

SUSTAINABILITY STATEMENT

Client: Gill Hudson Homes LTD
Site Address: Highover Farm, Highover Way, Hitchin. SG4 0RQ
Local Authority: North Hertfordshire Council
Project Details: 14 new dwellings



PREPARED BY: AP CONSULTING ENGINEERS LTD
ELMHURST ACCREDITED ENERGY ASSESSOR 8075-0001/EES017061
BRE CODE FOR SUSTAINABLE HOMES ASSESSOR
AUTHOR: PAUL ALLEN BEng (HONS)
MAY 2025 REVISION [1]

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1. BACKGROUND

This statement has been prepared on behalf of Gill Hudson Homes LTD in support of a residential development of 14 dwellings comprising 2 new build dwellings and 12 formed via change of use (barn conversion).

2. AIMS & OBJECTIVES

This statement will demonstrate how the proposed development complies with North Hertfordshire Council sustainability policies.

3. NEW BUILD EXECUTIVE SUMMARY

The proposed new build development would achieve an 86% reduction in CO₂ emissions and a 63% reduction in energy demand above the requirements set in Building Regulations part L 2021 by incorporating a high level of thermal fabric performance and renewable heating & energy generation systems.

CO₂ Emissions at each stage of the energy hierarchy:

	Regulated CO ₂ emissions (kg/year/m ²)
Stage 1: 'Be lean' Part L 2021 baseline	0.36
Stage 2: 'Be clean'	0.35
Stage 3: 'Be green'	0.13
% reduction	86%

Energy demand at each stage of the energy hierarchy:

	Energy demand (kWh/year)
Stage 1: 'Be lean' Part L 2021 baseline	2624.3
Stage 2: 'Be clean'	2593.4
Stage 3: 'Be green'	946.8
% reduction	63%

Energy performance summary:

	% improvement over building regulations 2021
Dwelling emission rate (Tonnes CO ₂ /yr)	85.14
Fabric efficiency (kWh/m ² /yr)	2.88
Primary energy rate (kWh/m ² /yr)	67.5

4. CONVERSION EXECUTIVE SUMMARY

In order to improve the energy performance of the change of use dwellings it is proposed to improved the thermal insulation by more than 10% above the minimum standards set out in building regulations approved document L 2021 (Conservation of fuel and Power) as per the table below:

Key design features:		
Element	Building regulations minimum (table 4.2 page 26)	Proposed
Wall U-value	0.30W/m ² k	0.24W/m ² k
Floor U-value	0.25W/m ² k	0.20W/m ² k
Roof U-value	0.16W/m ² k	0.14W/m ² k
Window U-value	1.60W/m ² k	1.40W/m ² k
Door U-value	1.80W/m ² k	1.20W/m ² k
Primary heating	Gas oil or electric	Air source heat pump COP >3.5
Ventilation	Natural & trickle ventilation	Natural & trickle ventilation
Mechanical cooling	None	None

Energy performance summary:

	Building regulations baseline	Proposed	% improvement over building regulations 2021
EPC Rating	74C	77C	3 points
Dwelling emission rate (Tonnes CO ₂ /yr)	5.96	0.84	86% reduction
Fabric efficiency (kWh/m ² /yr)	75.52	72.20	4% reduction
Primary energy rate (kWh/m ² /yr)	126.42	46.78	63% reduction

By adopting the above specification the conversion element of the development would achieve an 86% reduction in CO₂ emissions and a 63% reduction in energy demand above the requirements set in Building Regulations part L 2021.

This statement and associated energy and water calculation checklists demonstrate that the proposed development meets the requirements of the Council's sustainability policy.

5. NEW BUILD DEVELOPMENT STRATEGY

The development will follow the well established energy hierarchy





6. 'BE LEAN' (BASELINE) SPECIFICATION

Key design features:	
Wall U-value	0.18W/m ² k
Floor U-value	0.12W/m ² k
Roof U-value	0.10W/m ² k
Window U-value	1.40W/m ² k
Door U-value	1.50W/m ² k
Air Permeability	4.00 m ³ /hr/m ² at Δ50Pa
Primary heating	Air source heat pump COP >3.5
Ventilation	Natural & trickle ventilation
Thermal bridging	Registered details
Mechanical cooling	None
Renewables	None

'BE LEAN' (BASELINE) ENERGY PERFORMANCE

In order to demonstrate compliance with the Council's sustainability policy, government approved software and energy assessors have been used to generate detailed energy calculations based on the planning stage drawings. The process will be repeated prior to construction.

Plot No	Space heating kwh/yr	Water heating kwh/yr	Pumps & fans kwh/yr	Lighting kwh/yr	Sub total kwh/yr
14	1007.6	1295.8	75	245.9	2624.3

Note: Energy demand taken from calculated SAP calculation using section 12a and rounded to 2sf



To reduce energy demand for space heating, the external fabric and thermal bridging of the dwellings will be improved as per the table below.

7. 'BE CLEAN' SPECIFICATION

Key design features:	
Wall U-value	0.17W/m ² k
Floor U-value	0.12W/m ² k
Roof U-value	0.09W/m ² k
Window U-value	1.30W/m ² k
Door U-value	1.30W/m ² k
Air Permeability	4.00 m ³ /hr/m ² at Δ50Pa
Primary heating	Air source heat pump COP >3.5
Ventilation	Natural & trickle ventilation
Thermal bridging	Registered details
Mechanical cooling	None
Renewables	None

'BE CLEAN' ENERGY PERFORMANCE

Plot No	Space heating kwh/yr	Water heating kwh/yr	Pumps & fans kwh/yr	Lighting kwh/yr	Sub total kwh/yr
14	976.7	1295.8	75	245.9	2593.4



8. 'BE GREEN' SPECIFICATION

Due to the recent changes in building regulations there are limited practical improvements that can be made to the thermal fabric of the new build dwellings we have therefore concentrated on low and zero carbon heating and cooling technologies (LZC), low energy light and air tightness.

LZC technologies are considered to be renewables the options that will be considered for use are:

- Solar Photovoltaic's
 - Solar thermal hot water
 - Ground source heat pumps
 - Air source heat pumps
 - Biomass boilers
1. Photovoltaic (PV) panels use sunlight to produce electricity; the cells convert the sunlight into electricity which can be used to run plant and lighting.
 2. Solar thermal hot water (SHW) uses solar energy via solar thermal panels for the generation of hot water; solar water heating systems use heat from the sun to warm hot water systems.
 3. Ground source heat pumps (GSHP) circulate a mixture of water and antifreeze around a loop of a pipe which is buried externally. Heat from the ground is absorbed into this fluid and is pumped through a heat exchanger in the heat pump. Low grade heat passes through the heat pump compressor and is concentrated into a higher temperature; this useful heat is capable of providing water for the heating and hot water circuits of the unit. GSHP units generally provide a COP of 4 or greater (4 units of heat per 1 unit of energy (electricity))
 4. Air source heat pumps (ASHP) reclaim the heat available in ambient air and convert it to higher temperatures to heat the unit. As with ground source heat pumps, they use electricity to distribute heat. ASHP systems do not require ground works and are therefore less costly than ground source systems. ASHP systems can be used to both heat and cool retail spaces. ASHP units generally provide a COP of 3 or greater (3 units of heat per 1 unit of energy (electricity))
 5. Biomass fuelled heating systems generally burn wood pellets, chips or logs to power space heating and hot water boilers. Other fuel types are available but the energy density of wood chips or pellets means it is typically the most appropriate. Deliveries of fuel which would result in unacceptable volumes of traffic around the site.

LZC SELECTION

LZC option	Type	Suitability	Justification
1	Solar PV	Yes	Suitable roof area available & low visual impact
2	Solar hot water	No	Hot water demand of residential units is relatively low
3	GSHP	No	Limited space for ground source loops or boreholes
4	ASHP	Yes	Site suitable for heating plant
5	Biomass	No	Limited storage area for biomass fuels.

LZC CONCLUSIONS

Based on the above analysis the most suitable method of achieving the required energy contribution from renewable technologies for this development would be air source heating and solar PV.

'BE GREEN' SPECIFICATION

Key design features:	
Wall U-value	0.17W/m ² k
Floor U-value	0.12W/m ² k
Roof U-value	0.09W/m ² k
Window U-value	1.30W/m ² k
Door U-value	1.20W/m ² k
Air Permeability	4.00 m ³ /hr/m ² at Δ50Pa
Primary heating	Air source heat pump COP >3.5
Ventilation	Natural & trickle ventilation
Thermal bridging	Registered details
Mechanical cooling	None
Renewables	2.00kWp Solar PV

'BE GREEN' ENERGY PERFORMANCE

Plot No	Space heating kwh/yr	Water heating kwh/yr	Pumps & fans kwh/yr	Lighting kwh/yr	Contribution from solar PV	Sub total kwh/yr
1	976.7	1295.8	75	245.9	-1646.6	946.8

9. Overview appraisal

Criteria	Requirement	Requirement met?	Justification
Re-use of land	Re-use land and buildings	YES	The site is a former agricultural site
Re-use and recycling	Re-use and recycle materials	YES	Aggregates from the demolition of the building will be crushed on site and re-used. Spoil from excavations will be used to landscaping purposes.
Ecological footprint	Use materials and construction techniques that have smaller carbon footprint	YES	All materials used in the development will be sourced from responsible sources. 3 of the 5 categories will achieve an A+ to D rating: For details of the materials please refer to appendix 1.
Green roof and wall systems	Incorporate green external elements	YES	The proposal utilises a sedum based flat roof. <u>The remaining external elements achieve the same U values as a green wall</u>
Building life cycle	Design buildings that can be adapted to suit changing needs of the occupier	YES	Dwellings will be designed to be accessible and adaptable to suit occupants changing needs
Recycling	Provide adequate space for greater levels of waste recycling	YES	Dwellings comply with the guidance set out within the Code for sustainable homes. Provision for the storage of recyclable and non recyclable waste will be provided within the dwelling. Waste storage bins will be stored in a secure covered bin store. North Hertfordshire Council operates a collection scheme for both types of waste therefore the mandatory element is deemed to have been met.
Fabric first design	Minimise the energy demand for heating, cooling and lighting	YES	The proposed dwellings achieve the criteria set out in building regulations part L. For details please refer to appendix 2.
Water consumption	Reduce the consumption of potable water	YES	Internal water usage for each dwelling will be limited

			to 110L/day. This will be achieved by specifying the following: - Bath 170L capacity - Shower 10L/s - Dual flush WC 6/3L - Low flow aerated taps (Kitchen 10.00 L/s, Basin 5.00 L/s) - Dishwasher <0.75L per person/cycle - Washing machine <5.00L per kg/cycle - External water butts For details please refer to appendix 3.
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Materials appraisal

Aim:

In order to comply with this part of the “code” 3 of the 5 categories below are required to achieve an A+ to D rating:

- Roof Structure
- External walls
- Upper floor
- Internal walls
- Windows and doors

Results:

The table below demonstrates that the dwellings comply with the requirements.

Element	Summary rating	Climate change	Fossil fuel depletion	Ozone depletion	Freight transport	Human Toxicity	Waste disposal	Water extraction	Acid deposition	Ecotoxicity	Eutrophication	Summer smog	Mineral Extraction	Typical enhancement	Recycled input	Recyclability	Currently recycled	Energy saved by recycling
Roof structure	A	A	A	A	A	A	A	B	A	A	B	A	A	50	B	A	A	A
Wall	A	A	A	A	A	A	B	B	A	A	A	A	A	35	A	A	A	A
Floor	C	A	A	A	A	C	C	C	A	A	B	A	C	60	C	A	A	A
Upper floors	A	A	A	A	C	A	B	B	B	A	A	B	A	60	B	A	A	B
Internal walls	A	A	A	A	A	A	A	A	A	A	A	C	A	60	A	B	B	B
Windows & doors	C	A	A	A	A	A	C	A	C	C	A	A	A	25	A	A	A	A

10. WATER CONSUMPTION STRATEGY

Internal water usage for each dwelling will be limited to 110L per person/day. This will be achieved by specifying the following:

Outlet	Target capacity
Toilet	Dual flush 6/3 L
Basin tap	5.00L/min
Kitchen/Utility tap	10.00L/min
Bath	170 L to overflow
Shower	9.00L/min
Washing machine	5.00L per kg dry load
Dishwasher	0.75L per place setting

17. K COMPLIANCE		
EXTERNAL WATER USE	(litres / person / day)	5.00
TOTAL WATER CONSUMPTION	(litres / person / day)	107.9
17. K COMPLIANCE?		Yes



Job no:	25.148
Date:	09/05/2025
Assessor name:	Paul Allen
Registration no:	APCOE-12
Development name:	Higlover Farm, Hitchin
Issue Date:	09/05/2025

Rainwater

Greywater

Results

WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS

(for use with the Code for Sustainable Homes issues Wat 1 for the May 2009 and subsequent versions)

Dwelling Description	ALL PLOTS
-----------------------------	-----------

1st step - Select from options below:

Is a Rain and/or Greywater system specified?	No
Is a shower AND bath present?	Yes
Has a washing machine been specified?	Yes
Has a dishwasher been specified?	Yes

2nd step - Build spreadsheet (click button below)

BUILD SPREADSHEET

As soon as this button is pressed the spreadsheet will change according to the options selected previously in the 1st step. Scroll down to see the changes.

3rd step - Enter consumption details for the specified fittings

TAPS (excluding kitchen taps)		Fitting type	Flow rate (litres/min)	Number of fittings
	1	TARGET FLOW RATE	5.00	4
	2			
	3			
	4			
	Proportionate flow rate (litres/min)			3.50
	Consumption / person / day (Litres)			9.48

BATHS		Fitting type	Capacity to overflow (litres)	Number of fittings
	1	TARGET CAPACITY	170.00	1
	2			
	3			
	4			
		Proportionate capacity to overflow (litres)	119.00	
	Consumption / person / day (Litres)			18.70

SHOWERS		Fitting type	Flow rate (litres/min)	Number of fittings
	1	TARGET FLOW RATE	9.00	2
	2			
	3			
	4			
		Proportionate flow rate (litres/min)	6.30	
	Consumption / person / day (Litres)			39.33

DISHWASHER		Fitting Type	Litres per place setting	Number of fittings
	1	TARGET CONSUMPTION	0.75	1
	2			
	3			
	4			
		Proportionate litres per place setting	0.53	
	Consumption / person / day (Litres)			2.70

WASHING MACHINES		Fitting Type	Litres per kilogram of dry load	Number of fittings
	1	TARGET CONSUMPTION	5.00	1
	2			
	3			

4				
Where no washing machines have been specified but plumbing for future supply of grey/rainwater was installed, please enter details:				
		Proportionate of litres/kg of dry load	3.50	
		Consumption / person / day (Litres)	10.50	
WC's				
	Fitting Type	Flush Type	Volume**	Number of fittings
1	TARGET FLUSH	Full Flush	6.00	3
		Part Flush	3.00	
2		Full Flush		
		Part Flush		
3		Full Flush		
		Part Flush		
4		Full Flush		
		Part Flush		
		Average effective flushing volume (litres)	3.99	
		Consumption / person / day (Litres)	17.64	
KITCHEN SINK TAPS		Fitting Type	Flow rate (litres/minute)	Number of fittings
	1	TARGET FLOW RATE	10.00	2
	2			
	3			
	4			
		Proportionate flow rate (litres/min)	7.00	
		Consumption / person / day (Litres)	14.76	
WASTE DISPOSAL UNIT				
Is a waste disposal unit specified for the dwelling?		No		
		Consumption / person / day (Litres)	0.00	
WATER SOFTENER				
Water Softener in use?		No		
Total capacity used per regeneration (%)				

Water consumed per regeneration (litres)	
Average number of regeneration cycles per day (No.)	
Number of occupants served by the system (No.)	
Water consumed beyond 4% person / day (Litres)	0.00

4th step - Analyse Results[Go to Start](#)**INTERNAL WATER CONSUMPTION**

NET INTERNAL WATER CONSUMPTION	(litres/person/day)	113.11
RAINWATER ONLY COLLECTION SAVING	(litres/person/day)	0.00
GREYWATER ONLY RECYCLING SAVING	(litres/person/day)	0.00
RAIN/GREYWATER COLLECTION SAVING (combined system)	(litres/person/day)	0.00
NORMALISATION FACTOR	(litres/person/day)	0.91
TOTAL WATER CONSUMPTION	(litres/person/day)	102.9
CSH CREDITS ACHIEVED		3
CSH MANDATORY LEVEL:		Level 3/4

17. K COMPLIANCE

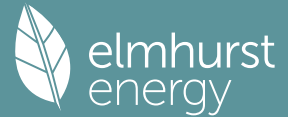
EXTERNAL WATER USE	(litres / person / day)	5.00
TOTAL WATER CONSUMPTION	(litres / person / day)	107.9
17. K COMPLIANCE?		Yes

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Full SAP Calculation Printout



Property Reference	LEAN				Issued on Date	09/05/2025	
Assessment Reference	PLOT 14			Prop Type Ref			
Property	Highover Farm, Highover Way, Hitchin, Hertfordshire, SG4 0RQ						
SAP Rating	84 B	DER	3.50	TER	9.89		
Environmental	97 A	% DER < TER				64.61	
CO ₂ Emissions (t/year)	0.36	DFEE	34.93	TFEE	34.95		
Compliance Check	See BREL	% DFEE < TFEE				0.07	
% DPER < TPER	28.64	DPER	36.79	TPER	51.56		
Assessor Details	Mr. Paul Allen				Assessor ID	8075-0001	
Client	APC, AP						

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	53.4800 (1b)	x 2.4000 (2b)	= 128.3520 (1b) - (3b)
First floor	53.4800 (1c)	x 2.6500 (2c)	= 141.7220 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.0740 (5)

2. Ventilation rate

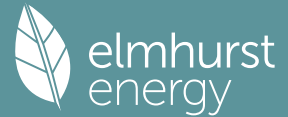
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.1481 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3481 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3220 (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	0.4105	0.4025	0.3944	0.3542	0.3461	0.3059	0.3059	0.2978	0.3220	0.3461	0.3622	0.3783 (22b)
Effective ac	0.5843	0.5810	0.5778	0.5627	0.5599	0.5468	0.5468	0.5444	0.5518	0.5599	0.5656	0.5716 (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							
WINDOW			13.8500	1.3258	18.3617		(27)
DOOR			2.1500	1.5000	3.2250		(26)
Heatloss Floor 1			53.4800	0.1200	6.4176	110.0000	5882.8000 (28a)
EXP WALL	108.0700	16.0000	92.0700	0.1800	16.5726	60.0000	5524.2000 (29a)
External Roof 1	53.4800		53.4800	0.0900	4.8132	9.0000	481.3200 (30)
Total net area of external elements Aum(A, m ²)			215.0300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.3901		(33)
Main dwelling							
Party Wall 1			43.9400	0.0000	0.0000	70.0000	3075.8000 (32)
Internal Wall 1			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			53.4800			18.0000	962.6400 (32d)
Internal Ceiling 1			53.4800			9.0000	481.3200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17308.0800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							161.8182 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				10.9300	0.3500	3.8255	
E3 Sill				9.9000	0.0120	0.1188	

Full SAP Calculation Printout



E4 Jamb	24.6000	0.0100	0.2460	
E5 Ground floor (normal)	21.4000	0.0650	1.3910	
E10 Eaves (insulation at ceiling level)	11.5000	0.0360	0.4140	
E12 Gable (insulation at ceiling level)	18.6000	0.0550	1.0230	
E16 Corner (normal)	20.2000	0.0540	1.0908	
P1 Party wall - Ground floor	8.7000	0.0450	0.3915	
E6 Intermediate floor within a dwelling	21.4000	0.0700	1.4980	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.9986	(36)
Point Thermal bridges			0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	59.3887	(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	52.0732	51.7815	51.4957	50.1529	49.9016	48.7321	48.7321	48.5155	49.1826	49.9016	50.4099	50.9412
Average = Sum(39)m / 12 =	111.4619	111.1703	110.8844	109.5416	109.2904	108.1208	108.1208	107.9043	108.5713	109.2904	109.7986	110.3300
												109.5404
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0421	1.0394	1.0367	1.0241	1.0218	1.0109	1.0109	1.0088	1.0151	1.0218	1.0265	1.0315
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7953	(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	81.9957	80.7780	79.0631	75.9012	73.5337	70.9084	69.4904	71.1932	73.0473	75.8564	79.0834	81.7185		(42b)
Hot water usage for other uses	43.2566	41.6836	40.1107	38.5377	36.9647	35.3918	35.3918	36.9647	38.5377	40.1107	41.6836	43.2566		(42c)
Average daily hot water use (litres/day)													115.3471	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	125.2523	122.4616	119.1738	114.4389	110.4984	106.3002	104.8821	108.1579	111.5850	115.9671	120.7671	124.9751		(44)
Energy content (annual)	198.3690	174.3837	183.1657	156.6612	148.7521	130.7084	126.8458	133.9221	137.5955	157.3663	172.0548	195.6808		(45)
Distribution loss (46)m = 0.15 x (45)m	29.7554	26.1576	27.4748	23.4992	22.3128	19.6063	19.0269	20.0883	20.6393	23.6049	25.8082	29.3521		(46)
Water storage loss:														
Store volume													200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6000	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.8640	(55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840		(56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840		(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	248.4154	219.5869	233.2121	205.0932	198.7985	179.1404	176.8922	183.9685	186.0275	207.4127	220.4868	245.7272		(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	248.4154	219.5869	233.2121	205.0932	198.7985	179.1404	176.8922	183.9685	186.0275	207.4127	220.4868	245.7272		(64)
12Total per year (kWh/year)													2504.7614	(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	105.9948	94.1451	100.9397	90.8354	89.4972	82.2062	82.2134	84.5662	84.4961	92.3614	95.9538	105.1010		(65)

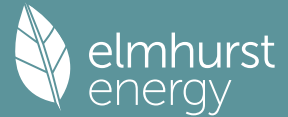
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647		(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	147.0414	162.7958	147.0414	151.9428	147.0414	151.9428	147.0414	147.0414	151.9428	147.0414	151.9428	147.0414		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765		(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)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117		(71)
Water heating gains (Table 5)	142.4662	140.0969	135.6716	126.1603	120.2919	114.1752	110.5018	113.6643	117.3557	124.1417	133.2692	141.2648		(72)
Total internal gains	621.5508	637.7078	610.5432	591.0633	561.5229	542.6658	522.3053	522.6960	538.2736	555.0281	587.8277	608.5636		(73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W	
Southeast				8.6900	36.7938		0.6300	0.7000		0.7700	97.7162 (77)	
Southwest				0.6600	36.7938		0.6300	0.7000		0.7700	7.4215 (79)	
Northwest				4.5000	11.2829		0.6300	0.7000		0.7700	15.5170 (81)	
Solar gains	120.6547	210.6736	301.9431	397.0690	465.6953	471.5406	450.7814	398.1747	334.6643	236.5305	145.4551	102.6479 (83)
Total gains	742.2054	848.3814	912.4863	988.1324	1027.2182	1014.2064	973.0867	920.8706	872.9379	791.5586	733.2828	711.2115 (84)

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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	43.1340	43.2472	43.3587	43.8902	43.9911	44.4669	44.4669	44.5562	44.2824	43.9911	43.7874	43.5766
alpha	3.8756	3.8831	3.8906	3.9260	3.9327	3.9645	3.9645	3.9704	3.9522	3.9327	3.9192	3.9051
util living area	0.9828	0.9703	0.9491	0.8949	0.7930	0.6263	0.4738	0.5166	0.7330	0.9121	0.9698	0.9852 (86)
Living	19.7074	19.8840	20.1247	20.4465	20.7042	20.8608	20.9063	20.9000	20.8040	20.4749	20.0444	19.6823
Non living	18.5320	18.7567	19.0607	19.4636	19.7634	19.9310	19.9670	19.9650	19.8781	19.5064	18.9699	18.5067
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	20.3388	19.8840	20.1247	20.4465	20.7042	20.8608	20.9063	20.9000	20.8040	20.4749	20.0444	19.8666 (87)
Th 2	20.0484	20.0507	20.0529	20.0633	20.0652	20.0743	20.0743	20.0760	20.0708	20.0652	20.0613	20.0572 (88)
util rest of house	0.9792	0.9641	0.9382	0.8721	0.7484	0.5527	0.3805	0.4220	0.6661	0.8882	0.9625	0.9821 (89)
MIT 2	19.4438	18.7567	19.0607	19.4636	19.7634	19.9310	19.9670	19.9650	19.8781	19.5064	18.9699	18.7861 (90)
Living area fraction									fLA =	Living area / (4) =		0.2001 (91)
MIT	19.6229	18.9822	19.2736	19.6602	19.9517	20.1170	20.1549	20.1521	20.0634	19.7002	19.1849	19.0023 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6229	18.9822	19.2736	19.6602	19.9517	20.1170	20.1549	20.1521	20.0634	19.7002	19.1849	19.0023 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9772	0.9553	0.9272	0.8606	0.7424	0.5563	0.3889	0.4301	0.6655	0.8769	0.9537	0.9777 (94)
Useful gains	725.3132	810.4739	846.0776	850.4197	762.5986	564.2333	378.4503	396.0290	580.9765	694.1348	699.3490	695.3164 (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	1707.9203	1565.5225	1416.3901	1178.6936	901.8268	596.5045	384.3594	404.8625	647.4500	994.5610	1326.9052	1633.1335 (97)
Space heating kWh	731.0597	507.3927	424.3125	236.3572	103.5857	0.0000	0.0000	0.0000	0.0000	223.5171	451.8404	697.7359 (98a)
Space heating requirement - total per year (kWh/year)												3375.8012
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	731.0597	507.3927	424.3125	236.3572	103.5857	0.0000	0.0000	0.0000	0.0000	223.5171	451.8404	697.7359 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3375.8012
Space heating per m2										(98c) / (4) =		31.5613 (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 %)												335.0511 (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	731.0597	507.3927	424.3125	236.3572	103.5857	0.0000	0.0000	0.0000	0.0000	223.5171	451.8404	697.7359 (98)
Space heating efficiency (main heating system 1)	335.0511	335.0511	335.0511	335.0511	335.0511	0.0000	0.0000	0.0000	0.0000	335.0511	335.0511	335.0511 (210)
Space heating fuel (main heating system)	218.1935	151.4374	126.6411	70.5436	30.9164	0.0000	0.0000	0.0000	0.0000	66.7113	134.8572	208.2476 (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	248.4154	219.5869	233.2121	205.0932	198.7985	179.1404	176.8922	183.9685	186.0275	207.4127	220.4868	245.7272 (64)
Efficiency of water heater (217)m	193.3042	193.3042	193.3042	193.3042	193.3042	193.3042	193.3042	193.3042	193.3042	193.3042	193.3042	193.3042 (216)
Fuel for water heating, kWh/month	128.5101	113.5965	120.6451	106.0987	102.8423	92.6728	91.5098	95.1705	96.2356	107.2986	114.0621	127.1194 (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	30.4636	24.4390	22.0046	16.1215	12.4527	10.1740	11.3598	14.7659	19.1794	25.1645	28.4232	31.3103 (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												1007.5482 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												193.3042
Water heating fuel used												1295.7614 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												

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Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	245.8586 (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	2549.1682 (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	1007.5482	0.1555	156.7209 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1295.7614	0.1409	182.5432 (264)
Space and water heating			339.2640 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	245.8586	0.1443	35.4850 (268)
Total CO2, kg/year			374.7490 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5000 (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	1007.5482	1.5758	1587.7340 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1295.7614	1.5209	1970.7383 (278)
Space and water heating			3558.4723 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	245.8586	1.5338	377.1061 (282)
Total Primary energy kWh/year			3935.5785 (286)
Dwelling Primary energy Rate (DPER)			36.7900 (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	53.4800 (1b)	x 2.4000 (2b)	= 128.3520 (1b) - (3b)
First floor	53.4800 (1c)	x 2.6500 (2c)	= 141.7220 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	270.0740 (5)

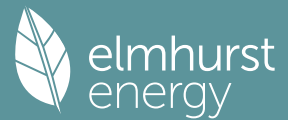
2. Ventilation rate

	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) = 0.1481 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3981 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3682 (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	0.4695	0.4603	0.4511	0.4051	0.3959	0.3498	0.3498	0.3406	0.3682	0.3959	0.4143	0.4327 (22b)
Effective ac	0.6102	0.6059	0.6017	0.5820	0.5784	0.5612	0.5612	0.5580	0.5678	0.5784	0.5858	0.5936 (25)

3. Heat losses and heat loss parameter

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Element													
Main dwelling													
TER Opaque door						2.1500	1.0000	2.1500					(26)
TER Opening Type						13.8500	1.1450	15.8588					(27)
Heatloss Floor 1						53.4800	0.1300	6.9524					(28a)
EXP WALL						92.0700	0.1800	16.5726					(29a)
External Roof 1						53.4800	0.1100	5.8828					(30)
Total net area of external elements Aum(A, m2)						215.0300							(31)
Fabric heat loss, W/K = Sum (A x U)						(26)...(30) + (32) =		47.4166					(33)
Main dwelling													
Party Wall 1						43.9400	0.0000	0.0000					(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												161.8182	(35)
List of Thermal Bridges													
K1 Element								Length		Psi-value		Total	
E2 Other lintels (including other steel lintels)								10.9300		0.0500		0.5465	
E3 Sill								9.9000		0.0500		0.4950	
E4 Jamb								24.6000		0.0500		1.2300	
E5 Ground floor (normal)								21.4000		0.1600		3.4240	
E10 Eaves (insulation at ceiling level)								11.5000		0.0600		0.6900	
E12 Gable (insulation at ceiling level)								18.6000		0.0600		1.1160	
E16 Corner (normal)								20.2000		0.0900		1.8180	
P1 Party wall - Ground floor								8.7000		0.0800		0.6960	
E6 Intermediate floor within a dwelling								21.4000		0.0000		0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												10.0155	(36)
Point Thermal bridges												(36a) =	0.0000
Total fabric heat loss												(33) + (36) + (36a) =	57.4321 (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	54.3858	54.0044	53.6305	51.8742	51.5456	50.0160	50.0160	49.7327	50.6052	51.5456	52.2104	52.9053	(38)
Average = Sum(39)m / 12 =	111.8179	111.4364	111.0625	109.3063	108.9777	107.4481	107.4481	107.1648	108.0373	108.9777	109.6424	110.3374	(39)
												109.3047	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0454	1.0419	1.0384	1.0219	1.0189	1.0046	1.0046	1.0019	1.0101	1.0189	1.0251	1.0316	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												1.0219	
												31	

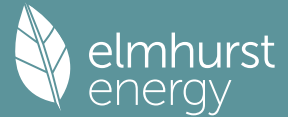
4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.7953 (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													
	81.9957	80.7780	79.0631	75.9012	73.5337	70.9084	69.4904	71.1932	73.0473	75.8564	79.0834	81.7185	(42b)
Hot water usage for other uses													
	43.2566	41.6836	40.1107	38.5377	36.9647	35.3918	35.3918	36.9647	38.5377	40.1107	41.6836	43.2566	(42c)
Average daily hot water use (litres/day)													115.3471 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	125.2523	122.4616	119.1738	114.4389	110.4984	106.3002	104.8821	108.1579	111.5850	115.9671	120.7671	124.9751	(44)
Energy conte	198.3690	174.3837	183.1657	156.6612	148.7521	130.7084	126.8458	133.9221	137.5955	157.3663	172.0548	195.6808	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
	29.7554	26.1576	27.4748	23.4992	22.3128	19.6063	19.0269	20.0883	20.6393	23.6049	25.8082	29.3521	(46)
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6525 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8924 (55)
Total storage loss													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(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													
	249.2951	220.3814	234.0917	205.9445	199.6781	179.9917	177.7719	184.8482	186.8788	208.2923	221.3381	246.6069	(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													
	249.2951	220.3814	234.0917	205.9445	199.6781	179.9917	177.7719	184.8482	186.8788	208.2923	221.3381	246.6069	(64)
12Total per year (kWh/year)													
Electric shower(s)													2515.1188 (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	(64a)
													0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													
Heat gains from water heating, kWh/month													
	106.6986	94.7808	101.6434	91.5165	90.2009	82.8872	82.9171	85.2700	85.1771	93.0651	96.6349	105.8047	(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	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.0414	162.7958	147.0414	151.9428	147.0414	151.9428	147.0414	147.0414	151.9428	147.0414	151.9428	147.0414	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280	(68)
Pumps, fans	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)
	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	(71)
Water heating gains (Table 5)													
	143.4120	141.0428	136.6175	127.1062	121.2378	115.1211	111.4477	114.6102	118.3016	125.0876	134.2151	142.2107	(72)
Total internal gains													
	625.4967	641.6537	614.4891	595.0092	565.4688	543.6117	523.2512	523.6418	539.2195	558.9740	591.7736	612.5095	(73)

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6. Solar gains

[Jan]	Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
Southeast	8.6900		36.7938		0.6300		0.7000		0.7700		97.7162 (77)	
Southwest	0.6600		36.7938		0.6300		0.7000		0.7700		7.4215 (79)	
Northwest	4.5000		11.2829		0.6300		0.7000		0.7700		15.5170 (81)	
Solar gains	120.6547	210.6736	301.9431	397.0690	465.6953	471.5406	450.7814	398.1747	334.6643	236.5305	145.4551	102.6479 (83)
Total gains	746.1513	852.3273	916.4322	992.0782	1031.1641	1015.1523	974.0326	921.8165	873.8837	795.5045	737.2286	715.1574 (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	42.9967	43.1439	43.2891	43.9847	44.1173	44.7453	44.7453	44.8636	44.5013	44.1173	43.8498	43.5736
alpha	3.8664	3.8763	3.8859	3.9323	3.9412	3.9830	3.9830	3.9909	3.9668	3.9412	3.9233	3.9049
util living area	0.9825	0.9699	0.9485	0.8936	0.7907	0.6233	0.4709	0.5134	0.7308	0.9106	0.9693	0.9850 (86)
MIT	19.3809	19.6177	19.9401	20.3736	20.7151	20.9208	20.9797	20.9715	20.8461	20.4121	19.8384	19.3536 (87)
Th 2	20.0457	20.0486	20.0515	20.0651	20.0676	20.0795	20.0795	20.0817	20.0749	20.0676	20.0625	20.0571 (88)
util rest of house	0.9788	0.9637	0.9376	0.8705	0.7459	0.5502	0.3786	0.4196	0.6640	0.8864	0.9618	0.9818 (89)
MIT 2	18.1585	18.4596	18.8664	19.4076	19.8044	20.0235	20.0700	20.0674	19.9544	19.4652	18.7512	18.1315 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.4031	18.6913	19.0812	19.6009	19.9866	20.2031	20.2520	20.2483	20.1328	19.6547	18.9687	18.3760 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.4031	18.6913	19.0812	19.6009	19.9866	20.2031	20.2520	20.2483	20.1328	19.6547	18.9687	18.3760 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9700	0.9520	0.9234	0.8571	0.7416	0.5605	0.3964	0.4372	0.6686	0.8734	0.9503	0.9739 (94)
Useful gains	723.7921	811.3852	846.2662	850.3374	764.7224	569.0175	386.0688	403.0349	584.2772	694.8219	700.6115	696.4810 (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	1576.9762	1536.8520	1397.2995	1169.6745	903.0553	602.0378	392.4055	412.4004	651.7664	986.7575	1301.3128	1564.1467 (97)
Space heating kWh	634.7689	487.5137	409.9687	229.9227	102.9197	0.0000	0.0000	0.0000	0.0000	217.2001	432.5049	645.5432 (98a)
Space heating requirement - total per year (kWh/year)	3160.3420											
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	634.7689	487.5137	409.9687	229.9227	102.9197	0.0000	0.0000	0.0000	0.0000	217.2001	432.5049	645.5432 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3160.3420											
Space heating per m ²	(98c) / (4) = 29.5470 (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	634.7689	487.5137	409.9687	229.9227	102.9197	0.0000	0.0000	0.0000	0.0000	217.2001	432.5049	645.5432 (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)	687.7237	528.1839	444.1698	249.1037	111.5056	0.0000	0.0000	0.0000	0.0000	235.3197	468.5860	699.3968 (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	249.2951	220.3814	234.0917	205.9445	199.6781	179.9917	177.7719	184.8482	186.8788	208.2923	221.3381	246.6069 (64)
Efficiency of water heater (217)m	86.0629	85.7879	85.3032	84.3074	82.6490	79.8000	79.8000	79.8000	79.8000	84.1538	85.5344	79.8000 (216)
Fuel for water heating, kWh/month	289.6661	256.8911	274.4230	244.2782	241.5976	225.5536	222.7718	231.6394	234.1839	247.5138	258.7709	286.3681 (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	30.5523	24.5102	22.0687	16.1685	12.4890	10.2036	11.3929	14.8089	19.2353	25.2378	28.5060	31.4014 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-48.6505	-67.8755	-96.5326	-107.3116	-114.6405	-106.5649	-105.2035	-99.8285	-90.2015	-77.0112	-53.2162	-42.1417 (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	-29.6547	-62.1368	-123.0772	-184.2629	-243.1057	-244.1212	-241.2874	-204.5680	-150.2758	-88.7060	-39.5372	-23.4719 (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)												

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(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												3423.9891	(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												3013.6573	(219)
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)												246.5746	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2643.3830	(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												4126.8380	(238)

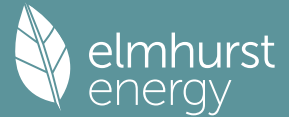
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3423.9891	0.2100	719.0377	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3013.6573	0.2100	632.8680	(264)
Space and water heating			1351.9058	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	246.5746	0.1443	35.5883	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1009.1781	0.1348	-136.0667	
PV Unit electricity exported	-1634.2049	0.1260	-205.8873	
Total			-341.9540	(269)
Total CO2, kg/year			1057.4693	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.8900	(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	3423.9891	1.1300	3869.1077	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.6573	1.1300	3405.4328	(278)
Space and water heating			7274.5405	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	246.5746	1.5338	378.2043	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1009.1781	1.4983	-1512.0715	
PV Unit electricity exported	-1634.2049	0.4625	-755.7541	
Total			-2267.8256	(283)
Total Primary energy kWh/year			5515.0200	(286)
Target Primary Energy Rate (TPER)			51.5600	(287)

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Property Reference	CLEAN	Issued on Date	09/05/2025
Assessment Reference	PLOT 14	Prop Type Ref	
Property	Highover Farm, Highover Way, Hitchin, Hertfordshire, SG4 0RQ		
SAP Rating	84 B	DER	3.46
Environmental	97 A	% DER < TER	65.02
CO ₂ Emissions (t/year)	0.35	DFEE	33.95
Compliance Check	See BREL	% DFEE < TFEE	2.88
% DPER < TPER	29.52	DPER	36.34
Assessor Details	Mr. Paul Allen	Assessor ID	8075-0001
Client	APC, AP		

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	53.4800 (1b)	x 2.4000 (2b)	= 128.3520 (1b) - (3b)
First floor	53.4800 (1c)	x 2.6500 (2c)	= 141.7220 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.0740 (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) = 0.1481 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3481 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3220 (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	0.4105	0.4025	0.3944	0.3542	0.3461	0.3059	0.3059	0.2978	0.3220	0.3461	0.3622	0.3783 (22b)
Effective ac	0.5843	0.5810	0.5778	0.5627	0.5599	0.5468	0.5468	0.5444	0.5518	0.5599	0.5656	0.5716 (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							
WINDOW			13.8500	1.2357	17.1150		(27)
DOOR			2.1500	1.3000	2.7950		(26)
Heatloss Floor 1			53.4800	0.1200	6.4176	110.0000	5882.8000 (28a)
EXP WALL	108.0700	16.0000	92.0700	0.1700	15.6519	60.0000	5524.2000 (29a)
External Roof 1	53.4800		53.4800	0.0900	4.8132	9.0000	481.3200 (30)
Total net area of external elements Aum(A, m ²)			215.0300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7927		(33)
Main dwelling							
Party Wall 1			43.9400	0.0000	0.0000	70.0000	3075.8000 (32)
Internal Wall 1			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			53.4800			18.0000	962.6400 (32d)
Internal Ceiling 1			53.4800			9.0000	481.3200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17308.0800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							161.8182 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				10.9300	0.3500	3.8255	
E3 Sill				9.9000	0.0120	0.1188	

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E4 Jamb	24.6000	0.0100	0.2460
E5 Ground floor (normal)	21.4000	0.0650	1.3910
E10 Eaves (insulation at ceiling level)	11.5000	0.0360	0.4140
E12 Gable (insulation at ceiling level)	18.6000	0.0550	1.0230
E16 Corner (normal)	20.2000	0.0540	1.0908
P1 Party wall - Ground floor	8.7000	0.0450	0.3915
E6 Intermediate floor within a dwelling	21.4000	0.0700	1.4980
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.9986 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =		56.7913 (37)

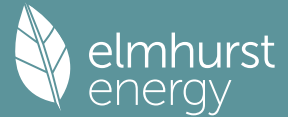
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.0732	51.7815	51.4957	50.1529	49.9016	48.7321	48.7321	48.5155	49.1826	49.9016	50.4099	50.9412 (38)
Average = Sum(39)m / 12 =	108.8645	108.5729	108.2870	106.9442	106.6929	105.5234	105.5234	105.3068	105.9739	106.6929	107.2012	107.7325 (39)
												106.9430
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0178	1.0151	1.0124	0.9999	0.9975	0.9866	0.9866	0.9845	0.9908	0.9975	1.0023	1.0072 (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												2.7953 (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	81.9957	80.7780	79.0631	75.9012	73.5337	70.9084	69.4904	71.1932	73.0473	75.8564	79.0834	81.7185 (42b)
Hot water usage for other uses	43.2566	41.6836	40.1107	38.5377	36.9647	35.3918	35.3918	36.9647	38.5377	40.1107	41.6836	43.2566 (42c)
Average daily hot water use (litres/day)												115.3471 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	125.2523	122.4616	119.1738	114.4389	110.4984	106.3002	104.8821	108.1579	111.5850	115.9671	120.7671	124.9751 (44)
Energy content (annual)	198.3690	174.3837	183.1657	156.6612	148.7521	130.7084	126.8458	133.9221	137.5955	157.3663	172.0548	195.6808 (45)
Distribution loss (46)m = 0.15 x (45)m	29.7554	26.1576	27.4748	23.4992	22.3128	19.6063	19.0269	20.0883	20.6393	23.6049	25.8082	29.3521 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8640 (55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (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	248.4154	219.5869	233.2121	205.0932	198.7985	179.1404	176.8922	183.9685	186.0275	207.4127	220.4868	245.7272 (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	248.4154	219.5869	233.2121	205.0932	198.7985	179.1404	176.8922	183.9685	186.0275	207.4127	220.4868	245.7272 (64)
12Total per year (kWh/year)												2504.7614 (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	105.9948	94.1451	100.9397	90.8354	89.4972	82.2062	82.2134	84.5662	84.4961	92.3614	95.9538	105.1010 (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	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.0414	162.7958	147.0414	151.9428	147.0414	151.9428	147.0414	147.0414	151.9428	147.0414	151.9428	147.0414 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280 (68)
Pumps, fans	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765 (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)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117 (71)
Total internal gains	142.4662	140.0969	135.6716	126.1603	120.2919	114.1752	110.5018	113.6643	117.3557	124.1417	133.2692	141.2648 (72)
	621.5508	637.7078	610.5432	591.0633	561.5229	542.6658	522.3053	522.6960	538.2736	555.0281	587.8277	608.5636 (73)

6. Solar gains												
[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				8.6900	36.7938	0.6000		0.7000		0.7700		93.0631 (77)
Southwest				0.6600	36.7938	0.6000		0.7000		0.7700		7.0681 (79)
Northwest				4.5000	11.2829	0.6000		0.7000		0.7700		14.7781 (81)
Solar gains	114.9092	200.6415	287.5648	378.1610	443.5193	449.0863	429.3156	379.2140	318.7279	225.2671	138.5287	97.7599 (83)
Total gains	736.4600	838.3493	898.1080	969.2243	1005.0422	991.7521	951.6210	901.9099	857.0015	780.2953	726.3563	706.3235 (84)

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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	44.1631	44.2818	44.3987	44.9562	45.0620	45.5615	45.5615	45.6552	45.3678	45.0620	44.8484	44.6272	
alpha	3.9442	3.9521	3.9599	3.9971	4.0041	4.0374	4.0374	4.0437	4.0245	4.0041	3.9899	3.9751	
util living area	0.9830	0.9707	0.9500	0.8965	0.7950	0.6271	0.4737	0.5160	0.7329	0.9125	0.9700	0.9854 (86)	
Living	19.7419	19.9138	20.1479	20.4622	20.7134	20.8655	20.9089	20.9030	20.8113	20.4919	20.0721	19.7179	
Non living	18.5909	18.8097	19.1055	19.4995	19.7921	19.9552	19.9895	19.9878	19.9045	19.5436	19.0204	18.5671	
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	20.3564	19.9138	20.1479	20.4622	20.7134	20.8655	20.9089	20.9030	20.8113	20.4919	20.0721	19.8972 (87)	
Th 2	20.0685	20.0708	20.0730	20.0835	20.0854	20.0945	20.0945	20.0962	20.0910	20.0854	20.0815	20.0773 (88)	
util rest of house	0.9794	0.9647	0.9394	0.8742	0.7511	0.5548	0.3823	0.4232	0.6671	0.8889	0.9628	0.9823 (89)	
MIT 2	19.4794	18.8097	19.1055	19.4995	19.7921	19.9552	19.9895	19.9878	19.9045	19.5436	19.0204	18.8392 (90)	
Living area fraction									fLA = Living area / (4) =				0.2001 (91)
MIT	19.6549	19.0306	19.3140	19.6921	19.9764	20.1373	20.1734	20.1709	20.0859	19.7333	19.2308	19.0509 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.6549	19.0306	19.3140	19.6921	19.9764	20.1373	20.1734	20.1709	20.0859	19.7333	19.2308	19.0509 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9775	0.9562	0.9288	0.8630	0.7454	0.5584	0.3905	0.4312	0.6667	0.8780	0.9543	0.9780 (94)
Useful gains	719.9240	801.6091	834.1361	836.4857	749.1114	553.8355	371.6073	388.9099	571.3463	685.1328	693.1475	690.7643 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.4000	16.4000	14.0000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1671.6041	1534.2017	1387.5935	1154.1558	883.0364	584.3154	377.0805	397.0990	634.3528	974.4592	1300.4385	1599.9235 (97)
Space heating kWh	708.0500	492.3022	411.7724	228.7225	99.6402	0.0000	0.0000	0.0000	0.0000	215.2589	437.2495	676.4144 (98a)
Space heating requirement - total per year (kWh/year)												3269.4101
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	708.0500	492.3022	411.7724	228.7225	99.6402	0.0000	0.0000	0.0000	0.0000	215.2589	437.2495	676.4144 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3269.4101
Space heating per m2										(98c) / (4) =		30.5667 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												334.7334 (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	708.0500	492.3022	411.7724	228.7225	99.6402	0.0000	0.0000	0.0000	0.0000	215.2589	437.2495	676.4144 (98)
Space heating efficiency (main heating system 1)	334.7334	334.7334	334.7334	334.7334	334.7334	0.0000	0.0000	0.0000	0.0000	334.7334	334.7334	334.7334 (210)
Space heating fuel (main heating system)	211.5266	147.0729	123.0150	68.3298	29.7670	0.0000	0.0000	0.0000	0.0000	64.3076	130.6262	202.0756 (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	248.4154	219.5869	233.2121	205.0932	198.7985	179.1404	176.8922	183.9685	186.0275	207.4127	220.4868	245.7272 (64)
Efficiency of water heater (217)m	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995 (216)
Fuel for water heating, kWh/month	128.5133	113.5993	120.6481	106.1013	102.8448	92.6751	91.5120	95.1728	96.2380	107.3012	114.0649	127.1226 (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	30.4636	24.4390	22.0046	16.1215	12.4527	10.1740	11.3598	14.7659	19.1794	25.1645	28.4232	31.3103 (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												976.7207 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												193.2995
Water heating fuel used												1295.7933 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												

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Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	245.8586 (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	2518.3726 (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	976.7207	0.1556	151.9409 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1295.7933	0.1409	182.5477 (264)
Space and water heating			334.4886 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	245.8586	0.1443	35.4850 (268)
Total CO2, kg/year			369.9736 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.4600 (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	976.7207	1.5759	1539.2118 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1295.7933	1.5209	1970.7868 (278)
Space and water heating			3509.9986 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	245.8586	1.5338	377.1061 (282)
Total Primary energy kWh/year			3887.1048 (286)
Dwelling Primary energy Rate (DPER)			36.3400 (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	53.4800 (1b)	x 2.4000 (2b)	= 128.3520 (1b) - (3b)
First floor	53.4800 (1c)	x 2.6500 (2c)	= 141.7220 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	270.0740 (5)

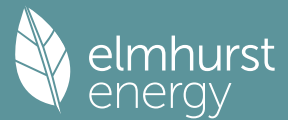
2. Ventilation rate

	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) = 0.1481 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3981 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3682 (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	0.4695	0.4603	0.4511	0.4051	0.3959	0.3498	0.3498	0.3406	0.3682	0.3959	0.4143	0.4327 (22b)
Effective ac	0.6102	0.6059	0.6017	0.5820	0.5784	0.5612	0.5612	0.5580	0.5678	0.5784	0.5858	0.5936 (25)

3. Heat losses and heat loss parameter

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Element													
Main dwelling													
TER Opaque door													(26)
TER Opening Type													(27)
Heatloss Floor 1													(28a)
EXP WALL													(29a)
External Roof 1													(30)
Total net area of external elements Aum(A, m2)													(31)
Fabric heat loss, W/K = Sum (A x U)													(33)
Main dwelling													
Party Wall 1													(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													161.8182 (35)
List of Thermal Bridges													
K1 Element													
E2 Other lintels (including other steel lintels)													
E3 Sill													
E4 Jamb													
E5 Ground floor (normal)													
E10 Eaves (insulation at ceiling level)													
E12 Gable (insulation at ceiling level)													
E16 Corner (normal)													
P1 Party wall - Ground floor													
E6 Intermediate floor within a dwelling													
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													10.0155 (36)
Point Thermal bridges													0.0000
Total fabric heat loss													(33) + (36) + (36a) = 57.4321 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m													
Heat transfer coeff													
Average = Sum(39)m / 12 =													
HLP													
HLP (average)													1.0316 (40)
Days in mont													1.0219
													31

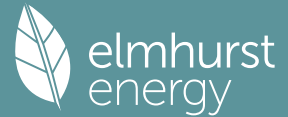
4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.7953 (42)
Hot water usage for mixer showers													
Hot water usage for baths													
Hot water usage for other uses													
Average daily hot water use (litres/day)													115.3471 (43)
Daily hot water use													
Energy conte													
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6525 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8924 (55)
Total storage loss													
If cylinder contains dedicated solar storage													
Primary loss													
Combi loss													
Total heat required for water heating calculated for each month													
WWHRS													
PV diverter													
Solar input													
FGHRS													
Output from w/h													
12Total per year (kWh/year)													
Electric shower(s)													
Heat gains from water heating, kWh/month													

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

Metabolic gains (Table 5), Watts													
(66)m													
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
Pumps, fans													
Losses e.g. evaporation (negative values) (Table 5)													
Water heating gains (Table 5)													
Total internal gains													

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6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
Southeast	8.6900		36.7938		0.6300		0.7000		0.7700		97.7162 (77)	
Southwest	0.6600		36.7938		0.6300		0.7000		0.7700		7.4215 (79)	
Northwest	4.5000		11.2829		0.6300		0.7000		0.7700		15.5170 (81)	
Solar gains	120.6547	210.6736	301.9431	397.0690	465.6953	471.5406	450.7814	398.1747	334.6643	236.5305	145.4551	102.6479 (83)
Total gains	746.1513	852.3273	916.4322	992.0782	1031.1641	1015.1523	974.0326	921.8165	873.8837	795.5045	737.2286	715.1574 (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	42.9967	43.1439	43.2891	43.9847	44.1173	44.7453	44.7453	44.8636	44.5013	44.1173	43.8498	43.5736
alpha	3.8664	3.8763	3.8859	3.9323	3.9412	3.9830	3.9830	3.9909	3.9668	3.9412	3.9233	3.9049
util living area	0.9825	0.9699	0.9485	0.8936	0.7907	0.6233	0.4709	0.5134	0.7308	0.9106	0.9693	0.9850 (86)
MIT	19.3809	19.6177	19.9401	20.3736	20.7151	20.9208	20.9797	20.9715	20.8461	20.4121	19.8384	19.3536 (87)
Th 2	20.0457	20.0486	20.0515	20.0651	20.0676	20.0795	20.0795	20.0817	20.0749	20.0676	20.0625	20.0571 (88)
util rest of house	0.9788	0.9637	0.9376	0.8705	0.7459	0.5502	0.3786	0.4196	0.6640	0.8864	0.9618	0.9818 (89)
MIT 2	18.1585	18.4596	18.8664	19.4076	19.8044	20.0235	20.0700	20.0674	19.9544	19.4652	18.7512	18.1315 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.4031	18.6913	19.0812	19.6009	19.9866	20.2031	20.2520	20.2483	20.1328	19.6547	18.9687	18.3760 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.4031	18.6913	19.0812	19.6009	19.9866	20.2031	20.2520	20.2483	20.1328	19.6547	18.9687	18.3760 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9700	0.9520	0.9234	0.8571	0.7416	0.5605	0.3964	0.4372	0.6686	0.8734	0.9503	0.9739 (94)
Useful gains	723.7921	811.3852	846.2662	850.3374	764.7224	569.0175	386.0688	403.0349	584.2772	694.8219	700.6115	696.4810 (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	1576.9762	1536.8520	1397.2995	1169.6745	903.0553	602.0378	392.4055	412.4004	651.7664	986.7575	1301.3128	1564.1467 (97)
Space heating kWh	634.7689	487.5137	409.9687	229.9227	102.9197	0.0000	0.0000	0.0000	0.0000	217.2001	432.5049	645.5432 (98a)
Space heating requirement - total per year (kWh/year)	3160.3420											
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	634.7689	487.5137	409.9687	229.9227	102.9197	0.0000	0.0000	0.0000	0.0000	217.2001	432.5049	645.5432 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3160.3420											
Space heating per m2	(98c) / (4) =											
	29.5470 (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	634.7689	487.5137	409.9687	229.9227	102.9197	0.0000	0.0000	0.0000	0.0000	217.2001	432.5049	645.5432 (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)	687.7237	528.1839	444.1698	249.1037	111.5056	0.0000	0.0000	0.0000	0.0000	235.3197	468.5860	699.3968 (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	249.2951	220.3814	234.0917	205.9445	199.6781	179.9917	177.7719	184.8482	186.8788	208.2923	221.3381	246.6069 (64)
Efficiency of water heater (217)m	86.0629	85.7879	85.3032	84.3074	82.6490	79.8000	79.8000	79.8000	79.8000	84.1538	85.5344	79.8000 (216)
Fuel for water heating, kWh/month	289.6661	256.8911	274.4230	244.2782	241.5976	225.5536	222.7718	231.6394	234.1839	247.5138	258.7709	286.3681 (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	30.5523	24.5102	22.0687	16.1685	12.4890	10.2036	11.3929	14.8089	19.2353	25.2378	28.5060	31.4014 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-48.6505	-67.8755	-96.5326	-107.3116	-114.6405	-106.5649	-105.2035	-99.8285	-90.2015	-77.0112	-53.2162	-42.1417 (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	-29.6547	-62.1368	-123.0772	-184.2629	-243.1057	-244.1212	-241.2874	-204.5680	-150.2758	-88.7060	-39.5372	-23.4719 (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)												

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(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												3423.9891	(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												3013.6573	(219)
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)												246.5746	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2643.3830	(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												4126.8380	(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	3423.9891	0.2100	719.0377	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3013.6573	0.2100	632.8680	(264)
Space and water heating			1351.9058	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	246.5746	0.1443	35.5883	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1009.1781	0.1348	-136.0667	
PV Unit electricity exported	-1634.2049	0.1260	-205.8873	
Total			-341.9540	(269)
Total CO2, kg/year			1057.4693	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.8900	(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	3423.9891	1.1300	3869.1077	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.6573	1.1300	3405.4328	(278)
Space and water heating			7274.5405	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	246.5746	1.5338	378.2043	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1009.1781	1.4983	-1512.0715	
PV Unit electricity exported	-1634.2049	0.4625	-755.7541	
Total			-2267.8256	(283)
Total Primary energy kWh/year			5515.0200	(286)
Target Primary Energy Rate (TPER)			51.5600	(287)

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Property Reference	GREEN			Issued on Date	09/05/2025	
Assessment Reference	PLOT 14		Prop Type Ref			
Property	Highover Farm, Highover Way, Hitchin, Hertfordshire, SG4 0RQ					
SAP Rating	93 A	DER	1.47	TER	9.89	
Environmental	99 A	% DER < TER				85.14
CO ₂ Emissions (t/year)	0.13	DFEE	33.95	TFEE	34.95	
Compliance Check	See BREL	% DFEE < TFEE				2.88
% DPER < TPER	67.49	DPER	16.76	TPER	51.56	
Assessor Details	Mr. Paul Allen			Assessor ID	8075-0001	
Client	APC, AP					

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	53.4800 (1b)	x 2.4000 (2b)	= 128.3520 (1b) - (3b)
First floor	53.4800 (1c)	x 2.6500 (2c)	= 141.7220 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.0740 (5)

2. Ventilation rate

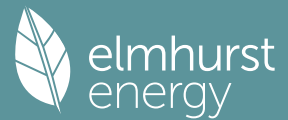
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.1481 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3481 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3220 (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	0.4105	0.4025	0.3944	0.3542	0.3461	0.3059	0.3059	0.2978	0.3220	0.3461	0.3622	0.3783 (22b)
Effective ac	0.5843	0.5810	0.5778	0.5627	0.5599	0.5468	0.5468	0.5444	0.5518	0.5599	0.5656	0.5716 (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							
WINDOW			13.8500	1.2357	17.1150		(27)
DOOR			2.1500	1.3000	2.7950		(26)
Heatloss Floor 1			53.4800	0.1200	6.4176	110.0000	5882.8000 (28a)
EXP WALL	108.0700	16.0000	92.0700	0.1700	15.6519	60.0000	5524.2000 (29a)
External Roof 1	53.4800		53.4800	0.0900	4.8132	9.0000	481.3200 (30)
Total net area of external elements Aum(A, m ²)			215.0300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7927		(33)
Main dwelling							
Party Wall 1			43.9400	0.0000	0.0000	70.0000	3075.8000 (32)
Internal Wall 1			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			53.4800			18.0000	962.6400 (32d)
Internal Ceiling 1			53.4800			9.0000	481.3200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17308.0800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							161.8182 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				10.9300	0.3500	3.8255	
E3 Sill				9.9000	0.0120	0.1188	

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E4 Jamb	24.6000	0.0100	0.2460	
E5 Ground floor (normal)	21.4000	0.0650	1.3910	
E10 Eaves (insulation at ceiling level)	11.5000	0.0360	0.4140	
E12 Gable (insulation at ceiling level)	18.6000	0.0550	1.0230	
E16 Corner (normal)	20.2000	0.0540	1.0908	
P1 Party wall - Ground floor	8.7000	0.0450	0.3915	
E6 Intermediate floor within a dwelling	21.4000	0.0700	1.4980	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.9986 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	56.7913 (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	52.0732	51.7815	51.4957	50.1529	49.9016	48.7321	48.7321	48.5155	49.1826	49.9016	50.4099	50.9412 (38)
Average = Sum(39)m / 12 =	108.8645	108.5729	108.2870	106.9442	106.6929	105.5234	105.5234	105.3068	105.9739	106.6929	107.2012	107.7325 (39)
												106.9430
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0178	1.0151	1.0124	0.9999	0.9975	0.9866	0.9866	0.9845	0.9908	0.9975	1.0023	1.0072 (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													2.7953 (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	81.9957	80.7780	79.0631	75.9012	73.5337	70.9084	69.4904	71.1932	73.0473	75.8564	79.0834	81.7185	(42b)
Hot water usage for other uses	43.2566	41.6836	40.1107	38.5377	36.9647	35.3918	35.3918	36.9647	38.5377	40.1107	41.6836	43.2566	(42c)
Average daily hot water use (litres/day)													115.3471 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	125.2523	122.4616	119.1738	114.4389	110.4984	106.3002	104.8821	108.1579	111.5850	115.9671	120.7671	124.9751	(44)
Energy content (annual)	198.3690	174.3837	183.1657	156.6612	148.7521	130.7084	126.8458	133.9221	137.5955	157.3663	172.0548	195.6808	(45)
Distribution loss (46)m = 0.15 x (45)m	29.7554	26.1576	27.4748	23.4992	22.3128	19.6063	19.0269	20.0883	20.6393	23.6049	25.8082	29.3521	(46)
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8640 (55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(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	248.4154	219.5869	233.2121	205.0932	198.7985	179.1404	176.8922	183.9685	186.0275	207.4127	220.4868	245.7272	(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	248.4154	219.5869	233.2121	205.0932	198.7985	179.1404	176.8922	183.9685	186.0275	207.4127	220.4868	245.7272	(64)
12Total per year (kWh/year)													2504.7614 (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	105.9948	94.1451	100.9397	90.8354	89.4972	82.2062	82.2134	84.5662	84.4961	92.3614	95.9538	105.1010	(65)

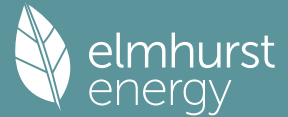
5. Internal gains (see Table 5 and 5a)

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	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.0414	162.7958	147.0414	151.9428	147.0414	151.9428	147.0414	147.0414	151.9428	147.0414	151.9428	147.0414	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280	(68)
Pumps, fans	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	(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)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	(71)
Total internal gains	142.4662	140.0969	135.6716	126.1603	120.2919	114.1752	110.5018	113.6643	117.3557	124.1417	133.2692	141.2648	(72)
	621.5508	637.7078	610.5432	591.0633	561.5229	542.6658	522.3053	522.6960	538.2736	555.0281	587.8277	608.5636	(73)

6. Solar gains

[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		
Southeast				8.6900	36.7938	0.6000		0.7000		0.7700	93.0631 (77)	
Southwest				0.6600	36.7938	0.6000		0.7000		0.7700	7.0681 (79)	
Northwest				4.5000	11.2829	0.6000		0.7000		0.7700	14.7781 (81)	
Solar gains	114.9092	200.6415	287.5648	378.1610	443.5193	449.0863	429.3156	379.2140	318.7279	225.2671	138.5287	97.7599 (83)
Total gains	736.4600	838.3493	898.1080	969.2243	1005.0422	991.7521	951.6210	901.9099	857.0015	780.2953	726.3563	706.3235 (84)

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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	44.1631	44.2818	44.3987	44.9562	45.0620	45.5615	45.5615	45.6552	45.3678	45.0620	44.8484	44.6272	21.0000 (85)
alpha	3.9442	3.9521	3.9599	3.9971	4.0041	4.0374	4.0374	4.0437	4.0245	4.0041	3.9899	3.9751	
util living area	0.9830	0.9707	0.9500	0.8965	0.7950	0.6271	0.4737	0.5160	0.7329	0.9125	0.9700	0.9854	(86)
Living	19.7419	19.9138	20.1479	20.4622	20.7134	20.8655	20.9089	20.9030	20.8113	20.4919	20.0721	19.7179	
Non living	18.5909	18.8097	19.1055	19.4995	19.7921	19.9552	19.9895	19.9878	19.9045	19.5436	19.0204	18.5671	
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	20.3564	19.9138	20.1479	20.4622	20.7134	20.8655	20.9089	20.9030	20.8113	20.4919	20.0721	19.8972	(87)
Th 2	20.0685	20.0708	20.0730	20.0835	20.0854	20.0945	20.0945	20.0962	20.0910	20.0854	20.0815	20.0773	(88)
util rest of house	0.9794	0.9647	0.9394	0.8742	0.7511	0.5548	0.3823	0.4232	0.6671	0.8889	0.9628	0.9823	(89)
MIT 2	19.4794	18.8097	19.1055	19.4995	19.7921	19.9552	19.9895	19.9878	19.9045	19.5436	19.0204	18.8392	(90)
Living area fraction									fLA = Living area / (4) =				0.2001 (91)
MIT	19.6549	19.0306	19.3140	19.6921	19.9764	20.1373	20.1734	20.1709	20.0859	19.7333	19.2308	19.0509	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6549	19.0306	19.3140	19.6921	19.9764	20.1373	20.1734	20.1709	20.0859	19.7333	19.2308	19.0509	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9775	0.9562	0.9288	0.8630	0.7454	0.5584	0.3905	0.4312	0.6667	0.8780	0.9543	0.9780	(94)
Useful gains	719.9240	801.6091	834.1361	836.4857	749.1114	553.8355	371.6073	388.9099	571.3463	685.1328	693.1475	690.7643	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.4000	16.4000	14.0000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1671.6041	1534.2017	1387.5935	1154.1558	883.0364	584.3154	377.0805	397.0990	634.3528	974.4592	1300.4385	1599.9235	(97)
Space heating kWh	708.0500	492.3022	411.7724	228.7225	99.6402	0.0000	0.0000	0.0000	0.0000	215.2589	437.2495	676.4144	(98a)
Space heating requirement - total per year (kWh/year)												3269.4101	
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	708.0500	492.3022	411.7724	228.7225	99.6402	0.0000	0.0000	0.0000	0.0000	215.2589	437.2495	676.4144	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3269.4101	
Space heating per m2										(98c) / (4) =		30.5667	(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)

Efficiency of main space heating system 1 (in %)

Efficiency of main space heating system 2 (in %)

Efficiency of secondary/supplementary heating system, %

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	708.0500	492.3022	411.7724	228.7225	99.6402	0.0000	0.0000	0.0000	0.0000	215.2589	437.2495	676.4144	(98)
Space heating efficiency (main heating system 1)	334.7334	334.7334	334.7334	334.7334	334.7334	0.0000	0.0000	0.0000	0.0000	334.7334	334.7334	334.7334	(210)
Space heating fuel (main heating system)	211.5266	147.0729	123.0150	68.3298	29.7670	0.0000	0.0000	0.0000	0.0000	64.3076	130.6262	202.0756	(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	248.4154	219.5869	233.2121	205.0932	198.7985	179.1404	176.8922	183.9685	186.0275	207.4127	220.4868	245.7272	(64)
Efficiency of water heater (217)m	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995	193.2995	(216)
Fuel for water heating, kWh/month	128.5133	113.5993	120.6481	106.1013	102.8448	92.6751	91.5120	95.1728	96.2380	107.3012	114.0649	127.1226	(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	30.4636	24.4390	22.0046	16.1215	12.4527	10.1740	11.3598	14.7659	19.1794	25.1645	28.4232	31.3103	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-42.2931	-69.8171	-116.8035	-149.0266	-172.7899	-162.7575	-160.3397	-144.8736	-118.3849	-86.6480	-49.6507	-35.2975	(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	-1.7884	-5.7519	-16.3675	-34.5160	-57.3139	-64.5843	-63.5466	-48.7039	-29.8362	-11.2564	-3.0533	-1.2983	(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												976.7207	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												193.2995	
Water heating fuel used												1295.7933	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

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Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	245.8586 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1646.6987 (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	871.6738 (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	976.7207	0.1556	151.9409 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1295.7933	0.1409	182.5477 (264)
Space and water heating			334.4886 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	245.8586	0.1443	35.4850 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1308.6820	0.1323	-173.0868
PV Unit electricity exported	-338.0167	0.1178	-39.8110
Total			-212.8978 (269)
Total CO2, kg/year			157.0758 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.4700 (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	976.7207	1.5759	1539.2118 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1295.7933	1.5209	1970.7868 (278)
Space and water heating			3509.9986 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	245.8586	1.5338	377.1061 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1308.6820	1.4887	-1948.2195
PV Unit electricity exported	-338.0167	0.4318	-145.9622
Total			-2094.1817 (283)
Total Primary energy kWh/year			1792.9231 (286)
Dwelling Primary energy Rate (DPER)			16.7600 (287)

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

1. Overall dwelling characteristics

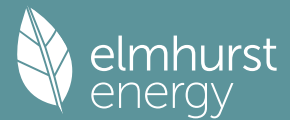
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	53.4800 (1b)	x 2.4000 (2b)	= 128.3520 (1b) - (3b)
First floor	53.4800 (1c)	x 2.6500 (2c)	= 141.7220 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.0740 (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) = 0.1481 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3981 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3682 (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)

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Adj infilt rate	0.4695	0.4603	0.4511	0.4051	0.3959	0.3498	0.3498	0.3406	0.3682	0.3959	0.4143	0.4327 (22b)
Effective ac	0.6102	0.6059	0.6017	0.5820	0.5784	0.5612	0.5612	0.5580	0.5678	0.5784	0.5858	0.5936 (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 Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type			13.8500	1.1450	15.8588		(27)
Heatloss Floor 1			53.4800	0.1300	6.9524		(28a)
EXP WALL	108.0700	16.0000	92.0700	0.1800	16.5726		(29a)
External Roof 1	53.4800		53.4800	0.1100	5.8828		(30)
Total net area of external elements Aum(A, m2)			215.0300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	47.4166		(33)
Main dwelling							
Party Wall 1			43.9400	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							161.8182 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.9300	0.0500	0.5465
E3 Sill	9.9000	0.0500	0.4950
E4 Jamb	24.6000	0.0500	1.2300
E5 Ground floor (normal)	21.4000	0.1600	3.4240
E10 Eaves (insulation at ceiling level)	11.5000	0.0600	0.6900
E12 Gable (insulation at ceiling level)	18.6000	0.0600	1.1160
E16 Corner (normal)	20.2000	0.0900	1.8180
P1 Party wall - Ground floor	8.7000	0.0800	0.6960
E6 Intermediate floor within a dwelling	21.4000	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.0155 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	57.4321 (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	54.3858	54.0044	53.6305	51.8742	51.5456	50.0160	50.0160	49.7327	50.6052	51.5456	52.2104	52.9053 (38)
Heat transfer coeff	111.8179	111.4364	111.0625	109.3063	108.9777	107.4481	107.4481	107.1648	108.0373	108.9777	109.6424	110.3374 (39)
Average = Sum(39)m / 12 =												109.3047
HLP	1.0454	1.0419	1.0384	1.0219	1.0189	1.0046	1.0046	1.0019	1.0101	1.0189	1.0251	1.0316 (40)
HLP (average)												1.0219
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

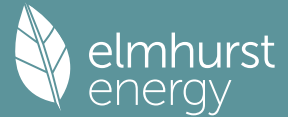
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7953 (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	81.9957	80.7780	79.0631	75.9012	73.5337	70.9084	69.4904	71.1932	73.0473	75.8564	79.0834	81.7185 (42b)
Hot water usage for other uses	43.2566	41.6836	40.1107	38.5377	36.9647	35.3918	35.3918	36.9647	38.5377	40.1107	41.6836	43.2566 (42c)
Average daily hot water use (litres/day)												115.3471 (43)
Daily hot water use	125.2523	122.4616	119.1738	114.4389	110.4984	106.3002	104.8821	108.1579	111.5850	115.9671	120.7671	124.9751 (44)
Energy conte	198.3690	174.3837	183.1657	156.6612	148.7521	130.7084	126.8458	133.9221	137.5955	157.3663	172.0548	195.6808 (45)
Energy content (annual)										Total = Sum(45)m =		1915.5054
Distribution loss (46)m = 0.15 x (45)m	29.7554	26.1576	27.4748	23.4992	22.3128	19.6063	19.0269	20.0883	20.6393	23.6049	25.8082	29.3521 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8924 (55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (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	249.2951	220.3814	234.0917	205.9445	199.6781	179.9917	177.7719	184.8482	186.8788	208.2923	221.3381	246.6069 (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	249.2951	220.3814	234.0917	205.9445	199.6781	179.9917	177.7719	184.8482	186.8788	208.2923	221.3381	246.6069 (64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2515.1188 (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	106.6986	94.7808	101.6434	91.5165	90.2009	82.8872	82.9171	85.2700	85.1771	93.0651	96.6349	105.8047 (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	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	147.0414	162.7958	147.0414	151.9428	147.0414	151.9428	147.0414	147.0414	151.9428	147.0414	151.9428	147.0414 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												

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Pumps, fans	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117 (71)
Total internal gains	143.4120	141.0428	136.6175	127.1062	121.2378	115.1211	111.4477	114.6102	118.3016	125.0876	134.2151	142.2107 (72)
	625.4967	641.6537	614.4891	595.0092	565.4688	543.6117	523.2512	523.6418	539.2195	558.9740	591.7736	612.5095 (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	
				8.6900	36.7938		0.6300	0.7000	0.7700		97.7162 (77)	
Southeast				0.6600	36.7938		0.6300	0.7000	0.7700		7.4215 (79)	
Southwest				4.5000	11.2829		0.6300	0.7000	0.7700		15.5170 (81)	
Northwest												
Solar gains	120.6547	210.6736	301.9431	397.0690	465.6953	471.5406	450.7814	398.1747	334.6643	236.5305	145.4551	102.6479 (83)
Total gains	746.1513	852.3273	916.4322	992.0782	1031.1641	1015.1523	974.0326	921.8165	873.8837	795.5045	737.2286	715.1574 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil, m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	42.9967	43.1439	43.2891	43.9847	44.1173	44.7453	44.7453	44.8636	44.5013	44.1173	43.8498	43.5736
util living area	3.8664	3.8763	3.8859	3.9323	3.9412	3.9830	3.9830	3.9909	3.9668	3.9412	3.9233	3.9049
	0.9825	0.9699	0.9485	0.8936	0.7907	0.6233	0.4709	0.5134	0.7308	0.9106	0.9693	0.9850 (86)
MIT	19.3809	19.6177	19.9401	20.3736	20.7151	20.9208	20.9797	20.9715	20.8461	20.4121	19.8384	19.3536 (87)
Th 2	20.0457	20.0486	20.0515	20.0651	20.0676	20.0795	20.0795	20.0817	20.0749	20.0676	20.0625	20.0571 (88)
util rest of house	0.9788	0.9637	0.9376	0.8705	0.7459	0.5502	0.3786	0.4196	0.6640	0.8864	0.9618	0.9818 (89)
MIT 2	18.1585	18.4596	18.8664	19.4076	19.8044	20.0235	20.0700	20.0674	19.9544	19.4652	18.7512	18.1315 (90)
Living area fraction	18.4031	18.6913	19.0812	19.6009	19.9866	20.2031	20.2520	20.2483	20.1328	19.6547	18.9687	18.3760 (92)
MIT	18.4031	18.6913	19.0812	19.6009	19.9866	20.2031	20.2520	20.2483	20.1328	19.6547	18.9687	18.3760 (93)
Temperature adjustment	18.4031	18.6913	19.0812	19.6009	19.9866	20.2031	20.2520	20.2483	20.1328	19.6547	18.9687	18.3760 (93)
adjusted MIT	18.4031	18.6913	19.0812	19.6009	19.9866	20.2031	20.2520	20.2483	20.1328	19.6547	18.9687	18.3760 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9700	0.9520	0.9234	0.8571	0.7416	0.5605	0.3964	0.4372	0.6686	0.8734	0.9503	0.9739 (94)
Ext temp.	723.7921	811.3852	846.2662	850.3374	764.7224	569.0175	386.0688	403.0349	584.2772	694.8219	700.6115	696.4810 (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	1576.9762	1536.8520	1397.2995	1169.6745	903.0553	602.0378	392.4055	412.4004	651.7664	986.7575	1301.3128	1564.1467 (97)
Space heating requirement - total per year (kWh/year)	634.7689	487.5137	409.9687	229.9227	102.9197	0.0000	0.0000	0.0000	0.0000	217.2001	432.5049	645.5432 (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)	634.7689	487.5137	409.9687	229.9227	102.9197	0.0000	0.0000	0.0000	0.0000	217.2001	432.5049	645.5432 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	634.7689	487.5137	409.9687	229.9227	102.9197	0.0000	0.0000	0.0000	0.0000	217.2001	432.5049	645.5432 (98c)
Space heating per m ²												29.5470 (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	634.7689	487.5137	409.9687	229.9227	102.9197	0.0000	0.0000	0.0000	0.0000	217.2001	432.5049	645.5432 (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)	687.7237	528.1839	444.1698	249.1037	111.5056	0.0000	0.0000	0.0000	0.0000	235.3197	468.5860	699.3968 (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	249.2951	220.3814	234.0917	205.9445	199.6781	179.9917	177.7719	184.8482	186.8788	208.2923	221.3381	246.6069 (64)
Efficiency of water heater (217)m	86.0629	85.7879	85.3032	84.3074	82.6490	79.8000	79.8000	79.8000	79.8000	84.1538	85.5344	79.8000 (216)
Fuel for water heating, kWh/month	289.6661	256.8911	274.4230	244.2782	241.5976	225.5536	222.7718	231.6394	234.1839	247.5138	258.7709	286.3681 (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	30.5523	24.5102	22.0687	16.1685	12.4890	10.2036	11.3929	14.8089	19.2353	25.2378	28.5060	31.4014 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-48.6505	-67.8755	-96.5326	-107.3116	-114.6405	-106.5649	-105.2035	-99.8285	-90.2015	-77.0112	-53.2162	-42.1417 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(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	-29.6547	-62.1368	-123.0772	-184.2629	-243.1057	-244.1212	-241.2874	-204.5680	-150.2758	-88.7060	-39.5372	-23.4719	(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												3423.9891	(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												3013.6573	(219)
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)												246.5746	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2643.3830	(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												4126.8380	(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	3423.9891	0.2100	719.0377 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3013.6573	0.2100	632.8680 (264)
Space and water heating			1351.9058 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	246.5746	0.1443	35.5883 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1009.1781	0.1348	-136.0667
PV Unit electricity exported	-1634.2049	0.1260	-205.8873
Total			-341.9540 (269)
Total CO2, kg/year			1057.4693 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.8900 (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	3423.9891	1.1300	3869.1077 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3013.6573	1.1300	3405.4328 (278)
Space and water heating			7274.5405 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	246.5746	1.5338	378.2043 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1009.1781	1.4983	-1512.0715
PV Unit electricity exported	-1634.2049	0.4625	-755.7541
Total			-2267.8256 (283)
Total Primary energy kWh/year			5515.0200 (286)
Target Primary Energy Rate (TPER)			51.5600 (287)

Predicted Energy Assessment



Highover Farm, Highover Way, Hitchin, Hertfordshire,
SG4 0RQ

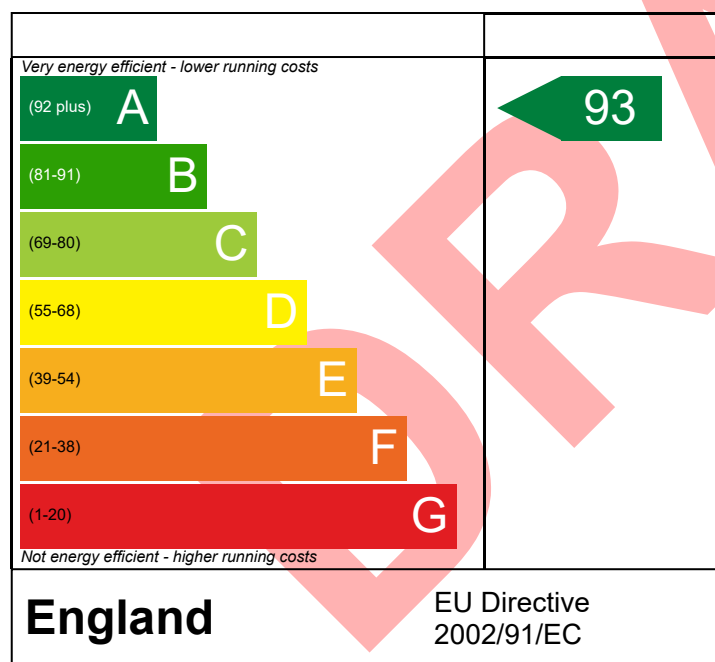
Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Semi-Detached
09/05/2025
Paul Allen
106.96 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

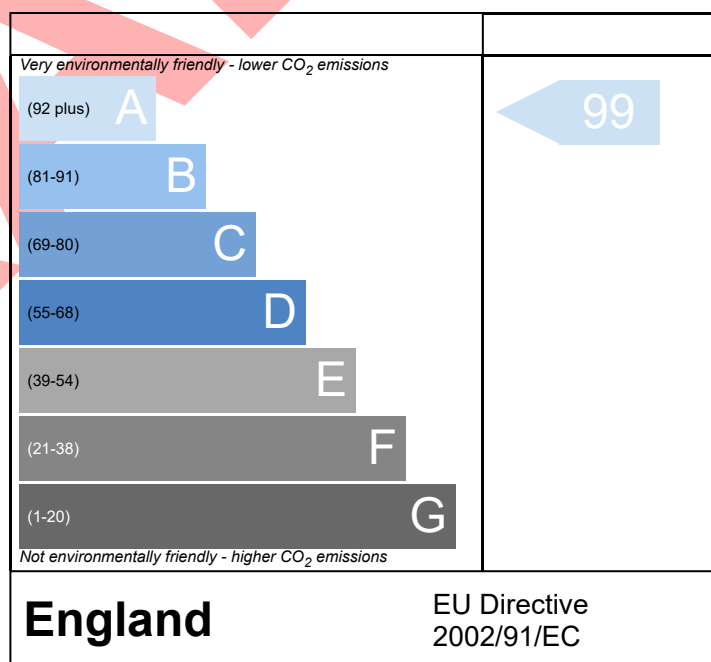
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data



Property Reference	REGS		Issued on Date	09/05/2025
Assessment Reference	PLOT 2	Prop Type Ref		
Property	Highover Farm, Highover Way, Hitchin, Hertfordshire, SG4 0RQ			

SAP Rating	74 C	DER	31.21	TER	
Environmental	66 D	% DER < TER			N/A
CO ₂ Emissions (t/year)	5.76	DFEE	75.52	TFEE	
Compliance Check	N/A	% DFEE < TFEE			
% DPER < TPER		DPER	126.42	TPER	

Assessor Details	Mr. Paul Allen	Assessor ID	8075-0001
Client	APC, AP		

SUMMARY FOR INPUT DATA FOR: Conversion (As Designed)

Orientation	Northeast	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Rural	
1.0 Property Type	House, Semi-Detached	
2.0 Number of Storeys	2	
3.0 Date Built	2025	
4.0 Sheltered Sides	1	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	214.38	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Ground floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	1st Storey:	35.81 m	98.50 m ²	2.40 m
		41.12 m	98.50 m ²	2.65 m

8.0 Living Area	18.00	m ²
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9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	EXP WALL	Solid Wall	Solid wall : plasterboard on dabs, 200 mm dense block, insulated externally	0.30	150.00	195.00	179.00	0.00	None	16.00	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill	0.00	70.00	12.70		None

9.2 Internal Walls	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Internal Wall 1	Plasterboard on timber frame	9.00	100.00

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	External Roof 1	External Plane Roof	Plasterboard, insulated at ceiling level	0.15	9.00	53.48	53.48	None	0.00	Enter Gross Area	0.00

10.2 Internal Ceilings	Description	Storey	Construction	Area (m ²)
	Internal Ceiling 1	+1	Plasterboard ceiling, carpeted chipboard floor	56.00

11.0 Heat Loss Floors	Description	Type	Storey Index	Construction	U-Value (W/m ² K)	Shelter Code	Shelter Factor	Kappa (kJ/m ² K)	Area (m ²)
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Summary for Input Data



Heatloss Floor 1 Ground Floor - Solid Lowest occupied Slab on ground, screed over insulation 0.20 None 0.00 110.00 98.50

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	98.50

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
WINDOW	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.60
DOOR	Manufacturer	Solid Door				0.00			1.80

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
DOOR FR	DOOR	EXP WALL	North East	2.15	
WDW FR	WINDOW	EXP WALL	North East	4.50	
WDW RR	WINDOW	EXP WALL	South West	8.69	
WDW RH	WINDOW	EXP WALL	North West	0.66	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Default

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)		10.93			No
E3 Sill		9.90			No
E4 Jamb		24.60			No
E5 Ground floor (normal)		21.40			No
E10 Eaves (insulation at ceiling level)		11.50			No
E12 Gable (insulation at ceiling level)		18.60			No
E16 Corner (normal)		20.20			No
P1 Party wall - Ground floor		8.70			No
E6 Intermediate floor within a dwelling		21.40			No

Y-value 0.20 W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present No

20.0 Fans, Open Fireplaces, Flues

Number of open chimneys 0

Number of open flues 0

Number of chimneys/flues attached to closed fire 0

Number of flues attached to solid fuel boiler 0

Number of flues attached to other heater 0

Number of blocked chimneys 0

Number of intermittent extract fans 3

Number of passive vents 0

Number of flueless gas fires 0

21.0 Fixed Cooling System

No

22.0 Pressure Testing

No

Test Method Blower Door

22.0 Lighting

No Fixed Lighting No

Name	Efficacy	Power	Capacity	Count
Lighting 1	134.17	6.00	805.00	10

24.0 Main Heating 1

Database

Percentage of Heat 100.00 %

Database Ref. No. 15230

Fuel Type Heating oil

In Winter 83.40

Summary for Input Data

In Summer	80.60											
Model Name	Greenstar Camray Utility											
Manufacturer	Worcester Bosch Group											
System Type	Regular boiler											
Controls SAP Code	2110											
Delayed Start Stat	No											
Oil Pump Inside	No											
Flue Type	None or Unknown											
Fan Assisted Flue	Yes											
Is MHS Pumped	Pump in heated space											
Heating Pump Age	2013 or later											
Heat Emitter	Underfloor											
Underfloor Heating	Yes - Pipes in thin screed											
Flow Temperature	Enter value											
Flow Temperature Value	45.00											
Boiler Interlock	No											
25.0 Main Heating 2												
												None
26.0 Heat Networks												
												None
27.0 Secondary Heating												
												None
28.0 Water Heating												
Water Heating	Main Heating 1											
SAP Code	901											
Flue Gas Heat Recovery System	No											
Waste Water Heat Recovery Instantaneous System 1	No											
Waste Water Heat Recovery Instantaneous System 2	No											
Waste Water Heat Recovery Storage System	No											
Solar Panel	No											
Water use <= 125 litres/person/day	Yes											
Cold Water Source	From mains											
Bath Count	1											
28.3 Waste Water Heat Recovery System												
29.0 Hot Water Cylinder												
Cylinder Stat	Hot Water Cylinder											
Cylinder In Heated Space	Yes											
Independent Time Control	Yes											
Insulation Type	Measured Loss											
Cylinder Volume	200.00										L	
Loss	1.60										kWh/day	
Pipes insulation	Fully insulated primary pipework											
In Airing Cupboard	No											
31.0 Thermal Store												
												None
34.0 Small-scale Hydro												
												None
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Recommendations												
Lower cost measures												
None												
Further measures to achieve even higher standards												

Summary for Input Data



Typical Cost	Typical savings per year	Ratings after improvement	
		SAP rating	Environmental Impact
£3,500 - £5,500	£294	C 75	D 68
£15,000 - £25,000	£715	C 78	D 67
		B 90	C 70

Summary for Input Data

Property Reference	REGS	Issued on Date	09/05/2025
Assessment Reference	PLOT 2-PROPOSED	Prop Type Ref	
Property	Highover Farm, Highover Way, Hitchin, Hertfordshire, SG4 0RQ		

SAP Rating	77 C	DER	4.52	TER	
Environmental	95 A	% DER < TER			N/A
CO ₂ Emissions (t/year)	0.84	DFEE	72.20	TFEE	
Compliance Check	N/A	% DFEE < TFEE			
% DPER < TPER		DPER	46.78	TPER	

Assessor Details	Mr. Paul Allen	Assessor ID	8075-0001
Client	APC, AP		

SUMMARY FOR INPUT DATA FOR: Conversion (As Designed)

Orientation	Northeast
Property Tenure	ND
Transaction Type	6
Terrain Type	Rural
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
Thermal Mass	214.38 kJ/m ² K
7.0 Electricity Tariff	Standard
Smart electricity meter fitted	Yes
Smart gas meter fitted	Yes

7.0 Measurements	Ground floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	1st Storey:	35.81 m	98.50 m ²	2.40 m
		41.12 m	98.50 m ²	2.65 m

8.0 Living Area	18.00 m ²
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9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	EXP WALL	Solid Wall	Solid wall : plasterboard on dabs, 200 mm dense block, insulated externally	0.24	150.00	195.00	179.00	0.00	None	16.00	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill	0.00	70.00	12.70		None

9.2 Internal Walls	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Internal Wall 1	Plasterboard on timber frame	9.00	100.00

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	External Roof 1	External Plane Roof	Plasterboard, insulated at ceiling level	0.14	9.00	53.48	53.48	None	0.00	Enter Gross Area	0.00

10.2 Internal Ceilings	Description	Storey	Construction	Area (m ²)
	Internal Ceiling 1	+1	Plasterboard ceiling, carpeted chipboard floor	56.00

11.0 Heat Loss Floors	Description	Type	Storey Index	Construction	U-Value (W/m ² K)	Shelter Code	Shelter Factor	Kappa (kJ/m ² K)	Area (m ²)
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Summary for Input Data

Heatloss Floor 1 Ground Floor - Solid Lowest occupied Slab on ground, screed over insulation 0.20 None 0.00 110.00 98.50

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	98.50

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
WINDOW	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
DOOR	Manufacturer	Solid Door				0.00			1.80

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
DOOR FR	DOOR	EXP WALL	North East	2.15	
WDW FR	WINDOW	EXP WALL	North East	4.50	
WDW RR	WINDOW	EXP WALL	South West	8.69	
WDW RH	WINDOW	EXP WALL	North West	0.66	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Default

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)		10.93			No
E3 Sill		9.90			No
E4 Jamb		24.60			No
E5 Ground floor (normal)		21.40			No
E10 Eaves (insulation at ceiling level)		11.50			No
E12 Gable (insulation at ceiling level)		18.60			No
E16 Corner (normal)		20.20			No
P1 Party wall - Ground floor		8.70			No
E6 Intermediate floor within a dwelling		21.40			No

Y-value 0.20 W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present No

20.0 Fans, Open Fireplaces, Flues

Number of open chimneys	0
Number of open flues	0
Number of chimneys/flues attached to closed fire	0
Number of flues attached to solid fuel boiler	0
Number of flues attached to other heater	0
Number of blocked chimneys	0
Number of intermittent extract fans	3
Number of passive vents	0
Number of flueless gas fires	0

21.0 Fixed Cooling System

No

22.0 Pressure Testing

No

Test Method Blower Door

22.0 Lighting

No Fixed Lighting No

Name	Efficacy	Power	Capacity	Count
Lighting 1	134.17	6.00	805.00	10

24.0 Main Heating 1

Database

Percentage of Heat 100.00 %

Database Ref. No. 102983

Fuel Type Electricity

In Winter 338.78

Summary for Input Data

In Summer	193.86											
Model Name	flexoTHERM 8kW											
Manufacturer	Vaillant Group UK Ltd											
System Type	Heat Pump											
Controls SAP Code	2207											
Is MHS Pumped	Pump in heated space											
Heating Pump Age	2013 or later											
Heat Emitter	Underfloor											
Underfloor Heating	Yes - Pipes in thin screed											
Flow Temperature	Enter value											
Flow Temperature Value	45.00											

25.0 Main Heating 2	None											
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26.0 Heat Networks	None											
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27.0 Secondary Heating	None											
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28.0 Water Heating												
Water Heating	Main Heating 1											
SAP Code	901											
Flue Gas Heat Recovery System	No											
Waste Water Heat Recovery Instantaneous System 1	No											
Waste Water Heat Recovery Instantaneous System 2	No											
Waste Water Heat Recovery Storage System	No											
Solar Panel	No											
Water use <= 125 litres/person/day	Yes											
Cold Water Source	From mains											
Bath Count	1											

28.3 Waste Water Heat Recovery System												
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29.0 Hot Water Cylinder	Hot Water Cylinder											
Cylinder Stat	Yes											
Cylinder In Heated Space	Yes											
Independent Time Control	Yes											
Insulation Type	Measured Loss											
Cylinder Volume	40.00										L	
Loss	1.60										kWh/day	
Pipes insulation	Fully insulated primary pipework											
In Airing Cupboard	No											

31.0 Thermal Store	None											
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34.0 Small-scale Hydro	None											
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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Recommendations												
Lower cost measures	None											
Further measures to achieve even higher standards												
	Typical Cost				Typical savings per year				Ratings after improvement			
	£4,000 - £6,000				£77				SAP rating C 78			
	£3,500 - £5,500				£317				SAP rating B 83			
	£15,000 - £25,000				£715				SAP rating A 94			
									Environmental Impact			
									A 95			
									A 97			
									A 99			