	939.9822	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1504.8793	1451.6708	1380.5264	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	287.8695	379.7596	327.7649	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	71.9674	94.9399	81.9412	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												248.8485 (107)
Energy for space heating												43.1387 (99)
Energy for space cooling												2.2088 (108)
Total												45.3475 (109)
Fabric Energy Efficiency (TFEE)												45.3 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	292.7200 (5)

2. Ventilation rate

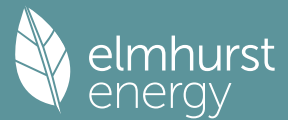
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1366 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3866 (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) = 0.3866 (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	0.4930	0.4833	0.4736	0.4253	0.4156	0.3673	0.3673	0.3577	0.3866	0.4156	0.4350	0.4543 (22b)
Effective ac	0.6215	0.6168	0.6122	0.5904	0.5864	0.5675	0.5675	0.5640	0.5747	0.5864	0.5946	0.6032 (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
Main dwelling							
Windows			32.5600	1.3258	43.1667		(27)
Heatloss Floor 1			57.3100	0.1200	6.8772	110.0000	6304.1000 (28a)
External Wall 1	221.3800	32.5600	188.8200	0.1800	33.9876	60.0000	11329.2000 (29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041	9.0000	515.7900 (30)
Total net area of external elements Aum(A, m2)			336.0000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.3356		(33)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				18149.0900 (34)

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

161.0961 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	17.0400	0.0150	0.2556
E2 Other lintels (including other steel lintels)	16.0100	0.0210	0.3362
E3 Sill	35.4000	0.0160	0.5664
E4 Jamb	32.1500	0.0900	2.8935
E5 Ground floor (normal)	31.0300	0.0020	0.0621
E6 Intermediate floor within a dwelling	19.6300	0.0650	1.2759
E10 Eaves (insulation at ceiling level)	11.4000	0.0000	0.0000
E12 Gable (insulation at ceiling level)	26.0000	0.0510	1.3260
E16 Corner (normal)	7.7000	-0.0910	-0.7007
E17 Corner (inverted - internal area greater than external area)			

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

6.0150 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 96.3506 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	60.0367	59.5809	59.1342	57.0357	56.6431	54.8154	54.8154	54.4769	55.5194	56.6431	57.4373	58.2677
Heat transfer coeff	156.3873	155.9315	155.4847	153.3863	152.9936	151.1659	151.1659	150.8275	151.8699	152.9936	153.7879	154.6183
Average = Sum(39)m / 12 =												153.3844

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3881	1.3841	1.3801	1.3615	1.3580	1.3418	1.3418	1.3388	1.3480	1.3580	1.3651	1.3724
HLP (average)												1.3615
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy

2.8299 (42)

Hot water usage for mixer showers

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths

87.0181 85.7258 83.9059 80.5503 78.0377 75.2517 73.7468 75.5539 77.5216 80.5028 83.9274 86.7239 (42b)

Hot water usage for other uses

45.9062 44.2368 42.5675 40.8982 39.2289 37.5596 37.5596 39.2289 40.8982 42.5675 44.2368 45.9062 (42c)

Average daily hot water use (litres/day)

122.4124 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	132.9243	129.9626	126.4734	121.4486	117.2666	112.8113	111.3064	114.7828	118.4198	123.0703	128.1643	132.6301
Energy conte	210.5196	185.0650	194.3849	166.2570	157.8634	138.7146	134.6154	142.1251	146.0235	167.0053	182.5935	207.6667
Energy content (annual)										Total = Sum(45)m =		2032.8340

Distribution loss (46)m = 0.15 x (45)m

31.5779 27.7598 29.1577 24.9385 23.6795 20.8072 20.1923 21.3188 21.9035 25.0508 27.3890 31.1500 (46)

Water storage loss (or HIU loss):

Store volume

300.0000 (47)

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

Temperature factor from Table 2b

2.2500 (48)

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

0.7800 (49)

Total storage loss

1.7550 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
54.4050	49.1400	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050
If cylinder contains dedicated solar storage												
54.4050	49.1400	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576
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

Total heat required for water heating calculated for each month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293	(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
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
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
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

Output from w/h

319.7822 283.7538 303.6475 271.9950 267.1260 213.8766 212.2828 219.7925 221.1855 276.2679 288.3315 316.9293 (64)

Total per year (kWh/year) = Sum(64)m = 3194.9706 (64)

Electric shower(s)

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

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

Heat gains from water heating, kWh/month

113.8838 101.1732 108.5191 97.7509 96.3757 64.1322 63.3695 65.8665 66.5624 99.4153 103.1827 112.9352 (65)

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

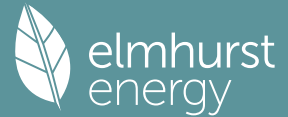
Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.2289	34.8428	28.3361	21.4522	16.0358	13.5381	14.6284	19.0145	25.5212	32.4051	37.8215	40.3192
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9308	415.1950	404.4494	381.5733	352.6964	325.5561	307.4248	303.1606	313.9062	336.7823	365.6592	392.7995
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092
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)	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954
Water heating gains (Table 5)	153.0697	150.5553	145.8590	135.7651	129.5372	89.0725	85.1741	88.5303	92.4478	133.6228	143.3094	151.7947
Total internal gains	714.6363	712.0000	690.0513	650.1975	609.6762	539.5736	518.6341	522.1123	543.2821	614.2170	658.1970	696.3202

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
North	10.3700	10.6334	0.6300	0.7000	0.7700	33.6994 (74)
South	21.7900	46.7521	0.6300	0.7000	0.7700	311.3364 (78)
West	0.4000	19.6403	0.6300	0.7000	0.7700	2.4009 (80)

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Solar gains	347.4367	578.9868	766.6762	921.1440	1015.5764	1003.8143	969.4237	897.8625	819.0581	632.1973	413.6060	299.0912 (83)
Total gains	1062.0730	1290.9867	1456.7275	1571.3415	1625.2527	1543.3879	1488.0578	1419.9748	1362.3402	1246.4142	1071.8030	995.4114 (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	32.2367	32.3309	32.4238	32.8674	32.9518	33.3502	33.3502	33.4250	33.1956	32.9518	32.7816	32.6056
alpha	3.1491	3.1554	3.1616	3.1912	3.1968	3.2233	3.2233	3.2283	3.2130	3.1968	3.1854	3.1737
util living area	0.9643	0.9364	0.8938	0.8205	0.7089	0.5665	0.4279	0.4626	0.6550	0.8452	0.9414	0.9701 (86)
Living	19.4161	19.6828	20.0093	20.3697	20.6485	20.8165	20.8777	20.8697	20.7572	20.3968	19.8410	19.3695
Non living	17.9609	18.2949	18.6983	19.1391	19.4523	19.6290	19.6750	19.6731	19.5757	19.1849	18.5094	17.9112
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1897	19.6828	20.0093	20.3697	20.6485	20.8165	20.8777	20.8697	20.7572	20.3968	19.8410	19.5976 (87)
Th 2	19.7724	19.7756	19.7786	19.7930	19.7957	19.8082	19.8082	19.8106	19.8034	19.7957	19.7902	19.7845 (88)
util rest of house	0.9566	0.9235	0.8723	0.7842	0.6503	0.4798	0.3199	0.3534	0.5723	0.8056	0.9273	0.9636 (89)
MIT 2	19.0502	18.2949	18.6983	19.1391	19.4523	19.6290	19.6750	19.6731	19.5757	19.1849	18.5094	18.2487 (90)
Living area fraction										FLA = Living area / (4) =		0.3147 (91)
MIT	19.4088	18.7316	19.1108	19.5264	19.8287	20.0027	20.0535	20.0496	19.9475	19.5663	18.9284	18.6732 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4088	18.7316	19.1108	19.5264	19.8287	20.0027	20.0535	20.0496	19.9475	19.5663	18.9284	18.6732 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9540	0.9098	0.8584	0.7751	0.6520	0.4948	0.3429	0.3763	0.5832	0.7969	0.9145	0.9561 (94)
Useful gains	1013.1705	1174.5657	1250.4842	1218.0245	1059.6878	763.6645	510.3253	534.3564	794.4554	993.2164	980.1412	951.6702 (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	2362.8223	2156.7881	1960.7924	1629.9363	1243.6412	816.6980	522.0466	550.4656	888.0593	1371.7798	1819.0642	2237.8158 (97)
Space heating kWh	1004.1409	660.0534	528.4693	296.5765	136.8613	0.0000	0.0000	0.0000	0.0000	281.6512	604.0245	956.8923 (98a)
Space heating requirement - total per year (kWh/year)												4468.6694
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	1004.1409	660.0534	528.4693	296.5765	136.8613	0.0000	0.0000	0.0000	0.0000	281.6512	604.0245	956.8923 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4468.6694
Space heating per m2										(98c) / (4) =		39.6651 (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 %)												239.5939 (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	1004.1409	660.0534	528.4693	296.5765	136.8613	0.0000	0.0000	0.0000	0.0000	281.6512	604.0245	956.8923 (98)
Space heating efficiency (main heating system 1)	239.5939	239.5939	239.5939	239.5939	239.5939	0.0000	0.0000	0.0000	0.0000	239.5939	239.5939	239.5939 (210)
Space heating fuel (main heating system)	419.1012	275.4884	220.5688	123.7830	57.1222	0.0000	0.0000	0.0000	0.0000	117.5536	252.1035	399.3809 (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	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293 (64)
Efficiency of water heater (217)m	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044 (216)
Fuel for water heating, kWh/month	185.9151	164.9690	176.5348	158.1326	155.3019	124.3437	123.4171	127.7831	128.5929	160.6168	167.6303	184.2565 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.3368	27.5463	24.8024	18.1713	14.0360	11.4676	12.8041	16.6433	21.6180	28.3640	32.0370	35.2912 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-85.9563	-136.6284	-217.5163	-263.0048	-290.9606	-258.6289	-255.3484	-237.4318	-203.4640	-164.1118	-99.4536	-72.3633 (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	0.0000	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												1865.1016 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												172.0044

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Water heating fuel used	1857.4938 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	277.1180 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2284.8684 (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	1714.8451 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1865.1016	16.4900	307.5553 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1857.4938	16.4900	306.3007 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	277.1180	16.4900	45.6968 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2284.8684	16.4900	-376.7748
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-376.7748 (252)
Total energy cost			282.7780 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 0.6457 (257)
SAP value	89.5333
SAP rating (Section 12)	90 (258)
SAP band	B

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	1865.1016	0.1558	290.5338 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1857.4938	0.1414	262.6323 (264)
Space and water heating			553.1661 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	277.1180	0.1443	39.9967 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2284.8684	0.1335	-305.0939
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-305.0939 (269)
Total CO2, kg/year			288.0688 (272)
CO2 emissions per m2			2.5600 (273)
EI value			97.5516
EI rating			98 (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

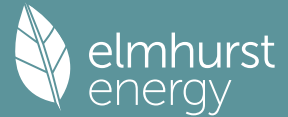
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 292.7200 (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)

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Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

4 * 10 = 40.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
40.0000 / (5) = 0.1366 (8)
Yes
Blower Door
5.0000 (17)
0.3866 (18)
0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3866 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4930	0.4543	0.4446	0.4156	0.4156	0.3866	0.3866	0.3770	0.3866	0.4350	0.4253	0.4543	(22b)
	0.6215	0.6032	0.5989	0.5864	0.5864	0.5747	0.5747	0.5711	0.5747	0.5946	0.5904	0.6032	(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	
Main dwelling								
Windows			32.5600	1.3258	43.1667			(27)
Heatloss Floor 1			57.3100	0.1200	6.8772	110.0000	6304.1000	(28a)
External Wall 1	221.3800	32.5600	188.8200	0.1800	33.9876	60.0000	11329.2000	(29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041	9.0000	515.7900	(30)
Total net area of external elements Aum(A, m2)			336.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	90.3356			(33)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	17.0400	0.0150	0.2556	
E3 Sill	16.0100	0.0210	0.3362	
E4 Jamb	35.4000	0.0160	0.5664	
E5 Ground floor (normal)	32.1500	0.0900	2.8935	
E6 Intermediate floor within a dwelling	31.0300	0.0020	0.0621	
E10 Eaves (insulation at ceiling level)	19.6300	0.0650	1.2759	
E12 Gable (insulation at ceiling level)	11.4000	0.0000	0.0000	
E16 Corner (normal)	26.0000	0.0510	1.3260	
E17 Corner (inverted - internal area greater than external area)	7.7000	-0.0910	-0.7007	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.0150	(36)
Point Thermal bridges			0.0000	(36a) =
Total fabric heat loss			96.3506	(33) + (36) + (36a) = (37)

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

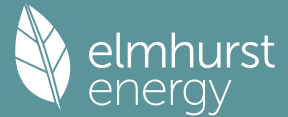
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.0367	58.2677	57.8480	56.6431	56.6431	55.5194	55.5194	55.1628	55.5194	57.4373	57.0357	58.2677	(38)
Heat transfer coeff	156.3873	154.6183	154.1986	152.9936	152.9936	151.8699	151.8699	151.5134	151.8699	153.7879	153.3863	154.6183	(39)
Average = Sum(39)m / 12 =												153.3423	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3881	1.3724	1.3687	1.3580	1.3580	1.3480	1.3480	1.3449	1.3480	1.3651	1.3615	1.3724	(40)
HLP (average)												1.3611	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8299 (42)
Hot water usage for mixer showers													(42a)
Hot water usage for baths													(42b)
Hot water usage for other uses													(42c)
Average daily hot water use (litres/day)													(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.9243	129.9626	126.4734	121.4486	117.2666	112.8113	111.3064	114.7828	118.4198	123.0703	128.1643	132.6301	(44)
Energy conte	210.5196	185.0650	194.3849	166.2570	157.8634	138.7146	134.6154	142.1251	146.0235	167.0053	182.5935	207.6667	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss (or HIU loss):													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2500 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.7550 (55)
Total storage loss													
If cylinder contains dedicated solar storage													
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(57)
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													
WWHRS	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293	(62)
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	(63a)
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													
	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)

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Heat gains from water heating, kWh/month
113.8838 101.1732 108.5191 97.7509 96.3757 64.1322 63.3695 65.8665 66.5624 99.4153 103.1827 112.9352 (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	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.2289	34.8428	28.3361	21.4522	16.0358	13.5381	14.6284	19.0145	25.5212	32.4051	37.8215	40.3192	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9308	415.1950	404.4494	381.5733	352.6964	325.5561	307.4248	303.1606	313.9062	336.7823	365.6592	392.7995	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	(71)
Water heating gains (Table 5)	153.0697	150.5553	145.8590	135.7651	129.5372	89.0725	85.1741	88.5303	92.4478	133.6228	143.3094	151.7947	(72)
Total internal gains	714.6363	712.0000	690.0513	650.1975	609.6762	539.5736	518.6341	522.1123	543.2821	614.2170	658.1970	696.3202	(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	
North					10.3700	13.8645		0.6300	0.7000	0.7700		43.9396 (74)	
South					21.7900	58.2505		0.6300	0.7000	0.7700		387.9081 (78)	
West					0.4000	25.9136		0.6300	0.7000	0.7700		3.1678 (80)	
Solar gains	435.0155	618.7242	816.1236	1006.1801	1069.4450	1149.1284	1081.0816	1014.5185	926.6183	714.4945	512.8638	357.8020	(83)
Total gains	1149.6518	1330.7241	1506.1749	1656.3776	1679.1213	1688.7020	1599.7157	1536.6308	1469.9004	1328.7115	1171.0607	1054.1222	(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	32.2367	32.6056	32.6943	32.9518	32.9518	33.1956	33.1956	33.2737	33.1956	32.7816	32.8674	32.6056	
alpha	3.1491	3.1737	3.1796	3.1968	3.1968	3.2130	3.2130	3.2182	3.2130	3.1854	3.1912	3.1737	
util living area	0.9483	0.9225	0.8707	0.7810	0.6521	0.4744	0.3433	0.3557	0.5614	0.7844	0.9092	0.9573	(86)
Living	19.6390	19.8337	20.1497	20.4790	20.7245	20.8577	20.8922	20.8911	20.8230	20.5527	20.0859	19.5992	
Non living	18.2410	18.4889	18.8747	19.2647	19.5289	19.6551	19.6771	19.6794	19.6311	19.3545	18.8123	18.2015	
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	20.3038	19.8337	20.1497	20.4790	20.7245	20.8577	20.8922	20.8911	20.8230	20.5527	20.0859	19.7952	(87)
Th 2	19.7724	19.7845	19.7874	19.7957	19.7957	19.8034	19.8034	19.8059	19.8034	19.7902	19.7930	19.7845	(88)
util rest of house	0.9369	0.9066	0.8446	0.7384	0.5851	0.3836	0.2359	0.2450	0.4685	0.7305	0.8869	0.9476	(89)
MIT 2	19.1619	18.4889	18.8747	19.2647	19.5289	19.6551	19.6771	19.6794	19.6311	19.3545	18.8123	18.4867	(90)
Living area fraction									FLA = Living area /	(4) =		0.3147	(91)
MIT	19.5212	18.9121	19.2759	19.6468	19.9051	20.0335	20.0594	20.0607	20.0061	19.7316	19.2130	18.8984	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5212	18.9121	19.2759	19.6468	19.9051	20.0335	20.0594	20.0607	20.0061	19.7316	19.2130	18.8984	(93)

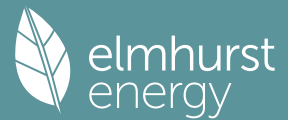
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1074.0680	1187.8135	1252.8261	1213.3324	993.4037	678.4096	414.8824	413.6367	713.2200	966.7404	1023.3501	989.6206	(94)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	2208.3777	2042.8279	1846.6663	1537.0911	1117.6338	703.6890	419.0774	418.2779	760.2810	1219.7787	1658.5695	2071.6449	(97)
Space heating kWh	843.9264	574.5697	441.8171	233.1063	92.4272	0.0000	0.0000	0.0000	0.0000	188.2605	457.3579	805.0261	(98a)
Space heating requirement - total per year (kWh/year)												3636.4912	
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	843.9264	574.5697	441.8171	233.1063	92.4272	0.0000	0.0000	0.0000	0.0000	188.2605	457.3579	805.0261	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3636.4912	
Space heating per m2										(98c) / (4) =		32.2785	(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 %)													239.5784 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
843.9264	574.5697	441.8171	233.1063	92.4272	0.0000	0.0000	0.0000	0.0000	0.0000	188.2605	457.3579	805.0261	(98)
Space heating efficiency (main heating system 1)	239.5784	239.5784	239.5784	239.5784	239.5784	0.0000	0.0000	0.0000	0.0000	239.5784	239.5784	239.5784	(210)
Space heating fuel (main heating system)	352.2548	239.8254	184.4144	97.2986	38.5791	0.0000	0.0000	0.0000	0.0000	78.5799	190.9012	336.0179	(211)

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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	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293	(64)
Efficiency of water heater	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	(216)
(217)m	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	(217)
Fuel for water heating, kWh/month	185.9182	164.9717	176.5377	158.1352	155.3045	124.3458	123.4192	127.7852	128.5951	160.6194	167.6331	184.2596	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	34.3368	27.5463	24.8024	18.1713	14.0360	11.4676	12.8041	16.6433	21.6180	28.3640	32.0370	35.2912	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-109.3168	-149.0649	-233.8706	-282.4168	-299.6172	-279.1947	-272.4269	-258.2536	-225.7674	-185.0188	-124.1607	-88.2590	(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	0.0000	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												1517.8713	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												172.0015	
Water heating fuel used												1857.5248	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												277.1180	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2507.3675	(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												1145.1466	(238)

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1517.8713	28.4300	431.5308	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1857.5248	28.4300	528.0943	(247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	277.1180	28.4300	78.7846	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2507.3675	28.4300	-712.8446	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-712.8446	(252)
Total energy cost			325.5652	(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	1517.8713	0.1563	237.2950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1857.5248	0.1414	262.6367	(264)
Space and water heating			499.9317	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	277.1180	0.1443	39.9967	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2507.3675	0.1340	-335.8941	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-335.8941	(269)
Total CO2, kg/year			204.0342	(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	1517.8713	1.5787	2396.3308	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1857.5248	1.5228	2828.7313	(278)
Space and water heating			5225.0621	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	277.1180	1.5338	425.0528	(282)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2507.3675	1.4951	-3748.6924
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-3748.6924 (283)
Total Primary energy kWh/year			1901.4224 (286)

SAP 10 EPC IMPROVEMENTS

After PV

Current energy efficiency rating: B 90
Current environmental impact rating: A 98

N Solar water heating			Recommended
U Solar photovoltaic panels			Already installed
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 78	-35 kg (17.1%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£78	0.31 kg/m ²	B 91 A 98
Total Savings	£78	0.31 kg/m ²	

Potential energy efficiency rating: B 91
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 589 TEST (12 Dec 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£1038	£931	£108
Space heating	£432	£454	-£23
Water heating	£528	£397	£131
Lighting	£79	£79	£0
Generated (PV)	-£713	-£683	-£30
Total cost of fuels	£325	£248	£78
Total cost of uses	£326	£247	£78
Delivered energy	10 kWh/m ²	8 kWh/m ²	2 kWh/m ²
Carbon dioxide emissions	0.2 tonnes	0.2 tonnes	0.0 tonnes
CO2 emissions per m ²	2 kg/m ²	2 kg/m ²	0 kg/m ²
Primary energy	17 kWh/m ²	13 kWh/m ²	4 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 292.7200 (5)

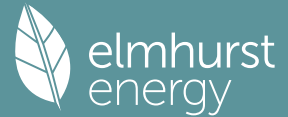
2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1366 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3866 (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) =	0.3866 (21)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

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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												
	0.4930	0.4833	0.4736	0.4253	0.4156	0.3673	0.3673	0.3577	0.3866	0.4156	0.4350	0.4543 (22b)
Effective ac	0.6215	0.6168	0.6122	0.5904	0.5864	0.5675	0.5675	0.5640	0.5747	0.5864	0.5946	0.6032 (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
Main dwelling							
Windows			32.5600	1.3258	43.1667		(27)
Heatloss Floor 1			57.3100	0.1200	6.8772	110.0000	6304.1000 (28a)
External Wall 1	221.3800	32.5600	188.8200	0.1800	33.9876	60.0000	11329.2000 (29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041	9.0000	515.7900 (30)
Total net area of external elements Aum(A, m2)			336.0000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.3356		(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18149.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 161.0961 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	17.0400	0.0150	0.2556
E3 Sill	16.0100	0.0210	0.3362
E4 Jamb	35.4000	0.0160	0.5664
E5 Ground floor (normal)	32.1500	0.0900	2.8935
E6 Intermediate floor within a dwelling	31.0300	0.0020	0.0621
E10 Eaves (insulation at ceiling level)	19.6300	0.0650	1.2759
E12 Gable (insulation at ceiling level)	11.4000	0.0000	0.0000
E16 Corner (normal)	26.0000	0.0510	1.3260
E17 Corner (inverted - internal area greater than external area)	7.7000	-0.0910	-0.7007
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.0150 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss			(33) + (36) + (36a) = 96.3506 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	60.0367	59.5809	59.1342	57.0357	56.6431	54.8154	54.8154	54.4769	55.5194	56.6431	57.4373	58.2677 (38)
Heat transfer coeff	156.3873	155.9315	155.4847	153.3863	152.9936	151.1659	151.1659	150.8275	151.8699	152.9936	153.7879	154.6183 (39)
Average = Sum(39)m / 12 =												153.3844

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3881	1.3841	1.3801	1.3615	1.3580	1.3418	1.3418	1.3388	1.3480	1.3580	1.3651	1.3724 (40)
HLP (average)												1.3615
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8299 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	87.0181	85.7258	83.9059	80.5503	78.0377	75.2517	73.7468	75.5539	77.5216	80.5028	83.9274	86.7239 (42b)
Hot water usage for other uses	45.9062	44.2368	42.5675	40.8982	39.2289	37.5596	37.5596	39.2289	40.8982	42.5675	44.2368	45.9062 (42c)
Average daily hot water use (litres/day)												122.4124 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	132.9243	129.9626	126.4734	121.4486	117.2666	112.8113	111.3064	114.7828	118.4198	123.0703	128.1643	132.6301 (44)
Energy conte	210.5196	185.0650	194.3849	166.2570	157.8634	138.7146	134.6154	142.1251	146.0235	167.0053	182.5935	207.6667 (45)
Energy content (annual)												Total = Sum(45)m = 2032.8340

Distribution loss (46)m = 0.15 x (45)m
31.5779 27.7598 29.1577 24.9385 23.6795 20.8072 20.1923 21.3188 21.9035 25.0508 27.3890 31.1500 (46)

Water storage loss (or HIU loss):
Store volume 300.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):
Temperature factor from Table 2b 2.2500 (48)
Enter (49) or (54) in (55) 0.7800 (49)
Total storage loss 1.7550 (55)

54.4050 49.1400 54.4050 52.6500 54.4050 52.6500 54.4050 54.4050 52.6500 54.4050 52.6500 54.4050 (56)

If cylinder contains dedicated solar storage
54.4050 49.1400 54.4050 52.6500 54.4050 52.6500 54.4050 54.4050 52.6500 54.4050 52.6500 54.4050 (57)

Primary loss 54.8576 49.5488 54.8576 53.0880 54.8576 22.5120 23.2624 23.2624 22.5120 54.8576 53.0880 54.8576 (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
319.7822 283.7538 303.6475 271.9950 267.1260 213.8766 212.2828 219.7925 221.1855 276.2679 288.3315 316.9293 (62)

WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)

PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Aperture area of solar collector 3.0000 (H1)

Zero-loss collector efficiency 0.8000 (H2)

Collector linear heat loss coefficient 1.8000 (H3)

Collector 2nd order heat loss coefficient 0.0000 (H4)

Collector loop efficiency 0.9000 (H5)

Incidence angle modifier 1.0000 (H6)

Overshading factor 0.8000 (H8)

Overall heat loss coefficient of system 6.5000 (H10)

Heat loss coefficient of collector loop 3.9667 (H11)

Dedicated solar storage volume 75.0000 (H12)

Effective solar volume 75.0000 (H14)

Reference volume 225.0000 (H15)

Storage tank correction coefficient 1.3161 (H16)

Heat delivered to hot water 647.1942 (H24)

Heat delivered to space heating 0.0000 (H29)

Solar input 647.1942 (63c)

Solar input -0.0000 -16.1758 -59.5551 -83.5129 -111.8742 -100.8559 -100.5448 -86.9225 -58.8704 -28.8826 -0.0000 -0.0000 (63d)

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 319.7822 267.5780 244.0924 188.4821 155.2518 113.0207 111.7380 132.8701 162.3151 247.3853 288.3315 316.9293 (64)

Total per year (kWh/year) = Sum(64)m = 2547.7764 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

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

Heat gains from water heating, kWh/month

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113.8838 101.1732 108.5191 97.7509 96.3757 64.1322 63.3695 65.8665 66.5624 99.4153 103.1827 112.9352 (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	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.2289	34.8428	28.3361	21.4522	16.0358	13.5381	14.6284	19.0145	25.5212	32.4051	37.8215	40.3192	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9308	415.1950	404.4494	381.5733	352.6964	325.5561	307.4248	303.1606	313.9062	336.7823	365.6592	392.7995	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	(71)
Water heating gains (Table 5)	153.0697	150.5553	145.8590	135.7651	129.5372	89.0725	85.1741	88.5303	92.4478	133.6228	143.3094	151.7947	(72)
Total internal gains	714.6363	712.0000	690.0513	650.1975	609.6762	539.5736	518.6341	522.1123	543.2821	614.2170	658.1970	696.3202	(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	
North					10.3700	10.6334		0.6300	0.7000	0.7700		33.6994 (74)	
South					21.7900	46.7521		0.6300	0.7000	0.7700		311.3364 (78)	
West					0.4000	19.6403		0.6300	0.7000	0.7700		2.4009 (80)	
Solar gains	347.4367	578.9868	766.6762	921.1440	1015.5764	1003.8143	969.4237	897.8625	819.0581	632.1973	413.6060	299.0912	(83)
Total gains	1062.0730	1290.9867	1456.7275	1571.3415	1625.2527	1543.3879	1488.0578	1419.9748	1362.3402	1246.4142	1071.8030	995.4114	(84)

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	32.2367	32.3309	32.4238	32.8674	32.9518	33.3502	33.3502	33.4250	33.1956	32.9518	32.7816	32.6056	
alpha	3.1491	3.1554	3.1616	3.1912	3.1968	3.2233	3.2233	3.2283	3.2130	3.1968	3.1854	3.1737	
util living area	0.9643	0.9364	0.8938	0.8205	0.7089	0.5665	0.4279	0.4626	0.6550	0.8452	0.9414	0.9701	(86)
Living	19.4161	19.6828	20.0093	20.3697	20.6485	20.8165	20.8777	20.8697	20.7572	20.3968	19.8410	19.3695	
Non living	17.9609	18.2949	18.6983	19.1391	19.4523	19.6290	19.6750	19.6731	19.5757	19.1849	18.5094	17.9112	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.1897	19.6828	20.0093	20.3697	20.6485	20.8165	20.8777	20.8697	20.7572	20.3968	19.8410	19.5976	(87)
Th 2	19.7724	19.7756	19.7786	19.7930	19.7957	19.8082	19.8082	19.8106	19.8034	19.7957	19.7902	19.7845	(88)
util rest of house	0.9566	0.9235	0.8723	0.7842	0.6503	0.4798	0.3199	0.3534	0.5723	0.8056	0.9273	0.9636	(89)
MIT 2	19.0502	18.2949	18.6983	19.1391	19.4523	19.6290	19.6750	19.6731	19.5757	19.1849	18.5094	18.2487	(90)
Living area fraction	19.4088	18.7316	19.1108	19.5264	19.8287	20.0027	20.0535	20.0496	19.9475	19.5663	18.9284	18.6732	(91)
MIT	19.4088	18.7316	19.1108	19.5264	19.8287	20.0027	20.0535	20.0496	19.9475	19.5663	18.9284	18.6732	(92)
Temperature adjustment	19.4088	18.7316	19.1108	19.5264	19.8287	20.0027	20.0535	20.0496	19.9475	19.5663	18.9284	18.6732	(93)
adjusted MIT	19.4088	18.7316	19.1108	19.5264	19.8287	20.0027	20.0535	20.0496	19.9475	19.5663	18.9284	18.6732	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1013.1705	1174.5657	1250.4842	1218.0245	1059.6878	763.6645	510.3253	534.3564	794.4554	993.2164	980.1412	951.6702	(94)
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	2362.8223	2156.7881	1960.7924	1629.9363	1243.6412	816.6980	522.0466	550.4656	888.0593	1371.7798	1819.0642	2237.8158	(97)
Space heating kWh	1004.1409	660.0534	528.4693	296.5765	136.8613	0.0000	0.0000	0.0000	0.0000	281.6512	604.0245	956.8923	(98a)
Space heating requirement - total per year (kWh/year)												4468.6694	
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	1004.1409	660.0534	528.4693	296.5765	136.8613	0.0000	0.0000	0.0000	0.0000	281.6512	604.0245	956.8923	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4468.6694	
Space heating per m ²										(98c) / (4) =		39.6651	(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 %)												239.5939	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	1004.1409	660.0534	528.4693	296.5765	136.8613	0.0000	0.0000	0.0000	0.0000	281.6512	604.0245	956.8923	(98)
Space heating efficiency (main heating system 1)	239.5939	239.5939	239.5939	239.5939	239.5939	0.0000	0.0000	0.0000	0.0000	239.5939	239.5939	239.5939	(210)
Space heating fuel (main heating system)	419.1012	275.4884	220.5688	123.7830	57.1222	0.0000	0.0000	0.0000	0.0000	117.5536	252.1035	399.3809	(211)
Space heating efficiency (main heating system 2)													

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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	(212)
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	(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	(215)
Water heating requirement	319.7822	267.5780	244.0924	188.4821	155.2518	113.0207	111.7380	132.8701	162.3151	247.3853	288.3315	316.9293	(64)
Efficiency of water heater (217)m	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	(216)
Fuel for water heating, kWh/month	185.9151	155.5647	141.9106	109.5798	90.2604	65.7080	64.9623	77.2481	94.3668	143.8250	167.6303	184.2565	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.5753	6.7945	6.5753	6.7945	6.5753	(231)
Lighting	34.3368	27.5463	24.8024	18.1713	14.0360	11.4676	12.8041	16.6433	21.6180	28.3640	32.0370	35.2912	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-85.9834	-136.5750	-216.2099	-258.0160	-277.8766	-241.2381	-238.1128	-225.9525	-198.8155	-163.6782	-99.5142	-72.3840	(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	0.0000	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												1865.1016	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												172.0044	(217)
Water heating fuel used												1481.2277	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												277.1180	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2214.3563	(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												1489.0910	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1865.1016	16.4900	307.5553	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1481.2277	16.4900	244.2544	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	277.1180	16.4900	45.6968	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2214.3563	16.4900	-365.1473	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-365.1473	(252)
Total energy cost			245.5511	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.5607	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	90.9112	
SAP rating (Section 12)		91	(258)
SAP band		B	

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	1865.1016	0.1558	290.5338	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1481.2277	0.1449	214.6576	(264)
Space and water heating			505.1914	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	277.1180	0.1443	39.9967	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2214.3563	0.1339	-296.5502	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-296.5502	(269)
Total CO2, kg/year			259.7349	(272)
CO2 emissions per m2			2.3100	(273)
EI value			97.7924	
EI rating			98	(274)

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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

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 292.7200 (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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.1366 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3866	(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) =	0.3866 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Adj infilt rate	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Effective ac	0.4930	0.4543	0.4446	0.4156	0.4156	0.3866	0.3866	0.3770	0.3866	0.4350	0.4253	0.4543 (22b)
	0.6215	0.6032	0.5989	0.5864	0.5864	0.5747	0.5747	0.5711	0.5747	0.5946	0.5904	0.6032 (25)

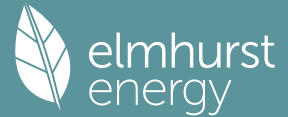
3. Heat losses and heat loss parameter

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
Main dwelling							
Windows			32.5600	1.3258	43.1667		(27)
Heatloss Floor 1			57.3100	0.1200	6.8772	110.0000	6304.1000 (28a)
External Wall 1	221.3800	32.5600	188.8200	0.1800	33.9876	60.0000	11329.2000 (29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041	9.0000	515.7900 (30)
Total net area of external elements Aum(A, m ²)			336.0000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.3356		(33)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =			18149.0900 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K						161.0961 (35)	
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				17.0400	0.0150	0.2556	
E3 Sill				16.0100	0.0210	0.3362	
E4 Jamb				35.4000	0.0160	0.5664	
E5 Ground floor (normal)				32.1500	0.0900	2.8935	
E6 Intermediate floor within a dwelling				31.0300	0.0020	0.0621	
E10 Eaves (insulation at ceiling level)				19.6300	0.0650	1.2759	
E12 Gable (insulation at ceiling level)				11.4000	0.0000	0.0000	
E16 Corner (normal)				26.0000	0.0510	1.3260	
E17 Corner (inverted - internal area greater than external area)				7.7000	-0.0910	-0.7007	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0150 (36)
Point Thermal Bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	96.3506 (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	60.0367	58.2677	57.8480	56.6431	56.6431	55.5194	55.5194	55.1628	55.5194	57.4373	57.0357	58.2677 (38)
Average = Sum(39)m / 12 =	156.3873	154.6183	154.1986	152.9936	152.9936	151.8699	151.8699	151.5134	151.8699	153.7879	153.3863	154.6183 (39)
												153.3423
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3881	1.3724	1.3687	1.3580	1.3580	1.3480	1.3480	1.3449	1.3480	1.3651	1.3615	1.3724 (40)
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												2.8299 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	87.0181	85.7258	83.9059	80.5503	78.0377	75.2517	73.7468	75.5539	77.5216	80.5028	83.9274	86.7239 (42b)
Hot water usage for other uses	45.9062	44.2368	42.5675	40.8982	39.2289	37.5596	37.5596	39.2289	40.8982	42.5675	44.2368	45.9062 (42c)
Average daily hot water use (litres/day)												122.4124 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	132.9243	129.9626	126.4734	121.4486	117.2666	112.8113	111.3064	114.7828	118.4198	123.0703	128.1643	132.6301 (44)
Energy content (annual)	210.5196	185.0650	194.3849	166.2570	157.8634	138.7146	134.6154	142.1251	146.0235	167.0053	182.5935	207.6667 (45)
Distribution loss (46)m = 0.15 x (45)m	31.5779	27.7598	29.1577	24.9385	23.6795	20.8072	20.1923	21.3188	21.9035	25.0508	27.3890	31.1500 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.7550 (55)
Total storage loss	54.4050	49.1400	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050	52.6500	54.4050	52.6500	54.4050 (56)
If cylinder contains dedicated solar storage	54.4050	49.1400	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050	52.6500	54.4050	52.6500	54.4050 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												790.3795 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												790.3795
Solar input	-4.8751	-23.1493	-70.4691	-98.2526	-122.5858	-120.1535	-116.7204	-105.1334	-75.4881	-43.2471	-10.3051	-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	314.9070	260.6045	233.1784	173.7424	144.5403	93.7231	95.5624	114.6591	145.6974	233.0208	278.0264	316.9293 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	113.8838	101.1732	108.5191	97.7509	96.3757	64.1322	63.3695	65.8665	66.5624	99.4153	103.1827	112.9352 (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	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.2289	34.8428	28.3361	21.4522	16.0358	13.5381	14.6284	19.0145	25.5212	32.4051	37.8215	40.3192 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9308	415.1950	404.4494	381.5733	352.6964	325.5561	307.4248	303.1606	313.9062	336.7823	365.6592	392.7995 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954 (71)
Water heating gains (Table 5)	153.0697	150.5553	145.8590	135.7651	129.5372	89.0725	85.1741	88.5303	92.4478	133.6228	143.3094	151.7947 (72)
Total internal gains	714.6363	712.0000	690.0513	650.1975	609.6762	539.5736	518.6341	522.1123	543.2821	614.2170	658.1970	696.3202 (73)

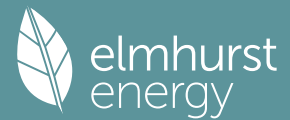
6. Solar gains

[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
North					10.3700	13.8645	0.6300	0.7000			0.7700	43.9396 (74)
South					21.7900	58.2505	0.6300	0.7000			0.7700	387.9081 (78)
West					0.4000	25.9136	0.6300	0.7000			0.7700	3.1678 (80)
Solar gains	435.0155	618.7242	816.1236	1006.1801	1069.4450	1149.1284	1081.0816	1014.5185	926.6183	714.4945	512.8638	357.8020 (83)
Total gains	1149.6518	1330.7241	1506.1749	1656.3776	1679.1213	1688.7020	1599.7157	1536.6308	1469.9004	1328.7115	1171.0607	1054.1222 (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	32.2367	32.6056	32.6943	32.9518	32.9518	33.1956	33.1956	33.2737	33.1956	32.7816	32.8674	32.6056
alpha	3.1491	3.1737	3.1796	3.1968	3.1968	3.2130	3.2130	3.2182	3.2130	3.1854	3.1912	3.1737
util living area	0.9483	0.9225	0.8707	0.7810	0.6521	0.4744	0.3433	0.3557	0.5614	0.7844	0.9092	0.9573 (86)

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Living	19.6390	19.8337	20.1497	20.4790	20.7245	20.8577	20.8922	20.8911	20.8230	20.5527	20.0859	19.5992
Non living	18.2410	18.4889	18.8747	19.2647	19.5289	19.6551	19.6771	19.6794	19.6311	19.3545	18.8123	18.2015
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	20.3038	19.8337	20.1497	20.4790	20.7245	20.8577	20.8922	20.8911	20.8230	20.5527	20.0859	19.7952 (87)
Th 2	19.7724	19.7845	19.7874	19.7957	19.7957	19.8034	19.8034	19.8059	19.8034	19.7902	19.7930	19.7845 (88)
util rest of house												
MIT 2	0.9369	0.9066	0.8446	0.7384	0.5851	0.3836	0.2359	0.2450	0.4685	0.7305	0.8869	0.9476 (89)
Living area fraction	19.1619	18.4889	18.8747	19.2647	19.5289	19.6551	19.6771	19.6794	19.6311	19.3545	18.8123	18.4867 (90)
MIT	19.5212	18.9121	19.2759	19.6468	19.9051	20.0335	20.0594	20.0607	20.0061	19.7316	19.2130	18.8984 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5212	18.9121	19.2759	19.6468	19.9051	20.0335	20.0594	20.0607	20.0061	19.7316	19.2130	18.8984 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9343	0.8926	0.8318	0.7325	0.5916	0.4017	0.2593	0.2692	0.4852	0.7276	0.8739	0.9388 (94)
Useful gains	1074.0680	1187.8135	1252.8261	1213.3324	993.4037	678.4096	414.8824	413.6367	713.2200	966.7404	1023.3501	989.6206 (95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000 (96)
Heat loss rate W	2208.3777	2042.8279	1846.6663	1537.0911	1117.6338	703.6890	419.0774	418.2779	760.2810	1219.7787	1658.5695	2071.6449 (97)
Space heating kWh	843.9264	574.5697	441.8171	233.1063	92.4272	0.0000	0.0000	0.0000	0.0000	188.2605	457.3579	805.0261 (98a)
Space heating requirement - total per year (kWh/year)												3636.4912
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	843.9264	574.5697	441.8171	233.1063	92.4272	0.0000	0.0000	0.0000	0.0000	188.2605	457.3579	805.0261 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3636.4912
Space heating per m2										(98c) / (4) =		32.2785 (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 %)												239.5784 (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	843.9264	574.5697	441.8171	233.1063	92.4272	0.0000	0.0000	0.0000	0.0000	188.2605	457.3579	805.0261 (98)
Space heating efficiency (main heating system 1)	239.5784	239.5784	239.5784	239.5784	239.5784	0.0000	0.0000	0.0000	0.0000	239.5784	239.5784	239.5784 (210)
Space heating fuel (main heating system)	352.2548	239.8254	184.4144	97.2986	38.5791	0.0000	0.0000	0.0000	0.0000	78.5799	190.9012	336.0179 (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	314.9070	260.6045	233.1784	173.7424	144.5403	93.7231	95.5624	114.6591	145.6974	233.0208	278.0264	316.9293 (64)
Efficiency of water heater (217)m	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015 (216)
Fuel for water heating, kWh/month	183.0839	151.5129	135.5677	101.0121	84.0343	54.4897	55.5591	66.6617	84.7070	135.4760	161.6418	184.2596 (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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	34.3368	27.5463	24.8024	18.1713	14.0360	11.4676	12.8041	16.6433	21.6180	28.3640	32.0370	35.2912 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-109.3464	-148.9065	-231.7675	-274.4424	-282.2917	-252.4761	-247.6146	-240.1341	-217.5527	-183.8073	-124.1709	-88.2943 (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	0.0000	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												1517.8713 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												172.0015
Water heating fuel used												1398.0058 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												277.1180 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2400.8044 (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												872.1907 (238)

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10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1517.8713	28.4300	431.5308 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1398.0058	28.4300	397.4531 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	28.4300	22.7440 (249)
Energy for lighting	277.1180	28.4300	78.7846 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2400.8044	28.4300	-682.5487
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-682.5487 (252)
Total energy cost			247.9638 (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	1517.8713	0.1563	237.2950 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1398.0058	0.1457	203.7370 (264)
Space and water heating			441.0320 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	277.1180	0.1443	39.9967 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2400.8044	0.1345	-322.9751
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-322.9751 (269)
Total CO2, kg/year			169.1506 (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	1517.8713	1.5787	2396.3308 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1398.0058	1.5391	2151.6758 (278)
Space and water heating			4548.0066 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	277.1180	1.5338	425.0528 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2400.8044	1.4972	-3594.4834
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-3594.4834 (283)
Total Primary energy kWh/year			1499.6000 (286)

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Plot Reference	BCA401 Honey Garston				Issued on Date	08/01/2026	
Assessment Reference	Before PV			Plot Type Ref			
Plot Address					SAP Version	10.2	
SAP Rating	76 C		DER	5.38		TER	11.82
Environmental	95 A		% DER < TER				54.48
CO ₂ Emissions (t/year)	0.54		DFEE	45.25		TFEE	45.35
Compliance Check	See BREL		% DFEE < TFEE				0.21
% DPER < TPER	9.26		DPER	56.17		TPER	61.90
Assessor Details	Mr. Liam Hanley				Assessor ID	R035-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 292.7200 (5)

2. Ventilation rate

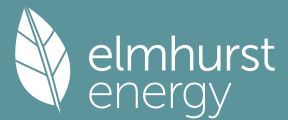
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 40.0000 / (5) = 0.1366 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3866 (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) = 0.3866 (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	0.4930	0.4833	0.4736	0.4253	0.4156	0.3673	0.3673	0.3577	0.3866	0.4156	0.4350	0.4543 (22b)
Effective ac	0.6215	0.6168	0.6122	0.5904	0.5864	0.5675	0.5675	0.5640	0.5747	0.5864	0.5946	0.6032 (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 kJ/m ² K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows			32.5600	1.3258	43.1667		(27)
Heatloss Floor 1			57.3100	0.1200	6.8772	110.0000	6304.1000 (28a)
External Wall 1	221.3800	32.5600	188.8200	0.1800	33.9876	60.0000	11329.2000 (29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041	9.0000	515.7900 (30)
Total net area of external elements Aum(A, m ²)			336.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	90.3356		(33)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =		18149.0900 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K						161.0961 (35)	
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				17.0400	0.0150	0.2556	
E3 Sill				16.0100	0.0210	0.3362	
E4 Jamb				35.4000	0.0160	0.5664	
E5 Ground floor (normal)				32.1500	0.0900	2.8935	
E6 Intermediate floor within a dwelling				31.0300	0.0020	0.0621	
E10 Eaves (insulation at ceiling level)				19.6300	0.0650	1.2759	
E12 Gable (insulation at ceiling level)				11.4000	0.0000	0.0000	
E16 Corner (normal)				26.0000	0.0510	1.3260	

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E17 Corner (inverted - internal area greater than external area) 7.7000 -0.0910 -0.7007
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.0150 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 96.3506 (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	60.0367	59.5809	59.1342	57.0357	56.6431	54.8154	54.8154	54.4769	55.5194	56.6431	57.4373	58.2677
Average = Sum(39)m / 12 =	156.3873	155.9315	155.4847	153.3863	152.9936	151.1659	151.1659	150.8275	151.8699	152.9936	153.7879	154.6183
	153.3844											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3881	1.3841	1.3801	1.3615	1.3580	1.3418	1.3418	1.3388	1.3480	1.3580	1.3651	1.3724
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8299	(42)
Hot water usage for mixer showers														
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	(42a)
Hot water usage for other uses	87.0181	85.7258	83.9059	80.5503	78.0377	75.2517	73.7468	75.5539	77.5216	80.5028	83.9274	86.7239	86.7239	(42b)
Average daily hot water use (litres/day)	45.9062	44.2368	42.5675	40.8982	39.2289	37.5596	37.5596	39.2289	40.8982	42.5675	44.2368	45.9062	45.9062	(42c)
													122.4124	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	132.9243	129.9626	126.4734	121.4486	117.2666	112.8113	111.3064	114.7828	118.4198	123.0703	128.1643	132.6301	132.6301	(44)
Energy content (annual)	210.5196	185.0650	194.3849	166.2570	157.8634	138.7146	134.6154	142.1251	146.0235	167.0053	182.5935	207.6667	207.6667	(45)
Distribution loss (46)m = 0.15 x (45)m													2032.8340	
Water storage loss (or HIU loss):	31.5779	27.7598	29.1577	24.9385	23.6795	20.8072	20.1923	21.3188	21.9035	25.0508	27.3890	31.1500	31.1500	(46)
Store volume													300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2500	(48)
Temperature factor from Table 2b													0.7800	(49)
Enter (49) or (54) in (55)													1.7550	(55)
Total storage loss	54.4050	49.1400	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050	(56)
If cylinder contains dedicated solar storage														
Primary loss	54.4050	49.1400	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050	(57)
Combi loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	54.8576	(59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
WWHRS	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293	316.9293	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293	316.9293	(64)
12Total per year (kWh/year)													3194.9706	(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	3195	(64)
Heat gains from water heating, kWh/month	113.8838	101.1732	108.5191	97.7509	96.3757	64.1322	63.3695	65.8665	66.5624	99.4153	103.1827	112.9352	112.9352	(65)

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

Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	138.8692	153.7480	138.8692	143.4981	138.8692	143.4981	138.8692	138.8692	143.4981	138.8692	143.4981	138.8692	138.8692	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	275.3236	278.1806	270.9811	255.6541	236.3066	218.1226	205.9746	203.1176	210.3171	225.6441	244.9917	263.1756	263.1756	(68)
Pumps, fans	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	(71)
Total internal gains	153.0697	150.5553	145.8590	135.7651	129.5372	89.0725	85.1741	88.5303	92.4478	133.6228	143.3094	151.7947	151.7947	(72)
	632.7107	647.9322	621.1575	600.3656	570.1612	516.1415	495.4661	495.9653	511.7113	563.5843	597.2474	619.2878	619.2878	(73)

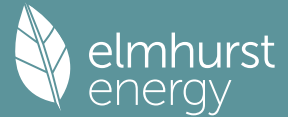
6. Solar gains

[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
North	10.3700	10.6334	0.6300	0.7000	0.7700	33.6994
South	21.7900	46.7521	0.6300	0.7000	0.7700	311.3364
West	0.4000	19.6403	0.6300	0.7000	0.7700	2.4009
Solar gains	347.4367	578.9868	766.6762	921.1440	1015.5764	1003.8143
Total gains	980.1475	1226.9190	1387.8337	1521.5096	1585.7376	1519.9558

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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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	32.2367	32.3309	32.4238	32.8674	32.9518	33.3502	33.3502	33.4250	33.1956	32.9518	32.7816	32.6056
alpha	3.1491	3.1554	3.1616	3.1912	3.1968	3.2233	3.2233	3.2283	3.2130	3.1968	3.1854	3.1737
util living area	0.9710	0.9437	0.9044	0.8309	0.7189	0.5732	0.4339	0.4700	0.6651	0.8573	0.9493	0.9758 (86)
Living	19.3483	19.6350	19.9653	20.3461	20.6371	20.8135	20.8766	20.8681	20.7503	20.3700	19.7944	19.3042
Non living	17.8761	18.2364	18.6463	19.1131	19.4415	19.6268	19.6745	19.6723	19.5702	19.1557	18.4526	17.8293
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	20.1550	19.6350	19.9653	20.3461	20.6371	20.8135	20.8766	20.8681	20.7503	20.3700	19.7944	19.5414 (87)
Th 2	19.7724	19.7756	19.7786	19.7930	19.7957	19.8082	19.8082	19.8106	19.8034	19.7957	19.7902	19.7845 (88)
util rest of house	0.9646	0.9320	0.8845	0.7957	0.6608	0.4860	0.3247	0.3596	0.5825	0.8196	0.9367	0.9705 (89)
MIT 2	19.0164	18.2364	18.6463	19.1131	19.4415	19.6268	19.6745	19.6723	19.5702	19.1557	18.4526	18.1816 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.3747	18.6765	19.0614	19.5010	19.8177	20.0002	20.0528	20.0486	19.9416	19.5378	18.8748	0.3147 (91)
Temperature adjustment												18.6095 (92)
adjusted MIT	19.3747	18.6765	19.0614	19.5010	19.8177	20.0002	20.0528	20.0486	19.9416	19.5378	18.8748	0.0000 (93)

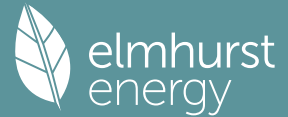
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9622	0.9188	0.8705	0.7861	0.6620	0.5009	0.3480	0.3827	0.5929	0.8101	0.9244	0.9638 (94)
Useful gains	943.0703	1127.3481	1208.0995	1195.9967	1049.7507	761.3970	509.7193	533.3960	789.0085	968.6751	934.4747	885.1426 (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	2357.4952	2148.1845	1953.0991	1626.0544	1241.9616	816.3299	521.9446	550.3058	887.1561	1367.4305	1810.8267	2227.9723 (97)
Space heating kWh	1052.3321	686.0020	554.2797	309.6415	143.0049	0.0000	0.0000	0.0000	0.0000	296.6740	630.9735	999.0653 (98a)
Space heating requirement - total per year (kWh/year)												4671.9731
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	1052.3321	686.0020	554.2797	309.6415	143.0049	0.0000	0.0000	0.0000	0.0000	296.6740	630.9735	999.0653 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4671.9731
Space heating per m2										(98c) / (4) =		41.4697 (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 %)												239.5939 (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	1052.3321	686.0020	554.2797	309.6415	143.0049	0.0000	0.0000	0.0000	0.0000	296.6740	630.9735	999.0653 (98)
Space heating efficiency (main heating system 1)	239.5939	239.5939	239.5939	239.5939	239.5939	0.0000	0.0000	0.0000	0.0000	239.5939	239.5939	239.5939 (210)
Space heating fuel (main heating system)	439.2149	286.3187	231.3414	129.2360	59.6864	0.0000	0.0000	0.0000	0.0000	123.8237	263.3512	416.9828 (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	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293 (64)
Efficiency of water heater	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044 (216)
Fuel for water heating, kWh/month	185.9151	164.9690	176.5348	158.1326	155.3019	124.3437	123.4171	127.7831	128.5929	160.6168	167.6303	184.2565 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.3368	27.5463	24.8024	18.1713	14.0360	11.4676	12.8041	16.6433	21.6180	28.3640	32.0370	35.2912 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)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 (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	0.0000	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												1949.9551 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												172.0044
Water heating fuel used												1857.4938 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												277.1180 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)

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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	4084.5669 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1949.9551	0.1558	303.7319 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1857.4938	0.1414	262.6323 (264)
Space and water heating			566.3642 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	277.1180	0.1443	39.9967 (268)
Total CO2, kg/year			606.3608 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.3800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1949.9551	1.5766	3074.3284 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1857.4938	1.5228	2828.6841 (278)
Space and water heating			5903.0126 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	277.1180	1.5338	425.0528 (282)
Total Primary energy kWh/year			6328.0654 (286)
Dwelling Primary energy Rate (DPER)			56.1700 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	292.7200 (5)

2. Ventilation rate

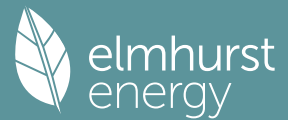
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1366 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3866 (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) = 0.3866 (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	0.4930	0.4833	0.4736	0.4253	0.4156	0.3673	0.3673	0.3577	0.3866	0.4156	0.4350	0.4543 (22b)
Effective ac	0.6215	0.6168	0.6122	0.5904	0.5864	0.5675	0.5675	0.5640	0.5747	0.5864	0.5946	0.6032 (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
Main dwelling							
TER Opening Type			28.1700	1.1450	32.2557		(27)
Heatloss Floor 1			57.3100	0.1300	7.4503		(28a)
External Wall 1	221.3800	28.1700	193.2100	0.1800	34.7778		(29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041		(30)

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Total net area of external elements Aum(A, m2) 336.0000 (31)
Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 80.7879 (33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 161.0961 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	17.0400	0.0500	0.8520
E3 Sill	16.0100	0.0500	0.8005
E4 Jamb	35.4000	0.0500	1.7700
E5 Ground floor (normal)	32.1500	0.1600	5.1440
E6 Intermediate floor within a dwelling	31.0300	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	19.6300	0.0600	1.1778
E12 Gable (insulation at ceiling level)	11.4000	0.0600	0.6840
E16 Corner (normal)	26.0000	0.0900	2.3400
E17 Corner (inverted - internal area greater than external area)	7.7000	-0.0900	-0.6930

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.0753 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 92.8632 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.0367	59.5809	59.1342	57.0357	56.6431	54.8154	54.8154	54.4769	55.5194	56.6431	57.4373	58.2677	(38)
Heat transfer coeff	152.8999	152.4442	151.9974	149.8989	149.5063	147.6786	147.6786	147.3401	148.3826	149.5063	150.3005	151.1309	(39)
Average = Sum(39)m / 12 =												149.8970	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3572	1.3531	1.3492	1.3305	1.3271	1.3108	1.3108	1.3078	1.3171	1.3271	1.3341	1.3415	(40)
HLP (average)												1.3305	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8299 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths 82.6672 81.4395 79.7106 76.5228 74.1359 71.4891 70.0594 71.7762 73.6455 76.4777 79.7311 82.3877 (42b)

Hot water usage for other uses 43.6108 42.0250 40.4392 38.8533 37.2675 35.6816 35.6816 37.2675 38.8533 40.4392 42.0250 43.6108 (42c)

Average daily hot water use (litres/day) 116.2918 (43)

Daily hot water use 126.2781 123.4645 120.1497 115.3761 111.4033 107.1707 105.7411 109.0437 112.4988 116.9168 121.7561 125.9986 (44)

Energy conte 199.9936 175.8118 184.6657 157.9441 149.9703 131.7789 127.8846 135.0189 138.7223 158.6550 173.4638 197.2833 (45)

Energy content (annual) Total = Sum(45)m = 1931.1923

Distribution loss (46)m = 0.15 x (45)m 29.9990 26.3718 27.6999 23.6916 22.4955 19.7668 19.1827 20.2528 20.8083 23.7983 26.0196 29.5925 (46)

Water storage loss (or HIU loss):

Store volume 300.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 2.1127 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 1.1409 (55)

Total storage loss 35.3664 31.9439 35.3664 34.2256 35.3664 34.2256 35.3664 35.3664 34.2256 35.3664 34.2256 35.3664 (56)

If cylinder contains dedicated solar storage 35.3664 31.9439 35.3664 34.2256 35.3664 34.2256 35.3664 35.3664 34.2256 35.3664 34.2256 35.3664 (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 258.6224 228.7668 243.2945 214.6817 208.5991 188.5164 186.5135 193.6477 195.4599 217.2838 230.2014 255.9121 (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 258.6224 228.7668 243.2945 214.6817 208.5991 188.5164 186.5135 193.6477 195.4599 217.2838 230.2014 255.9121 (64)

Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 2621.4993 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

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

Heat gains from water heating, kWh/month 113.4009 100.8215 108.3044 97.9065 96.7682 89.2065 89.4247 91.7968 91.5152 99.6558 103.0668 112.4998 (65)

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

Metabolic gains (Table 5), Watts

(66)m 141.4942 141.4942 141.4942 141.4942 141.4942 141.4942 141.4942 141.4942 141.4942 141.4942 141.4942 141.4942 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 138.8692 153.7480 138.8692 143.4981 138.8692 143.4981 138.8692 138.8692 143.4981 138.8692 143.4981 138.8692 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 275.3236 278.1806 270.9811 255.6541 236.3066 218.1226 205.9746 203.1176 210.3171 225.6441 244.9917 263.1756 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 37.1494 37.1494 37.1494 37.1494 37.1494 37.1494 37.1494 37.1494 37.1494 37.1494 37.1494 37.1494 (69)

Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5) -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 (71)

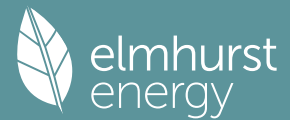
Water heating gains (Table 5) 152.4206 150.0319 145.5704 135.9812 130.0647 123.8980 120.1945 123.3828 127.1045 133.9460 143.1483 151.2094 (72)

Total internal gains 635.0617 650.4088 623.8689 603.5817 573.6887 550.9670 530.4865 530.8179 546.3680 566.9076 600.0864 621.7024 (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
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North	8.9700	10.6334	0.6300	0.7000	0.7700	29.1498 (74)
South	18.8500	46.7521	0.6300	0.7000	0.7700	269.3295 (78)
West	0.3500	19.6403	0.6300	0.7000	0.7700	2.1008 (80)

Solar gains	300.5802	500.9088	663.3009	796.9571	878.6686	868.4954	838.7396	776.8188	708.6260	546.9476	357.8269	258.7539 (83)
Total gains	935.6418	1151.3177	1287.1699	1400.5389	1452.3574	1419.4624	1369.2261	1307.6366	1254.9940	1113.8552	957.9133	880.4563 (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	32.9720	33.0706	33.1678	33.6321	33.7204	34.1377	34.1377	34.2162	33.9758	33.7204	33.5422	33.3579
alpha	3.1981	3.2047	3.2112	3.2421	3.2480	3.2758	3.2758	3.2811	3.2651	3.2480	3.2361	3.2239
util living area	0.9741	0.9510	0.9175	0.8521	0.7477	0.5946	0.4519	0.4876	0.6826	0.8733	0.9549	0.9783 (86)
MIT	18.9350	19.2887	19.7109	20.2147	20.6142	20.8714	20.9606	20.9488	20.7877	20.2625	19.5148	18.8821 (87)
Th 2	19.7963	19.7994	19.8025	19.8170	19.8197	19.8324	19.8324	19.8347	19.8275	19.8197	19.8142	19.8085 (88)
util rest of house	0.9684	0.9407	0.8998	0.8199	0.6921	0.5078	0.3414	0.3763	0.6016	0.8387	0.9436	0.9734 (89)
MIT 2	17.4349	17.8800	18.4060	19.0243	19.4803	19.7477	19.8161	19.8118	19.6730	19.0976	18.1800	17.3757 (90)
Living area fraction	17.9069	18.3233	18.8166	19.3989	19.8371	20.1013	20.1762	20.1696	20.0237	19.4642	18.6000	17.8497 (92)
MIT	17.9069	18.3233	18.8166	19.3989	19.8371	20.1013	20.1762	20.1696	20.0237	19.4642	18.6000	17.8497 (93)
Temperature adjustment												0.0000
adjusted MIT	17.9069	18.3233	18.8166	19.3989	19.8371	20.1013	20.1762	20.1696	20.0237	19.4642	18.6000	17.8497 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9557	0.9240	0.8818	0.8067	0.6930	0.5290	0.3751	0.4096	0.6164	0.8262	0.9281	0.9621 (94)
Useful gains	894.2234	1063.7979	1134.9695	1129.8714	1006.4873	750.9177	513.5697	535.6618	773.5699	920.2991	889.0289	847.1136 (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	2080.4931	2046.3022	1872.0939	1573.7696	1216.5520	812.4232	528.1324	555.4130	878.9807	1325.2525	1728.4584	2062.8963 (97)
Space heating kWh	882.5847	660.2429	548.4206	319.6067	156.2882	0.0000	0.0000	0.0000	0.0000	301.2853	604.3893	904.5423 (98a)
Space heating requirement - total per year (kWh/year)												4377.3599
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	882.5847	660.2429	548.4206	319.6067	156.2882	0.0000	0.0000	0.0000	0.0000	301.2853	604.3893	904.5423 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4377.3599
Space heating per m2										(98c) / (4) =		38.8546 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	882.5847	660.2429	548.4206	319.6067	156.2882	0.0000	0.0000	0.0000	0.0000	301.2853	604.3893	904.5423 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	956.2131	715.3227	594.1718	346.2694	169.3263	0.0000	0.0000	0.0000	0.0000	326.4197	654.8096	980.0025 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	258.6224	228.7668	243.2945	214.6817	208.5991	188.5164	186.5135	193.6477	195.4599	217.2838	230.2014	255.9121 (64)
Efficiency of water heater (217)m	86.5869	86.2955	85.8255	84.9503	83.4214	79.8000	79.8000	79.8000	79.8000	84.7930	86.1209	79.8000 (216)
Fuel for water heating, kWh/month	298.6852	265.0969	283.4759	252.7144	250.0547	236.2361	233.7261	242.6663	244.9372	256.2521	267.3002	295.3571 (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	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	28.8543	23.1480	20.8422	15.2699	11.7949	9.6365	10.7597	13.9859	18.1662	23.8351	26.9217	29.6562 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-51.5204	-71.5884	-101.4264	-112.3258	-119.6534	-111.0970	-109.6380	-104.1571	-94.3571	-80.9559	-56.2325	-44.6589 (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	-32.3927	-67.7348	-133.9108	-200.1300	-263.7130	-264.7037	-261.6671	-222.0389	-163.3422	-96.6292	-43.1635	-25.6536 (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												4742.5351 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												3126.5022 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	232.8705 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2832.6903 (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	5355.2174 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4742.5351	0.2100	995.9324 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3126.5022	0.2100	656.5655 (264)
Space and water heating			1652.4978 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	232.8705	0.1443	33.6104 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1057.6109	0.1349	-142.6862
PV Unit electricity exported	-1775.0794	0.1260	-223.7243
Total			-366.4105 (269)
Total CO2, kg/year			1331.6270 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.8200 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4742.5351	1.1300	5359.0646 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3126.5022	1.1300	3532.9475 (278)
Space and water heating			8892.0121 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	232.8705	1.5338	357.1845 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1057.6109	1.4986	-1584.9743
PV Unit electricity exported	-1775.0794	0.4626	-821.2323
Total			-2406.2066 (283)
Total Primary energy kWh/year			6973.0908 (286)
Target Primary Energy Rate (TPER)			61.9000 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

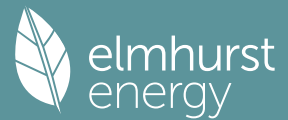
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	292.7200 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1366 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3866 (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) = 0.3866 (21)

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Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4930	0.4833	0.4736	0.4253	0.4156	0.3673	0.3673	0.3577	0.3866	0.4156	0.4350	0.4543 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.6215	0.6168	0.6122	0.5904	0.5864	0.5675	0.5675	0.5640	0.5747	0.5864	0.5946	0.6032 (23c)
												0.6032 (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	
Main dwelling								
Windows			32.5600	1.3258	43.1667			(27)
Heatloss Floor 1			57.3100	0.1200	6.8772	110.0000	6304.1000	(28a)
External Wall 1	221.3800	32.5600	188.8200	0.1800	33.9876	60.0000	11329.2000	(29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041	9.0000	515.7900	(30)
Total net area of external elements Aum(A, m2)			336.0000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	90.3356		(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18149.0900 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 161.0961 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	17.0400	0.0150	0.2556
E3 Sill	16.0100	0.0210	0.3362
E4 Jamb	35.4000	0.0160	0.5664
E5 Ground floor (normal)	32.1500	0.0900	2.8935
E6 Intermediate floor within a dwelling	31.0300	0.0020	0.0621
E10 Eaves (insulation at ceiling level)	19.6300	0.0650	1.2759
E12 Gable (insulation at ceiling level)	11.4000	0.0000	0.0000
E16 Corner (normal)	26.0000	0.0510	1.3260
E17 Corner (inverted - internal area greater than external area)	7.7000	-0.0910	-0.7007

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.0150 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 96.3506 (37)

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

(38)m	Jan 60.0367	Feb 59.5809	Mar 59.1342	Apr 57.0357	May 56.6431	Jun 54.8154	Jul 54.8154	Aug 54.4769	Sep 55.5194	Oct 56.6431	Nov 57.4373	Dec 58.2677 (38)
Heat transfer coeff	156.3873	155.9315	155.4847	153.3863	152.9936	151.1659	151.1659	150.8275	151.8699	152.9936	153.7879	154.6183 (39)
Average = Sum(39)m / 12 =												153.3844

HLP	Jan 1.3881	Feb 1.3841	Mar 1.3801	Apr 1.3615	May 1.3580	Jun 1.3418	Jul 1.3418	Aug 1.3388	Sep 1.3480	Oct 1.3580	Nov 1.3651	Dec 1.3724 (40)
HLP (average)												1.3615
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8299 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	30.9427	30.4831	29.8360	28.6428	27.7493	26.7587	26.2235	26.8661	27.5658	28.6259	29.8437	30.8381 (42b)
Hot water usage for other uses	43.6108	42.0250	40.4392	38.8533	37.2675	35.6816	35.6816	37.2675	38.8533	40.4392	42.0250	43.6108 (42c)
Average daily hot water use (litres/day)												68.3350 (43)

Daily hot water use	Jan 74.5535	Feb 72.5081	Mar 70.2751	Apr 67.4961	May 65.0168	Jun 62.4403	Jul 61.9051	Aug 64.1336	Sep 66.4191	Oct 69.0650	Nov 71.8687	Dec 74.4489 (44)
Energy conte	118.0745	103.2506	108.0103	92.3988	87.5251	76.7776	74.8689	79.4108	81.9014	93.7206	102.3901	116.5690 (45)
Energy content (annual)										Total = Sum(45)m =		1134.8977
Distribution loss (46)m = 0.15 x (45)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 (46)

Water storage loss (or HIU loss):

Total storage 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 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	100.3634	87.7630	91.8087	78.5390	74.3963	65.2609	63.6386	67.4992	69.6162	79.6625	87.0316	99.0836 (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 100.3634 87.7630 91.8087 78.5390 74.3963 65.2609 63.6386 67.4992 69.6162 79.6625 87.0316 99.0836 (64)

Total per year (kWh/year) = Sum(64)m = 964.6630 (64)

12Total per year (kWh/year) 965 (64)

Electric shower(s) 57.3939 51.1384 55.8412 53.2886 54.2885 51.7860 53.5122 54.2885 53.2886 55.8412 54.7911 57.3939 (64a)

Heat gains from water heating, kWh/month 39.4393 34.7254 36.9125 32.9569 32.1712 29.2617 29.2877 30.4469 30.7262 33.8759 35.4557 39.1194 (65)

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

Metabolic gains (Table 5), Watts	Jan 141.4942	Feb 141.4942	Mar 141.4942	Apr 141.4942	May 141.4942	Jun 141.4942	Jul 141.4942	Aug 141.4942	Sep 141.4942	Oct 141.4942	Nov 141.4942	Dec 141.4942 (66)
(66)m												
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	138.8692	153.7480	138.8692	143.4981	138.8692	143.4981	138.8692	138.8692	143.4981	138.8692	143.4981	138.8692 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.3236	278.1806	270.9811	255.6541	236.3066	218.1226	205.9746	203.1176	210.3171	225.6441	244.9917	263.1756 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494 (69)

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Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954 (71)
Water heating gains (Table 5)	53.0098	51.6746	49.6135	45.7734	43.2409	40.6413	39.3652	40.9233	42.6753	45.5322	49.2440	52.5798 (72)
Total internal gains	532.6509	549.0515	524.9121	510.3740	483.8649	467.7103	449.6572	448.3583	461.9388	475.4937	503.1821	520.0729 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					10.3700	10.6334		0.6300	0.7000	0.7700		33.6994 (74)
South					21.7900	46.7521		0.6300	0.7000	0.7700		311.3364 (78)
West					0.4000	19.6403		0.6300	0.7000	0.7700		2.4009 (80)
Solar gains	347.4367	578.9868	766.6762	921.1440	1015.5764	1003.8143	969.4237	897.8625	819.0581	632.1973	413.6060	299.0912 (83)
Total gains	880.0876	1128.0383	1291.5883	1431.5180	1499.4413	1471.5246	1419.0809	1346.2208	1280.9969	1107.6910	916.7881	819.1641 (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	32.2367	32.3309	32.4238	32.8674	32.9518	33.3502	33.3502	33.4250	33.1956	32.9518	32.7816	32.6056
alpha	3.1491	3.1554	3.1616	3.1912	3.1968	3.2233	3.2233	3.2283	3.2130	3.1968	3.1854	3.1737
util living area	0.9782	0.9542	0.9186	0.8494	0.7414	0.5872	0.4461	0.4841	0.6813	0.8778	0.9603	0.9823 (86)
MIT	18.8145	19.2081	19.6642	20.1960	20.6087	20.8696	20.9596	20.9468	20.7792	20.2220	19.4219	18.7535 (87)
Th 2	19.7724	19.7756	19.7786	19.7930	19.7957	19.8082	19.8082	19.8106	19.8034	19.7957	19.7902	19.7845 (88)
util rest of house	0.9733	0.9444	0.9010	0.8166	0.6846	0.4994	0.3346	0.3714	0.5991	0.8437	0.9501	0.9783 (89)
MIT 2	17.8212	18.2084	18.6518	19.1625	19.5291	19.7420	19.7955	19.7923	19.6789	19.2017	18.4339	17.7693 (90)
Living area fraction	18.1338	18.5229	18.9704	19.4877	19.8688	20.0968	20.1618	20.1556	20.0251	19.5228	18.7448	18.0790 (92)
MIT	18.1338	18.5229	18.9704	19.4877	19.8688	20.0968	20.1618	20.1556	20.0251	19.5228	18.7448	18.0790 (92)
Temperature adjustment	18.1338	18.5229	18.9704	19.4877	19.8688	20.0968	20.1618	20.1556	20.0251	19.5228	18.7448	18.0790 (93)
adjusted MIT	18.1338	18.5229	18.9704	19.4877	19.8688	20.0968	20.1618	20.1556	20.0251	19.5228	18.7448	18.0790 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9642	0.9314	0.8867	0.8070	0.6884	0.5219	0.3689	0.4055	0.6157	0.8344	0.9384	0.9704 (94)
Ext temp.	848.5986	1050.6643	1145.2429	1155.2828	1032.2216	767.9699	523.4694	545.8552	788.6570	924.2905	860.3401	794.8964 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	2163.4230	2124.2467	1938.9494	1624.0070	1249.7741	830.9268	538.4166	566.4426	899.8500	1365.1274	1790.8271	2145.9475 (97)
Space heating requirement - total per year (kWh/year)	978.2294	721.4474	590.5177	337.4815	161.8590	0.0000	0.0000	0.0000	0.0000	327.9826	669.9507	1005.1820 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98c)
Space heating kWh	978.2294	721.4474	590.5177	337.4815	161.8590	0.0000	0.0000	0.0000	0.0000	327.9826	669.9507	1005.1820 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	978.2294	721.4474	590.5177	337.4815	161.8590	0.0000	0.0000	0.0000	0.0000	327.9826	669.9507	1005.1820 (98c)
Space heating per m2	(98c) / (4) = 42.5408 (99)											

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1420.9599	1118.6280	1146.2888	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8194	0.8789	0.8585	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1164.3335	983.1901	984.0556	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1663.0442	1604.4185	1522.0060	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	359.0717	462.1939	400.2351	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) = 1.0000 (105)											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	89.7679	115.5485	100.0588	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	305.3752 (107)											
Energy for space heating	42.5408 (99)											
Energy for space cooling	2.7106 (108)											
Total	45.2514 (109)											
Fabric Energy Efficiency (DFEE)	45.3 (109)											

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	292.7200 (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	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1366 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3866 (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) = 0.3866 (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	0.4930	0.4833	0.4736	0.4253	0.4156	0.3673	0.3673	0.3577	0.3866	0.4156	0.4350	0.4543 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.6215	0.6168	0.6122	0.5904	0.5864	0.5675	0.5675	0.5640	0.5747	0.5864	0.5946	0.6032 (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
Main dwelling							
TER Opening Type			28.1700	1.1450	32.2557		(27)
Heatloss Floor 1			57.3100	0.1300	7.4503		(28a)
External Wall 1	221.3800	28.1700	193.2100	0.1800	34.7778		(29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041		(30)
Total net area of external elements Aum(A, m ²)			336.0000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.7879		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							161.0961 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				17.0400	0.0500	0.8520	
E3 Sill				16.0100	0.0500	0.8005	
E4 Jamb				35.4000	0.0500	1.7700	
E5 Ground floor (normal)				32.1500	0.1600	5.1440	
E6 Intermediate floor within a dwelling				31.0300	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)				19.6300	0.0600	1.1778	
E12 Gable (insulation at ceiling level)				11.4000	0.0600	0.6840	
E16 Corner (normal)				26.0000	0.0900	2.3400	
E17 Corner (inverted - internal area greater than external area)				7.7000	-0.0900	-0.6930	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.0753 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	92.8632 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	60.0367	59.5809	59.1342	57.0357	56.6431	54.8154	54.8154	54.4769	55.5194	56.6431	57.4373	58.2677 (38)
Heat transfer coeff	152.8999	152.4442	151.9974	149.8989	149.5063	147.6786	147.6786	147.3401	148.3826	149.5063	150.3005	151.1309 (39)
Average = Sum(39)m / 12 =												149.8970
HLP	1.3572	1.3531	1.3492	1.3305	1.3271	1.3108	1.3108	1.3078	1.3171	1.3271	1.3341	1.3415 (40)
HLP (average)												1.3305
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8299 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths												
30.9427	30.4831	29.8360	28.6428	27.7493	26.7587	26.2235	26.8661	27.5658	28.6259	29.8437	30.8381	(42b)
Hot water usage for other uses												
43.6108	42.0250	40.4392	38.8533	37.2675	35.6816	35.6816	37.2675	38.8533	40.4392	42.0250	43.6108	(42c)
Average daily hot water use (litres/day)												68.3350 (43)
Daily hot water use												
74.5535	72.5081	70.2751	67.4961	65.0168	62.4403	61.9051	64.1336	66.4191	69.0650	71.8687	74.4489	(44)
Energy conte	118.0745	103.2506	108.0103	92.3988	87.5251	76.7776	74.8689	79.4108	81.9014	93.7206	102.3901	116.5690 (45)
Energy content (annual)										Total = Sum(45)m =		1134.8977

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Distribution loss (46)m = 0.15 x (45)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 (46)
Water storage loss (or HIU loss):												
Total storage 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 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	100.3634	87.7630	91.8087	78.5390	74.3963	65.2609	63.6386	67.4992	69.6162	79.6625	87.0316	99.0836 (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	100.3634	87.7630	91.8087	78.5390	74.3963	65.2609	63.6386	67.4992	69.6162	79.6625	87.0316	99.0836 (64)
12Total per year (kWh/year)												964.6630 (64)
Electric shower(s)	57.3939	51.1384	55.8412	53.2886	54.2885	51.7860	53.5122	54.2885	53.2886	55.8412	54.7911	57.3939 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												652.8518 (64a)
Heat gains from water heating, kWh/month	39.4393	34.7254	36.9125	32.9569	32.1712	29.2617	29.2877	30.4469	30.7262	33.8759	35.4557	39.1194 (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	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942	141.4942 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	138.8692	153.7480	138.8692	143.4981	138.8692	143.4981	138.8692	138.8692	143.4981	138.8692	143.4981	138.8692 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.3236	278.1806	270.9811	255.6541	236.3066	218.1226	205.9746	203.1176	210.3171	225.6441	244.9917	263.1756 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494	37.1494 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954 (71)
Water heating gains (Table 5)	53.0098	51.6746	49.6135	45.7734	43.2409	40.6413	39.3652	40.9233	42.6753	45.5322	49.2440	52.5798 (72)
Total internal gains	532.6509	549.0515	524.9121	510.3740	483.8649	467.7103	449.6572	448.3583	461.9388	475.4937	503.1821	520.0729 (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	
North					8.9700	10.6334		0.6300	0.7000		0.7700	29.1498 (74)	
South					18.8500	46.7521		0.6300	0.7000		0.7700	269.3295 (78)	
West					0.3500	19.6403		0.6300	0.7000		0.7700	2.1008 (80)	
Solar gains	300.5802	500.9088	663.3009	796.9571	878.6686	868.4954	838.7396	776.8188	708.6260	546.9476	357.8269	258.7539 (83)	
Total gains	833.2311	1049.9604	1188.2130	1307.3311	1362.5335	1336.2057	1288.3967	1225.1771	1170.5648	1022.4413	861.0089	778.8267 (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	32.9720	33.0706	33.1678	33.6321	33.7204	34.1377	34.1377	34.2162	33.9758	33.7204	33.5422	33.3579
alpha	3.1981	3.2047	3.2112	3.2421	3.2480	3.2758	3.2758	3.2811	3.2651	3.2480	3.2361	3.2239
util living area	0.9811	0.9613	0.9315	0.8713	0.7723	0.6211	0.4763	0.5147	0.7120	0.8945	0.9658	0.9845 (86)
MIT	18.8169	19.1809	19.6176	20.1461	20.5716	20.8535	20.9540	20.9400	20.7582	20.1888	19.4096	18.7628 (87)
Th 2	19.7963	19.7994	19.8025	19.8170	19.8197	19.8324	19.8324	19.8347	19.8275	19.8197	19.8142	19.8085 (88)
util rest of house	0.9768	0.9528	0.9163	0.8419	0.7187	0.5334	0.3613	0.3994	0.6321	0.8639	0.9569	0.9810 (89)
MIT 2	17.8401	18.1996	18.6266	19.1388	19.5224	19.7561	19.8174	19.8134	19.6879	19.1924	18.4395	17.7951 (90)
Living area fraction	18.1475	18.5084	18.9385	19.4558	19.8526	20.1014	20.1750	20.1679	20.0247	19.5060	18.7448	18.0996 (91)
MIT	18.1475	18.5084	18.9385	19.4558	19.8526	20.1014	20.1750	20.1679	20.0247	19.5060	18.7448	18.0996 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1475	18.5084	18.9385	19.4558	19.8526	20.1014	20.1750	20.1679	20.0247	19.5060	18.7448	18.0996 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9686	0.9409	0.9026	0.8314	0.7204	0.5550	0.3965	0.4340	0.6469	0.8540	0.9462	0.9739 (94)
Useful gains	807.1075	987.9384	1072.5003	1086.9025	981.5300	741.5994	510.8136	531.7644	757.2344	873.1998	814.6665	758.5186 (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	2117.2768	2074.5153	1890.6150	1582.2958	1218.8600	812.4434	527.9555	555.1670	879.1182	1331.4997	1750.2133	2100.6645 (97)
Space heating kWh	974.7660	730.1797	608.6774	356.6832	176.5735	0.0000	0.0000	0.0000	0.0000	340.9751	673.5937	998.5566 (98a)
Space heating requirement - total per year (kWh/year)												4860.0051
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	974.7660	730.1797	608.6774	356.6832	176.5735	0.0000	0.0000	0.0000	0.0000	340.9751	673.5937	998.5566 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4860.0051
Space heating per m ²												43.1387 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1388.1787	1092.8215	1119.7849	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7961	0.8613	0.8394	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1105.0605	941.2412	939.9822	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1504.8793	1451.6708	1380.5264	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	287.8695	379.7596	327.7649	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	71.9674	94.9399	81.9412	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												248.8485 (107)
Energy for space heating												43.1387 (99)
Energy for space cooling												2.2088 (108)
Total												45.3475 (109)
Fabric Energy Efficiency (TFEE)												45.3 (109)

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)
Main dwelling			
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 292.7200 (5)

2. Ventilation rate

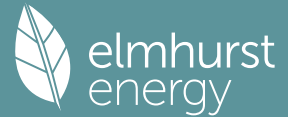
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1366 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3866 (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) = 0.3866 (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	0.4930	0.4833	0.4736	0.4253	0.4156	0.3673	0.3673	0.3577	0.3866	0.4156	0.4350	0.4543 (22b)
Effective ac	0.6215	0.6168	0.6122	0.5904	0.5864	0.5675	0.5675	0.5640	0.5747	0.5864	0.5946	0.6032 (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
Main dwelling							
Windows			32.5600	1.3258	43.1667		(27)
Heatloss Floor 1			57.3100	0.1200	6.8772	110.0000	6304.1000 (28a)
External Wall 1	221.3800	32.5600	188.8200	0.1800	33.9876	60.0000	11329.2000 (29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041	9.0000	515.7900 (30)
Total net area of external elements Aum(A, m ²)			336.0000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.3356		(33)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =			18149.0900 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K						161.0961 (35)	
List of Thermal Bridges							
K1 Element			Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)			17.0400	0.0150	0.2556		
E3 Sill			16.0100	0.0210	0.3362		
E4 Jamb			35.4000	0.0160	0.5664		
E5 Ground floor (normal)			32.1500	0.0900	2.8935		
E6 Intermediate floor within a dwelling			31.0300	0.0020	0.0621		
E10 Eaves (insulation at ceiling level)			19.6300	0.0650	1.2759		
E12 Gable (insulation at ceiling level)			11.4000	0.0000	0.0000		

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E16 Corner (normal) 26.0000 0.0510 1.3260
E17 Corner (inverted - internal area greater than external area) 7.7000 -0.0910 -0.7007
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.0150 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 96.3506 (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 60.0367 59.5809 59.1342 57.0357 56.6431 54.8154 54.8154 54.4769 55.5194 56.6431 57.4373 58.2677 (38)
Average = Sum(39)m / 12 = 156.3873 155.9315 155.4847 153.3863 152.9936 151.1659 151.1659 150.8275 151.8699 152.9936 153.7879 154.6183 (39)
153.3844
HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
HLP (average) 1.3881 1.3841 1.3801 1.3615 1.3580 1.3418 1.3418 1.3388 1.3480 1.3580 1.3651 1.3724 (40)
Days in month 31 28 31 30 31 30 31 31 30 31 30 31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8299 (42)
Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)
Hot water usage for baths 87.0181 85.7258 83.9059 80.5503 78.0377 75.2517 73.7468 75.5539 77.5216 80.5028 83.9274 86.7239 (42b)
Hot water usage for other uses 45.9062 44.2368 42.5675 40.8982 39.2289 37.5596 37.5596 39.2289 40.8982 42.5675 44.2368 45.9062 (42c)
Average daily hot water use (litres/day) 122.4124 (43)
Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Energy content 132.9243 129.9626 126.4734 121.4486 117.2666 112.8113 111.3064 114.7828 118.4198 123.0703 128.1643 132.6301 (44)
Energy content (annual) 210.5196 185.0650 194.3849 166.2570 157.8634 138.7146 134.6154 142.1251 146.0235 167.0053 182.5935 207.6667 (45)
Distribution loss (46)m = 0.15 x (45)m 31.5779 27.7598 29.1577 24.9385 23.6795 20.8072 20.1923 21.3188 21.9035 25.0508 27.3890 31.1500 (46)
Water storage loss (or HIU loss): 300.0000 (47)
Store volume 2.2500 (48)
a) If manufacturer declared loss factor is known (kWh/day): 0.7800 (49)
Temperature factor from Table 2b 1.7550 (55)
Enter (49) or (54) in (55)
Total storage loss 54.4050 49.1400 54.4050 52.6500 54.4050 52.6500 54.4050 54.4050 52.6500 54.4050 52.6500 54.4050 (56)
If cylinder contains dedicated solar storage 54.4050 49.1400 54.4050 52.6500 54.4050 52.6500 54.4050 54.4050 52.6500 54.4050 52.6500 54.4050 (57)
Primary loss 54.8576 49.5488 54.8576 53.0880 54.8576 22.5120 23.2624 23.2624 22.5120 54.8576 53.0880 54.8576 (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 319.7822 283.7538 303.6475 271.9950 267.1260 213.8766 212.2828 219.7925 221.1855 276.2679 288.3315 316.9293 (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 319.7822 283.7538 303.6475 271.9950 267.1260 213.8766 212.2828 219.7925 221.1855 276.2679 288.3315 316.9293 (64)
Total per year (kWh/year) = Sum(64)m = 3194.9706 (64)
Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month 113.8838 101.1732 108.5191 97.7509 96.3757 64.1322 63.3695 65.8665 66.5624 99.4153 103.1827 112.9352 (65)

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

Metabolic gains (Table 5), Watts (66)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 39.2289 34.8428 28.3361 21.4522 16.0358 13.5381 14.6284 19.0145 25.5212 32.4051 37.8215 40.3192 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 410.9308 415.1950 404.4494 381.5733 352.6964 325.5561 307.4248 303.1606 313.9062 336.7823 365.6592 392.7995 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 54.8092 54.8092 54.8092 54.8092 54.8092 54.8092 54.8092 54.8092 54.8092 54.8092 54.8092 54.8092 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5) -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 -113.1954 (71)
Water heating gains (Table 5) 153.0697 150.5553 145.8590 135.7651 129.5372 89.0725 85.1741 88.5303 92.4478 133.6228 143.3094 151.7947 (72)
Total internal gains 714.6363 712.0000 690.0513 650.1975 609.6762 539.5736 518.6341 522.1123 543.2821 614.2170 658.1970 696.3202 (73)

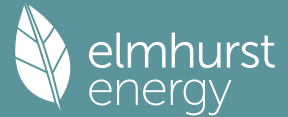
6. Solar gains

[Jan] Area m2 Solar flux W/m2 g Specific data or Table 6b FF Specific data or Table 6c Access factor Table 6d Gains W
North 10.3700 10.6334 0.6300 0.7700 33.6994 (74)
South 21.7900 46.7521 0.6300 0.7700 311.3364 (78)
West 0.4000 19.6403 0.6300 0.7700 2.4009 (80)
Solar gains 347.4367 578.9868 766.6762 921.1440 1015.5764 1003.8143 969.4237 897.8625 819.0581 632.1973 413.6060 299.0912 (83)
Total gains 1062.0730 1290.9867 1456.7275 1571.3415 1625.2527 1543.3879 1488.0578 1419.9748 1362.3402 1246.4142 1071.8030 995.4114 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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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	32.2367	32.3309	32.4238	32.8674	32.9518	33.3502	33.3502	33.4250	33.1956	32.9518	32.7816	32.6056
alpha	3.1491	3.1554	3.1616	3.1912	3.1968	3.2233	3.2233	3.2283	3.2130	3.1968	3.1854	3.1737
util living area	0.9643	0.9364	0.8938	0.8205	0.7089	0.5665	0.4279	0.4626	0.6550	0.8452	0.9414	0.9701 (86)
Living	19.4161	19.6828	20.0093	20.3697	20.6485	20.8165	20.8777	20.8697	20.7572	20.3968	19.8410	19.3695
Non living	17.9609	18.2949	18.6983	19.1391	19.4523	19.6290	19.6750	19.6731	19.5757	19.1849	18.5094	17.9112
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1897	19.6828	20.0093	20.3697	20.6485	20.8165	20.8777	20.8697	20.7572	20.3968	19.8410	19.5976 (87)
Th 2	19.7724	19.7756	19.7786	19.7930	19.7957	19.8082	19.8082	19.8106	19.8034	19.7957	19.7902	19.7845 (88)
util rest of house	0.9566	0.9235	0.8723	0.7842	0.6503	0.4798	0.3199	0.3534	0.5723	0.8056	0.9273	0.9636 (89)
MIT 2	19.0502	18.2949	18.6983	19.1391	19.4523	19.6290	19.6750	19.6731	19.5757	19.1849	18.5094	18.2487 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.4088	18.7316	19.1108	19.5264	19.8287	20.0027	20.0535	20.0496	19.9475	19.5663	18.9284	0.3147 (91)
Temperature adjustment												18.6732 (92)
adjusted MIT	19.4088	18.7316	19.1108	19.5264	19.8287	20.0027	20.0535	20.0496	19.9475	19.5663	18.9284	0.0000 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9540	0.9098	0.8584	0.7751	0.6520	0.4948	0.3429	0.3763	0.5832	0.7969	0.9145	0.9561 (94)
Useful gains	1013.1705	1174.5657	1250.4842	1218.0245	1059.6878	763.6645	510.3253	534.3564	794.4554	993.2164	980.1412	951.6702 (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	2362.8223	2156.7881	1960.7924	1629.9363	1243.6412	816.6980	522.0466	550.4656	888.0593	1371.7798	1819.0642	2237.8158 (97)
Space heating kWh	1004.1409	660.0534	528.4693	296.5765	136.8613	0.0000	0.0000	0.0000	0.0000	281.6512	604.0245	956.8923 (98a)
Space heating requirement - total per year (kWh/year)												4468.6694
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	1004.1409	660.0534	528.4693	296.5765	136.8613	0.0000	0.0000	0.0000	0.0000	281.6512	604.0245	956.8923 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4468.6694
Space heating per m2										(98c) / (4) =		39.6651 (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 %)												239.5939 (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	1004.1409	660.0534	528.4693	296.5765	136.8613	0.0000	0.0000	0.0000	0.0000	281.6512	604.0245	956.8923 (98)
Space heating efficiency (main heating system 1)	239.5939	239.5939	239.5939	239.5939	239.5939	0.0000	0.0000	0.0000	0.0000	239.5939	239.5939	239.5939 (210)
Space heating fuel (main heating system)	419.1012	275.4884	220.5688	123.7830	57.1222	0.0000	0.0000	0.0000	0.0000	117.5536	252.1035	399.3809 (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	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293 (64)
Efficiency of water heater	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044 (216)
Fuel for water heating, kWh/month	185.9151	164.9690	176.5348	158.1326	155.3019	124.3437	123.4171	127.7831	128.5929	160.6168	167.6303	184.2565 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.3368	27.5463	24.8024	18.1713	14.0360	11.4676	12.8041	16.6433	21.6180	28.3640	32.0370	35.2912 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)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 (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	0.0000	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												1865.1016 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												172.0044
Water heating fuel used												1857.4938 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												277.1180 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)

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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	3999.7134 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1865.1016	16.4900	307.5553	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1857.4938	16.4900	306.3007	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	277.1180	16.4900	45.6968	(250)
Additional standing charges			0.0000	(251)
Total energy cost			659.5527	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 1.5060 (257)
SAP value	75.5874
SAP rating (Section 12)	76 (258)
SAP band	C

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	1865.1016	0.1558	290.5338	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1857.4938	0.1414	262.6323	(264)
Space and water heating			553.1661	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	277.1180	0.1443	39.9967	(268)
Total CO2, kg/year			593.1628	(272)
CO2 emissions per m2			5.2700	(273)
EI value			94.9585	
EI rating			95	(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)	
Main dwelling				
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)	
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	292.7200 (5)	

2. Ventilation rate

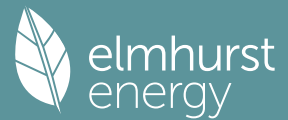
	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1366 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3866 (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) =		0.3866 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate												

[illegible]

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Water heating gains (Table 5)	153.0697	150.5553	145.8590	135.7651	129.5372	89.0725	85.1741	88.5303	92.4478	133.6228	143.3094	151.7947 (72)
Total internal gains	714.6363	712.0000	690.0513	650.1975	609.6762	539.5736	518.6341	522.1123	543.2821	614.2170	658.1970	696.3202 (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

North					10.3700	13.8645	0.6300	0.7000	0.7700				43.9396 (74)
South					21.7900	58.2505	0.6300	0.7000	0.7700				387.9081 (78)
West					0.4000	25.9136	0.6300	0.7000	0.7700				3.1678 (80)

Solar gains	435.0155	618.7242	816.1236	1006.1801	1069.4450	1149.1284	1081.0816	1014.5185	926.6183	714.4945	512.8638	357.8020 (83)	
Total gains	1149.6518	1330.7241	1506.1749	1656.3776	1679.1213	1688.7020	1599.7157	1536.6308	1469.9004	1328.7115	1171.0607	1054.1222 (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	32.2367	32.6056	32.6943	32.9518	32.9518	33.1956	33.1956	33.2737	33.1956	32.7816	32.8674	32.6056
alpha	3.1491	3.1737	3.1796	3.1968	3.1968	3.2130	3.2130	3.2182	3.2130	3.1854	3.1912	3.1737
util living area	0.9483	0.9225	0.8707	0.7810	0.6521	0.4744	0.3433	0.3557	0.5614	0.7844	0.9092	0.9573 (86)
Living	19.6390	19.8337	20.1497	20.4790	20.7245	20.8577	20.8922	20.8911	20.8230	20.5527	20.0859	19.5992
Non living	18.2410	18.4889	18.8747	19.2647	19.5289	19.6551	19.6771	19.6794	19.6311	19.3545	18.8123	18.2015
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	20.3038	19.8337	20.1497	20.4790	20.7245	20.8577	20.8922	20.8911	20.8230	20.5527	20.0859	19.7952 (87)
Th 2	19.7724	19.7845	19.7874	19.7957	19.7957	19.8034	19.8034	19.8059	19.8034	19.7902	19.7930	19.7845 (88)
util rest of house	0.9369	0.9066	0.8446	0.7384	0.5851	0.3836	0.2359	0.2450	0.4685	0.7305	0.8869	0.9476 (89)
MIT 2	19.1619	18.4889	18.8747	19.2647	19.5289	19.6551	19.6771	19.6794	19.6311	19.3545	18.8123	18.4867 (90)
Living area fraction	FLA = Living area / (4) =											0.3147 (91)
MIT	19.5212	18.9121	19.2759	19.6468	19.9051	20.0335	20.0594	20.0607	20.0061	19.7316	19.2130	18.8984 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5212	18.9121	19.2759	19.6468	19.9051	20.0335	20.0594	20.0607	20.0061	19.7316	19.2130	18.8984 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9343	0.8926	0.8318	0.7325	0.5916	0.4017	0.2593	0.2692	0.4852	0.7276	0.8739	0.9388 (94)
Useful gains	1074.0680	1187.8135	1252.8261	1213.3324	993.4037	678.4096	414.8824	413.6367	713.2200	966.7404	1023.3501	989.6206 (95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000 (96)
Heat loss rate W	2208.3777	2042.8279	1846.6663	1537.0911	1117.6338	703.6890	419.0774	418.2779	760.2810	1219.7787	1658.5695	2071.6449 (97)
Space heating kWh	843.9264	574.5697	441.8171	233.1063	92.4272	0.0000	0.0000	0.0000	0.0000	188.2605	457.3579	805.0261 (98a)
Space heating requirement - total per year (kWh/year)												3636.4912
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	843.9264	574.5697	441.8171	233.1063	92.4272	0.0000	0.0000	0.0000	0.0000	188.2605	457.3579	805.0261 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3636.4912
Space heating per m2												(98c) / (4) = 32.2785 (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 %)												239.5784 (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	843.9264	574.5697	441.8171	233.1063	92.4272	0.0000	0.0000	0.0000	0.0000	188.2605	457.3579	805.0261 (98)
Space heating efficiency (main heating system 1)	239.5784	239.5784	239.5784	239.5784	239.5784	0.0000	0.0000	0.0000	0.0000	239.5784	239.5784	239.5784 (210)
Space heating fuel (main heating system)	352.2548	239.8254	184.4144	97.2986	38.5791	0.0000	0.0000	0.0000	0.0000	78.5799	190.9012	336.0179 (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	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293 (64)
Efficiency of water heater (217)m	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015 (216)
Fuel for water heating, kWh/month	185.9182	164.9717	176.5377	158.1352	155.3045	124.3458	123.4192	127.7852	128.5951	160.6194	167.6331	184.2596 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.3368	27.5463	24.8024	18.1713	14.0360	11.4676	12.8041	16.6433	21.6180	28.3640	32.0370	35.2912 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)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 (233a)

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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													1517.8713	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													172.0015	
Water heating fuel used													1857.5248	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													277.1180	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(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													3652.5141	(238)

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1517.8713	28.4300	431.5308	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1857.5248	28.4300	528.0943	(247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	277.1180	28.4300	78.7846	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1038.4098	(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	1517.8713	0.1563	237.2950	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1857.5248	0.1414	262.6367	(264)
Space and water heating			499.9317	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	277.1180	0.1443	39.9967	(268)
Total CO2, kg/year			539.9284	(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	1517.8713	1.5787	2396.3308	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1857.5248	1.5228	2828.7313	(278)
Space and water heating			5225.0621	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	277.1180	1.5338	425.0528	(282)
Total Primary energy kWh/year			5650.1149	(286)

SAP 10 EPC IMPROVEMENTS

Before PV

Current energy efficiency rating: C 76
Current environmental impact rating: A 95

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.8	-£ 108	-48 kg (8.9%)
U Solar photovoltaic panels	+ 5.6	-£ 285	-135 kg (27.5%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£108	0.42 kg/m²	C 77 A 95
Solar photovoltaic panels	£285	1.20 kg/m²	B 83 A 96
Total Savings	£393	1.63 kg/m²	

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Potential energy efficiency rating:
Potential environmental impact rating:

B 83

A 96

Fuel prices for cost data on this page from database revision number 589 TEST (12 Dec 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

Electricity	Current £1038	Potential £931	Saving £108
Space heating	£432	£454	-£23
Water heating	£528	£397	£131
Lighting	£79	£79	£0
Generated (PV)	-£10	-£285	£285
Total cost of fuels	£1038	£646	£393
Total cost of uses	£1039	£645	£393
Delivered energy	32 kWh/m ²	20 kWh/m ²	12 kWh/m ²
Carbon dioxide emissions	0.5 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m ²	5 kg/m ²	3 kg/m ²	2 kg/m ²
Primary energy	50 kWh/m ²	32 kWh/m ²	18 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)
Main dwelling			
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	292.7200 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1366 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3866	(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) =	0.3866 (21)

Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4930	0.4833	0.4736	0.4253	0.4156	0.3673	0.3673	0.3577	0.3866	0.4156	0.4350	0.4543	(22b)
Effective ac	0.6215	0.6168	0.6122	0.5904	0.5864	0.5675	0.5675	0.5640	0.5747	0.5864	0.5946	0.6032	(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
Main dwelling							
Windows			32.5600	1.3258	43.1667		(27)
Heatloss Floor 1			57.3100	0.1200	6.8772	110.0000	6304.1000 (28a)
External Wall 1	221.3800	32.5600	188.8200	0.1800	33.9876	60.0000	11329.2000 (29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041	9.0000	515.7900 (30)
Total net area of external elements Aum(A, m ²)			336.0000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.3356		(33)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =			18149.0900 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K						161.0961 (35)	
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				17.0400	0.0150		0.2556
E3 Sill				16.0100	0.0210		0.3362
E4 Jamb				35.4000	0.0160		0.5664
E5 Ground floor (normal)				32.1500	0.0900		2.8935
E6 Intermediate floor within a dwelling				31.0300	0.0020		0.0621
E10 Eaves (insulation at ceiling level)				19.6300	0.0650		1.2759
E12 Gable (insulation at ceiling level)				11.4000	0.0000		0.0000
E16 Corner (normal)				26.0000	0.0510		1.3260

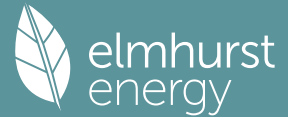
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	60.0367	59.5809	59.1342	57.0357	56.6431	54.8154	54.8154	54.4769	55.5194	56.6431	57.4373	58.2677 (38)
Heat transfer coeff	156.3873	155.9315	155.4847	153.3863	152.9936	151.1659	151.1659	150.8275	151.8699	152.9936	153.7879	154.6183 (39)
Average = Sum(39)m / 12 =												153.3844
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.3881	1.3841	1.3801	1.3615	1.3580	1.3418	1.3418	1.3388	1.3480	1.3580	1.3651	1.3724 (40)
HLP (average)												1.3615
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

Assumed occupancy												2.8299 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	87.0181	85.7258	83.9059	80.5503	78.0377	75.2517	73.7468	75.5539	77.5216	80.5028	83.9274	86.7239 (42b)
Hot water usage for other uses	45.9062	44.2368	42.5675	40.8982	39.2289	37.5596	37.5596	39.2289	40.8982	42.5675	44.2368	45.9062 (42c)
Average daily hot water use (litres/day)												122.4124 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	132.9243	129.9626	126.4734	121.4486	117.2666	112.8113	111.3064	114.7828	118.4198	123.0703	128.1643	132.6301 (44)
Energy content (annual)	210.5196	185.0650	194.3849	166.2570	157.8634	138.7146	134.6154	142.1251	146.0235	167.0053	182.5935	207.6667 (45)
Distribution loss (46)m = 0.15 x (45)m	31.5779	27.7598	29.1577	24.9385	23.6795	20.8072	20.1923	21.3188	21.9035	25.0508	27.3890	31.1500 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.7550 (55)
Total storage loss	54.4050	49.1400	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050	52.6500	54.4050	52.6500	54.4050 (56)
If cylinder contains dedicated solar storage	54.4050	49.1400	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050	52.6500	54.4050	52.6500	54.4050 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												647.1942 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												647.1942
Solar input	-0.0000	-16.1758	-59.5551	-83.5129	-111.8742	-100.8559	-100.5448	-86.9225	-58.8704	-28.8826	-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	319.7822	267.5780	244.0924	188.4821	155.2518	113.0207	111.7380	132.8701	162.3151	247.3853	288.3315	316.9293 (64)
												Total per year (kWh/year) = Sum(64)m = 2547.7764 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	113.8838	101.1732	108.5191	97.7509	96.3757	64.1322	63.3695	65.8665	66.5624	99.4153	103.1827	112.9352 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.2289	34.8428	28.3361	21.4522	16.0358	13.5381	14.6284	19.0145	25.5212	32.4051	37.8215	40.3192 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9308	415.1950	404.4494	381.5733	352.6964	325.5561	307.4248	303.1606	313.9062	336.7823	365.6592	392.7995 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954 (71)
Water heating gains (Table 5)	153.0697	150.5553	145.8590	135.7651	129.5372	89.0725	85.1741	88.5303	92.4478	133.6228	143.3094	151.7947 (72)
Total internal gains	714.6363	712.0000	690.0513	650.1975	609.6762	539.5736	518.6341	522.1123	543.2821	614.2170	658.1970	696.3202 (73)

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	

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North	10.3700	10.6334	0.6300	0.7000	0.7700	33.6994 (74)
South	21.7900	46.7521	0.6300	0.7000	0.7700	311.3364 (78)
West	0.4000	19.6403	0.6300	0.7000	0.7700	2.4009 (80)

Solar gains	347.4367	578.9868	766.6762	921.1440	1015.5764	1003.8143	969.4237	897.8625	819.0581	632.1973	413.6060	299.0912 (83)
Total gains	1062.0730	1290.9867	1456.7275	1571.3415	1625.2527	1543.3879	1488.0578	1419.9748	1362.3402	1246.4142	1071.8030	995.4114 (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	32.2367	32.3309	32.4238	32.8674	32.9518	33.3502	33.3502	33.4250	33.1956	32.9518	32.7816	32.6056
alpha	3.1491	3.1554	3.1616	3.1912	3.1968	3.2233	3.2233	3.2283	3.2130	3.1968	3.1854	3.1737
util living area	0.9643	0.9364	0.8938	0.8205	0.7089	0.5665	0.4279	0.4626	0.6550	0.8452	0.9414	0.9701 (86)
Living	19.4161	19.6828	20.0093	20.3697	20.6485	20.8165	20.8777	20.8697	20.7572	20.3968	19.8410	19.3695
Non living	17.9609	18.2949	18.6983	19.1391	19.4523	19.6290	19.6750	19.6731	19.5757	19.1849	18.5094	17.9112
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1897	19.6828	20.0093	20.3697	20.6485	20.8165	20.8777	20.8697	20.7572	20.3968	19.8410	19.5976 (87)
Th 2	19.7724	19.7756	19.7786	19.7930	19.7957	19.8082	19.8082	19.8106	19.8034	19.7957	19.7902	19.7845 (88)
util rest of house	0.9566	0.9235	0.8723	0.7842	0.6503	0.4798	0.3199	0.3534	0.5723	0.8056	0.9273	0.9636 (89)
MIT 2	19.0502	18.2949	18.6983	19.1391	19.4523	19.6290	19.6750	19.6731	19.5757	19.1849	18.5094	18.2487 (90)
Living area fraction	19.4088	18.7316	19.1108	19.5264	19.8287	20.0027	20.0535	20.0496	fLA = Living area / (4) =	19.5663	18.9284	0.3147 (91)
MIT	19.4088	18.7316	19.1108	19.5264	19.8287	20.0027	20.0535	20.0496	19.9475	19.5663	18.9284	18.6732 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4088	18.7316	19.1108	19.5264	19.8287	20.0027	20.0535	20.0496	19.9475	19.5663	18.9284	18.6732 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9540	0.9098	0.8584	0.7751	0.6520	0.4948	0.3429	0.3763	0.5832	0.7969	0.9145	0.9561 (94)
Useful gains	1013.1705	1174.5657	1250.4842	1218.0245	1059.6878	763.6645	510.3253	534.3564	794.4554	993.2164	980.1412	951.6702 (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	2362.8223	2156.7881	1960.7924	1629.9363	1243.6412	816.6980	522.0466	550.4656	888.0593	1371.7798	1819.0642	2237.8158 (97)
Space heating kWh	1004.1409	660.0534	528.4693	296.5765	136.8613	0.0000	0.0000	0.0000	0.0000	281.6512	604.0245	956.8923 (98a)
Space heating requirement - total per year (kWh/year)												4468.6694
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	1004.1409	660.0534	528.4693	296.5765	136.8613	0.0000	0.0000	0.0000	0.0000	281.6512	604.0245	956.8923 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4468.6694
Space heating per m2										(98c) / (4) =		39.6651 (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 %)													239.5939 (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	1004.1409	660.0534	528.4693	296.5765	136.8613	0.0000	0.0000	0.0000	0.0000	281.6512	604.0245	956.8923	(98)
Space heating efficiency (main heating system 1)	239.5939	239.5939	239.5939	239.5939	239.5939	0.0000	0.0000	0.0000	0.0000	239.5939	239.5939	239.5939	(210)
Space heating fuel (main heating system)	419.1012	275.4884	220.5688	123.7830	57.1222	0.0000	0.0000	0.0000	0.0000	117.5536	252.1035	399.3809	(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	319.7822	267.5780	244.0924	188.4821	155.2518	113.0207	111.7380	132.8701	162.3151	247.3853	288.3315	316.9293	(64)
Efficiency of water heater	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	172.0044	(216)
Fuel for water heating, kWh/month	185.9151	155.5647	141.9106	109.5798	90.2604	65.7080	64.9623	77.2481	94.3668	143.8250	167.6303	184.2565	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	34.3368	27.5463	24.8024	18.1713	14.0360	11.4676	12.8041	16.6433	21.6180	28.3640	32.0370	35.2912	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.9595	-59.9452	-90.6952	-104.9532	-112.5732	-99.0851	-97.7974	-91.8234	-80.4681	-68.9257	-44.7582	-33.9742	(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	0.0000	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)

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Annual totals kWh/year		
Space heating fuel - main system 1	1865.1016	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	172.0044	
Water heating fuel used	1481.2277	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	80.0000	(231)
Electricity for lighting (calculated in Appendix L)	277.1180	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-924.9583	(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	2778.4890	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1865.1016	16.4900	307.5553	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1481.2277	16.4900	244.2544	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	277.1180	16.4900	45.6968	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-924.9583	16.4900	-152.5256	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-152.5256	(252)
Total energy cost			458.1728	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0462	(257)
SAP value		83.0413	
SAP rating (Section 12)		83	(258)
SAP band		B	

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	1865.1016	0.1558	290.5338	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1481.2277	0.1449	214.6576	(264)
Space and water heating			505.1914	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	277.1180	0.1443	39.9967	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-924.9583	0.1345	-124.3662	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-124.3662	(269)
Total CO2, kg/year			431.9189	(272)
CO2 emissions per m2			3.8300	(273)
EI value			96.3290	
EI rating			96	(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

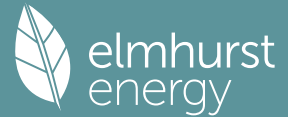
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	57.3100 (1b)	x 2.5000 (2b)	= 143.2750 (1b) - (3b)	
First floor	55.3500 (1c)	x 2.7000 (2c)	= 149.4450 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6600		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	292.7200 (5)	

2. Ventilation rate

m3 per hour

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Number of open chimneys 0 * 80 = 0.0000 (6a)
Number of open flues 0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire 0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler 0 * 20 = 0.0000 (6d)
Number of flues attached to other heater 0 * 35 = 0.0000 (6e)
Number of blocked chimneys 0 * 20 = 0.0000 (6f)
Number of intermittent extract fans 4 * 10 = 40.0000 (7a)
Number of passive vents 0 * 10 = 0.0000 (7b)
Number of flueless gas fires 0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1366 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3866 (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) = 0.3866 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4930	0.4543	0.4446	0.4156	0.4156	0.3866	0.3866	0.3770	0.3866	0.4350	0.4253	0.4543 (22b)
	0.6215	0.6032	0.5989	0.5864	0.5864	0.5747	0.5747	0.5711	0.5747	0.5946	0.5904	0.6032 (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
Main dwelling							
Windows			32.5600	1.3258	43.1667		(27)
Heatloss Floor 1			57.3100	0.1200	6.8772	110.0000	6304.1000 (28a)
External Wall 1	221.3800	32.5600	188.8200	0.1800	33.9876	60.0000	11329.2000 (29a)
External Roof 1	57.3100		57.3100	0.1100	6.3041	9.0000	515.7900 (30)
Total net area of external elements Aum(A, m2)			336.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 90.3356		(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18149.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 161.0961 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	17.0400	0.0150	0.2556
E3 Sill	16.0100	0.0210	0.3362
E4 Jamb	35.4000	0.0160	0.5664
E5 Ground floor (normal)	32.1500	0.0900	2.8935
E6 Intermediate floor within a dwelling	31.0300	0.0020	0.0621
E10 Eaves (insulation at ceiling level)	19.6300	0.0650	1.2759
E12 Gable (insulation at ceiling level)	11.4000	0.0000	0.0000
E16 Corner (normal)	26.0000	0.0510	1.3260
E17 Corner (inverted - internal area greater than external area)	7.7000	-0.0910	-0.7007

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.0150 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 96.3506 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	60.0367	58.2677	57.8480	56.6431	56.6431	55.5194	55.5194	55.1628	55.5194	57.4373	57.0357	58.2677 (38)
Heat transfer coeff	156.3873	154.6183	154.1986	152.9936	152.9936	151.8699	151.8699	151.5134	151.8699	153.7879	153.3863	154.6183 (39)
Average = Sum(39)m / 12 =												153.3423

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3881	1.3724	1.3687	1.3580	1.3580	1.3480	1.3480	1.3449	1.3480	1.3651	1.3615	1.3724 (40)
HLP (average)												1.3611
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8299 (42)
Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)
Hot water usage for baths 87.0181 85.7258 83.9059 80.5503 78.0377 75.2517 73.7468 75.5539 77.5216 80.5028 83.9274 86.7239 (42b)
Hot water usage for other uses 45.9062 44.2368 42.5675 40.8982 39.2289 37.5596 37.5596 39.2289 40.8982 42.5675 44.2368 45.9062 (42c)
Average daily hot water use (litres/day) 122.4124 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	132.9243	129.9626	126.4734	121.4486	117.2666	112.8113	111.3064	114.7828	118.4198	123.0703	128.1643	132.6301 (44)
Energy conte	210.5196	185.0650	194.3849	166.2570	157.8634	138.7146	134.6154	142.1251	146.0235	167.0053	182.5935	207.6667 (45)
Energy content (annual)										Total = Sum(45)m =		2032.8340
Distribution loss (46)m = 0.15 x (45)m	31.5779	27.7598	29.1577	24.9385	23.6795	20.8072	20.1923	21.3188	21.9035	25.0508	27.3890	31.1500 (46)
Water storage loss (or HIU loss):												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.7550 (55)
Total storage loss	54.4050	49.1400	54.4050	52.6500	54.4050	52.6500	54.4050	54.4050	52.6500	54.4050	52.6500	54.4050 (56)
If cylinder contains dedicated solar storage												
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	52.5120	54.8576	54.8576	52.5120	54.8576	53.0880	54.8576 (57)
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	319.7822	283.7538	303.6475	271.9950	267.1260	213.8766	212.2828	219.7925	221.1855	276.2679	288.3315	316.9293 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)

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Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												790.3795	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												790.3795	
Solar input	-4.8751	-23.1493	-70.4691	-98.2526	-122.5858	-120.1535	-116.7204	-105.1334	-75.4881	-43.2471	-10.3051	-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	314.9070	260.6045	233.1784	173.7424	144.5403	93.7231	95.5624	114.6591	145.6974	233.0208	278.0264	316.9293	(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)
Heat gains from water heating, kWh/month	113.8838	101.1732	108.5191	97.7509	96.3757	64.1322	63.3695	65.8665	66.5624	99.4153	103.1827	112.9352	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	169.7931	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	39.2289	34.8428	28.3361	21.4522	16.0358	13.5381	14.6284	19.0145	25.5212	32.4051	37.8215	40.3192	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.9308	415.1950	404.4494	381.5733	352.6964	325.5561	307.4248	303.1606	313.9062	336.7823	365.6592	392.7995	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	54.8092	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	-113.1954	(71)
Water heating gains (Table 5)													
	153.0697	150.5553	145.8590	135.7651	129.5372	89.0725	85.1741	88.5303	92.4478	133.6228	143.3094	151.7947	(72)
Total internal gains													
	714.6363	712.0000	690.0513	650.1975	609.6762	539.5736	518.6341	522.1123	543.2821	614.2170	658.1970	696.3202	(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
North					10.3700	13.8645	0.6300	0.7000	0.7700			43.9396 (74)
South					21.7900	58.2505	0.6300	0.7000	0.7700			387.9081 (78)
West					0.4000	25.9136	0.6300	0.7000	0.7700			3.1678 (80)
Solar gains	435.0155	618.7242	816.1236	1006.1801	1069.4450	1149.1284	1081.0816	1014.5185	926.6183	714.4945	512.8638	357.8020 (83)
Total gains	1149.6518	1330.7241	1506.1749	1656.3776	1679.1213	1688.7020	1599.7157	1536.6308	1469.9004	1328.7115	1171.0607	1054.1222 (84)

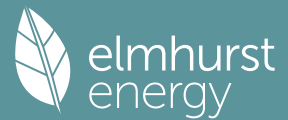
7. Mean internal temperature (heating season)

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	32.2367	32.6056	32.6943	32.9518	32.9518	33.1956	33.1956	33.2737	33.1956	32.7816	32.8674	32.6056		
alpha	3.1491	3.1737	3.1796	3.1968	3.1968	3.2130	3.2130	3.2182	3.2130	3.1854	3.1912	3.1737		
util living area	0.9483	0.9225	0.8707	0.7810	0.6521	0.4744	0.3433	0.3557	0.5614	0.7844	0.9092	0.9573	(86)	
Living	19.6390	19.8337	20.1497	20.4790	20.7245	20.8577	20.8922	20.8911	20.8230	20.5527	20.0859	19.5992		
Non living	18.2410	18.4889	18.8747	19.2647	19.5289	19.6551	19.6771	19.6794	19.6311	19.3545	18.8123	18.2015		
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	20.3038	19.8337	20.1497	20.4790	20.7245	20.8577	20.8922	20.8911	20.8230	20.5527	20.0859	19.7952	(87)	
Th 2	19.7724	19.7845	19.7874	19.7957	19.7957	19.8034	19.8034	19.8059	19.8034	19.7902	19.7930	19.7845	(88)	
util rest of house														
	0.9369	0.9066	0.8446	0.7384	0.5851	0.3836	0.2359	0.2450	0.4685	0.7305	0.8869	0.9476	(89)	
MIT 2	19.1619	18.4889	18.8747	19.2647	19.5289	19.6551	19.6771	19.6794	19.6311	19.3545	18.8123	18.4867	(90)	
Living area fraction														
MIT	19.5212	18.9121	19.2759	19.6468	19.9051	20.0335	20.0594	20.0607	20.0061	19.7316	19.2130	18.8984	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.5212	18.9121	19.2759	19.6468	19.9051	20.0335	20.0594	20.0607	20.0061	19.7316	19.2130	18.8984	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9343	0.8926	0.8318	0.7325	0.5916	0.4017	0.2593	0.2692	0.4852	0.7276	0.8739	0.9388	(94)
Useful gains	1074.0680	1187.8135	1252.8261	1213.3324	993.4037	678.4096	414.8824	413.6367	713.2200	966.7404	1023.3501	989.6206	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W													
	2208.3777	2042.8279	1846.6663	1537.0911	1117.6338	703.6890	419.0774	418.2779	760.2810	1219.7787	1658.5695	2071.6449	(97)
Space heating kWh													
	843.9264	574.5697	441.8171	233.1063	92.4272	0.0000	0.0000	0.0000	0.0000	188.2605	457.3579	805.0261	(98a)
Space heating requirement - total per year (kWh/year)												3636.4912	
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	

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Space heating kWh	843.9264	574.5697	441.8171	233.1063	92.4272	0.0000	0.0000	0.0000	0.0000	188.2605	457.3579	805.0261 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3636.4912
Space heating per m2												(98c) / (4) = 32.2785 (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 %)												239.5784 (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	843.9264	574.5697	441.8171	233.1063	92.4272	0.0000	0.0000	0.0000	0.0000	188.2605	457.3579	805.0261 (98)
Space heating efficiency (main heating system 1)	239.5784	239.5784	239.5784	239.5784	239.5784	0.0000	0.0000	0.0000	0.0000	239.5784	239.5784	239.5784 (210)
Space heating fuel (main heating system)	352.2548	239.8254	184.4144	97.2986	38.5791	0.0000	0.0000	0.0000	0.0000	78.5799	190.9012	336.0179 (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	314.9070	260.6045	233.1784	173.7424	144.5403	93.7231	95.5624	114.6591	145.6974	233.0208	278.0264	316.9293 (64)
Efficiency of water heater (217)m	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015	172.0015 (216)
Fuel for water heating, kWh/month	183.0839	151.5129	135.5677	101.0121	84.0343	54.4897	55.5591	66.6617	84.7070	135.4760	161.6418	184.2596 (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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	34.3368	27.5463	24.8024	18.1713	14.0360	11.4676	12.8041	16.6433	21.6180	28.3640	32.0370	35.2912 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-49.5946	-64.5661	-96.1955	-111.1183	-114.8542	-105.7826	-103.3340	-98.6504	-88.0930	-76.1336	-54.3690	-40.6264 (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	0.0000	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												1517.8713 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												172.0015
Water heating fuel used												1398.0058 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												277.1180 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1003.3174 (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												2269.6777 (238)

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1517.8713	28.4300	431.5308 (240)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1398.0058	28.4300	397.4531 (247)	
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)	
Pump for solar water heating	80.0000	28.4300	22.7440 (249)	
Energy for lighting	277.1180	28.4300	78.7846 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1003.3174	28.4300	-285.2431	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-285.2431 (252)	
Total energy cost			645.2694 (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	1517.8713	0.1563	237.2950 (261)	
Total CO2 associated with community systems			0.0000 (373)	

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Water heating (other fuel)	1398.0058	0.1457	203.7370 (264)
Space and water heating			441.0320 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	277.1180	0.1443	39.9967 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1003.3174	0.1349	-135.3292
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-135.3292 (269)
Total CO2, kg/year			356.7965 (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	1517.8713	1.5787	2396.3308 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1398.0058	1.5391	2151.6758 (278)
Space and water heating			4548.0066 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	277.1180	1.5338	425.0528 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1003.3174	1.4985	-1503.4877
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1503.4877 (283)
Total Primary energy kWh/year			3590.5957 (286)