

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Mon 03 Mar 2025 15:09:47

Project Information			
Assessed By	James Turner	Building Type	House, Detached
OCDEA Registration	EES/003630	Assessment Date	2025-03-03

Dwelling Details			
Assessment Type	As designed	Total Floor Area	267 m ²
Site Reference	7358-0001-KW-578	Plot Reference	Proposed
Address	Proposed dwelling 1 The Drive, Blackmore End, AL4 8LE		

Client Details	
Name	Luke Kenton
Company	K W Architectural Design
Address	Lainswood House, Barnards Close, Chearsley, HP18 0BY

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	8.45 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	1.5 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	44.9 kWh _{PE} /m ²		
Dwelling primary energy	15.11 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	43.3 kWh/m ²		
Dwelling fabric energy efficiency	41.9 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.11	Heat Loss Floor 1 (0.11)	OK
Roofs	0.16	0.11	Roof (1) (0.13)	OK
Windows, doors, and roof windows	1.6	1.16	Opening 3 (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	201.711	0.18
Ground floor: Heat Loss Floor 1, Heat Loss Floor 1	133.38	0.11
Exposed roof: Roof (1)	2.88	0.13
Exposed roof: Roof (2)	111.45	0.11
Exposed roof: Roof (3)	23.82	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Opening 1, Entrance door	3.78	North East	N/A	0.8 (!)
Opening 2, Entrance door	1.974	South West	N/A	0.8 (!)
Opening 3, sliding/folding doors	7.0875	South East	0.7	1.2
Opening 3, sliding/folding doors	7.0875	South East	0.7	1.2
Opening 4, Windows	1.5	South West	0.7	1.2
Opening 4, Windows	1.5	South West	0.7	1.2
Opening 5, Windows	2.16	North West	0.7	1.2
Opening 5, Windows	2.16	North West	0.7	1.2
Opening 5, Windows	1.5	North West	0.7	1.2
Opening 6, Windows	2.16	South East	0.7	1.2
Opening 6, Windows	2.16	South East	0.7	1.2
Opening 6, Windows	1.5	South East	0.7	1.2

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Opening 7, Windows	4.68	North East	0.7	1.2
Opening 7, Windows	4.68	North East	0.7	1.2
Opening 7, Windows	4.68	North East	0.7	1.2
Opening 7, Windows	4.68	North East	0.7	1.2
Opening 8, Fixed glazing	5.1	North East	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.024 (!)	MHF-150-E2-02
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.202	Kingspan K106 detail
External wall	E3: Sill	Calculated by person with suitable expertise	0.023 (!)	MHF-150-E3-01
External wall	E4: Jamb	Calculated by person with suitable expertise	0.018 (!)	MHF-150-E4-01
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.073	MHF-150-E5-04
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.001 (!)	MHF-150-E6-01
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.038 (!)	MHF-150-E13-01
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.069	MHF-150-E10-01
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.152	ROI detail 1.20
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.036 (!)	MHF-150-E16-01
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.062	MHF-150-E17-01
Roof	R4: Ridge (vaulted ceiling)	SAP table default	0.12	
Roof	R6: Flat ceiling	Calculated by person with suitable expertise	0.02 (!)	ROI detail 1.13.2

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	5.01 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity

Efficiency	373.8%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Mitsubishi Electric Europe B.V.
Model	Ecodan 14.0 kW
Commissioning	

Secondary heating system: Closed room heater

Fuel	Wood logs
Efficiency	65.0%
Commissioning	

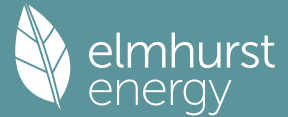
5 Hot water

Cylinder/store - type: Cylinder

Capacity	300 litres
Declared heat loss	2.26 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		
6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	0.9 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	91%	OK
Manufacturer/Model	Sentinel Kinetic Plus BS	
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	3.8 kWp	
Orientation	South East	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	7358-0001-KW-578				Issued on Date	03/03/2025	
Assessment Reference	Proposed			Prop Type Ref			
Property	Proposed dwelling, 1 The Drive, Blackmore End, Herts, AL4 8LE						
SAP Rating	93 A	DER	1.50	TER	8.45		
Environmental	98 A	% DER < TER				82.25	
CO ₂ Emissions (t/year)	0.32	DFEE	41.89	TFEE	43.25		
Compliance Check	See BREL	% DFEE < TFEE				3.16	
% DPER < TPER	66.36	DPER	15.11	TPER	44.90		
Assessor Details	Mr. James Turner				Assessor ID	7358-0001	
Client	603, Luke Kenton						

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	133.3800 (1b)	x 2.4100 (2b)	= 321.4458 (1b) - (3b)
First floor	133.3800 (1c)	x 2.8500 (2c)	= 380.1330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	266.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 701.5788 (5)

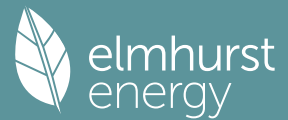
2. Ventilation rate

	m ³ per hour											
Number of open chimneys	0 * 80 = 0.0000 (6a)											
Number of open flues	0 * 20 = 0.0000 (6b)											
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)											
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)											
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)											
Number of blocked chimneys	0 * 20 = 0.0000 (6f)											
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)											
Number of passive vents	0 * 10 = 0.0000 (7b)											
Number of flueless gas fires	0 * 40 = 0.0000 (7c)											
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)											
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	5.0100 (17)											
Infiltration rate	0.2505 (18)											
Number of sides sheltered	0 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2505 (21)											
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3194	0.3131	0.3069	0.2756	0.2693	0.2380	0.2380	0.2317	0.2505	0.2693	0.2818	0.2943 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.9000 (23c)
Effective ac	0.4099	0.4036	0.3974	0.3660	0.3598	0.3285	0.3285	0.3222	0.3410	0.3598	0.3723	0.3848 (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							
Entrance door			5.7500	0.8000	4.6000		(26)
sliding/folding doors			14.1800	1.1450	16.2366		(27)
Windows			33.3600	1.1450	38.1985		(27)
Fixed glazing			5.1000	1.1450	5.8397		(27)
Heat Loss Floor 1			133.3800	0.1100	14.6718	65.5200	8739.0576 (28a)
Brick wall	260.1000	58.3900	201.7100	0.1800	36.3078	113.6000	22914.2560 (29a)
Bay windows	2.8800		2.8800	0.1300	0.3744	0.0000	0.0000 (30)
Main roof	111.4500		111.4500	0.1100	12.2595	12.1700	1356.3465 (30)
Vaulted	23.8200		23.8200	0.1200	2.8584	12.1700	289.8894 (30)
Total net area of external elements Aum(A, m ²)			531.6300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		131.3467		(33)
Main dwelling							
Internal Wall 1			209.2200			9.0000	1882.9800 (32c)
Internal Wall 2			212.2400			75.0000	15918.0000 (32c)

Full SAP Calculation Printout

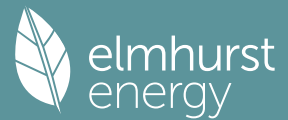


Internal Floor 1	133.3800										18.0000	2400.8400	(32d)	
Internal Ceiling 1	133.3800										9.0000	1200.4200	(32e)	
Heat capacity Cm = Sum(A x k)														
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K														
(28)...(30) + (32) + (32a)...(32e) = 54701.7895 (34)														
List of Thermal Bridges														
K1 Element											Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)											6.7500	0.0240	0.1620	
E2 Other lintels (including other steel lintels)											30.5400	0.2020	6.1691	
E3 Sill											27.8000	0.0230	0.6394	
E4 Jamb											45.6000	0.0180	0.8208	
E5 Ground floor (normal)											51.0000	0.0730	3.7230	
E6 Intermediate floor within a dwelling											51.0000	0.0010	0.0510	
E13 Gable (insulation at rafter level)											4.2000	0.0380	0.1596	
E10 Eaves (insulation at ceiling level)											47.7800	0.0690	3.2968	
E14 Flat roof											6.8000	0.1520	1.0336	
E16 Corner (normal)											51.0000	0.0360	1.8360	
E17 Corner (inverted - internal area greater than external area)											30.6000	-0.0620	-1.8972	
R4 Ridge (vaulted ceiling)											6.4000	0.1200	0.7680	
R6 Flat ceiling											12.8000	0.0200	0.2560	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)														
												(36a) =	17.0181	(36)
Point Thermal bridges													0.0000	
Total fabric heat loss												(33) + (36) + (36a) =	148.3648	(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		
	94.8976	93.4477	91.9978	84.7483	83.2984	76.0489	76.0489	74.5990	78.9487	83.2984	86.1982	89.0980	(38)	
Heat transfer coeff														
	243.2624	241.8125	240.3626	233.1131	231.6632	224.4137	224.4137	222.9638	227.3135	231.6632	234.5630	237.4628	(39)	
Average = Sum(39)m / 12 =														
												232.7506		
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9119	0.9065	0.9010	0.8739	0.8684	0.8413	0.8413	0.8358	0.8521	0.8684	0.8793	0.8902	(40)	
HLP (average)														
												0.8725		
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31		

4. Water heating energy requirements (kWh/year)														

Assumed occupancy														
												3.0887	(42)	
Hot water usage for mixer showers														
	85.5085	84.2235	82.3509	78.7682	76.1242	73.1756	71.4997	73.3580	75.3951	78.5610	82.2207	85.1809	(42a)	
Hot water usage for baths														
	32.8089	32.3217	31.6355	30.3704	29.4230	28.3726	27.8052	28.4865	29.2284	30.3524	31.6437	32.6980	(42b)	
Hot water usage for other uses														
	46.2616	44.5793	42.8971	41.2148	39.5326	37.8504	37.8504	39.5326	41.2148	42.8971	44.5793	46.2616	(42c)	
Average daily hot water use (litres/day)														
												151.3110	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	164.5790	161.1245	156.8835	150.3534	145.0798	139.3986	137.1552	141.3772	145.8384	151.8105	158.4437	164.1404	(44)	
Energy conte	260.6529	229.4391	241.1241	205.8262	195.3053	171.4068	165.8773	175.0545	179.8333	206.0054	225.7321	257.0043	(45)	
Energy content (annual)														
												Total = Sum(45)m =	2513.2614	
Distribution loss (46)m = 0.15 x (45)m														
	39.0979	34.4159	36.1686	30.8739	29.2958	25.7110	24.8816	26.2582	26.9750	30.9008	33.8598	38.5506	(46)	
Water storage loss:														
Store volume												300.0000	(47)	
a) If manufacturer declared loss factor is known (kWh/day):														
Temperature factor from Table 2b												2.2600	(48)	
Enter (49) or (54) in (55)														
												0.5400	(49)	
												1.2204	(55)	
Total storage loss														
	37.8324	34.1712	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324	36.6120	37.8324	36.6120	37.8324	(56)	
If cylinder contains dedicated solar storage														
	37.8324	34.1712	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324	36.6120	37.8324	36.6120	37.8324	(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														
	321.7477	284.6215	302.2189	264.9502	256.4001	230.5308	226.9721	236.1493	238.9573	267.1002	284.8561	318.0991	(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														
	321.7477	284.6215	302.2189	264.9502	256.4001	230.5308	226.9721	236.1493	238.9573	267.1002	284.8561	318.0991	(64)	
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m =	3232.6034	(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														
	135.5429	120.4344	129.0496	115.7364	113.8149	104.2920	104.0301	107.0815	107.0938	117.3726	122.3551	134.3298	(65)	

Full SAP Calculation Printout



[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				14.1800	36.7938	0.6300		0.7000		0.7700		159.4495 (77)
Northeast				18.7200	11.2829	0.6300		0.7000		0.7700		64.5506 (75)
Southeast				5.8200	36.7938	0.6300		0.7000		0.7700		65.4440 (77)
Southwest				3.0000	36.7938	0.6300		0.7000		0.7700		33.7340 (79)
Northwest				5.8200	11.2829	0.6300		0.7000		0.7700		20.0686 (81)
Northeast				5.1000	11.2829	0.5700		0.7000		0.7700		15.9110 (75)
Solar gains	359.1577	645.1704	971.4457	1352.3353	1650.4245	1698.1777	1612.3850	1380.8718	1101.9104	736.9654	436.2691	303.4293 (83)
Total gains	1260.8518	1571.8810	1857.6182	2209.1336	2461.8704	2480.3613	2363.2237	2131.3420	1875.7735	1536.5115	1285.5782	1184.4868 (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	62.4632	62.8377	63.2168	65.1827	65.5907	67.7095	67.7095	68.1498	66.8458	65.5907	64.7798	63.9887
alpha	5.1642	5.1892	5.2145	5.3455	5.3727	5.5140	5.5140	5.5433	5.4564	5.3727	5.3187	5.2659
util living area	0.9984	0.9946	0.9821	0.9255	0.7819	0.5667	0.4158	0.4768	0.7608	0.9657	0.9957	0.9988 (86)
Living	19.9026	20.0772	20.3245	20.6523	20.8566	20.9323	20.9420	20.9405	20.8902	20.5965	20.2036	19.8977
Non living	18.8463	19.0731	19.3908	19.8136	20.0456	20.1383	20.1448	20.1491	20.0962	19.7568	19.2537	18.8546
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	20.4386	20.0772	20.3245	20.6523	20.8566	20.9323	20.9420	20.9405	20.8902	20.5965	20.2036	20.0519 (87)
Th 2	20.1574	20.1620	20.1666	20.1898	20.1944	20.2177	20.2177	20.2224	20.2084	20.1944	20.1851	20.1759 (88)
util rest of house	0.9979	0.9931	0.9771	0.9061	0.7360	0.5022	0.3429	0.3984	0.6967	0.9531	0.9943	0.9985 (89)
MIT 2	19.6347	19.0731	19.3908	19.8136	20.0456	20.1383	20.1448	20.1491	20.0962	19.7568	19.2537	19.0927 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.8060	19.2870	19.5897	19.9923	20.2184	20.3075	20.3147	20.3177	20.2654	19.9357	19.4561	19.2971 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.8060	19.2870	19.5897	19.9923	20.2184	20.3075	20.3147	20.3177	20.2654	19.9357	19.4561	19.2971 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9977	0.9911	0.9727	0.9006	0.7374	0.5098	0.3520	0.4081	0.7017	0.9480	0.9926	0.9980 (94)
Useful gains	1257.9225	1557.8171	1806.9461	1989.5662	1815.4979	1264.4177	831.8999	869.8244	1316.2700	1456.5725	1276.0423	1182.1582 (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	3772.0210	3478.9595	3146.2785	2585.7620	1973.3968	1280.8334	833.6269	873.5065	1401.4723	2162.7436	2898.2840	3584.9928 (97)
Space heating kWh	1870.4893	1291.0077	996.4634	429.2610	117.4768	0.0000	0.0000	0.0000	0.0000	525.3913	1168.0140	1787.7089 (98a)
Space heating requirement - total per year (kWh/year)												8185.8124
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	1870.4893	1291.0077	996.4634	429.2610	117.4768	0.0000	0.0000	0.0000	0.0000	525.3913	1168.0140	1787.7089 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8185.8124
Space heating per m2	(98c) / (4) =											30.6861 (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 %)												373.8177 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1870.4893	1291.0077	996.4634	429.2610	117.4768	0.0000	0.0000	0.0000	0.0000	525.3913	1168.0140	1787.7089 (98)
Space heating efficiency (main heating system 1)	373.8177	373.8177	373.8177	373.8177	373.8177	0.0000	0.0000	0.0000	0.0000	373.8177	373.8177	373.8177 (210)
Space heating fuel (main heating system)	500.3747	345.3576	266.5640	114.8316	31.4262	0.0000	0.0000	0.0000	0.0000	140.5475	312.4555	478.2301 (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	321.7477	284.6215	302.2189	264.9502	256.4001	230.5308	226.9721	236.1493	238.9573	267.1002	284.8561	318.0991 (64)
Efficiency of water heater												167.7916 (216)
(217)m	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916 (217)
Fuel for water heating, kWh/month	191.7544	169.6280	180.1157	157.9044	152.8087	137.3912	135.2703	140.7397	142.4132	159.1857	169.7678	189.5799 (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	81.7820	73.8676	81.7820	79.1439	81.7820	79.1439	81.7820	81.7820	79.1439	81.7820	79.1439	81.7820 (231)
Lighting	45.5926	36.5761	32.9327	24.1279	18.6371	15.2267	17.0014	22.0990	28.7045	37.6618	42.5389	46.8598 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-90.0921	-148.7072	-248.5151	-322.9509	-386.2496	-373.8197	-369.4413	-329.0830	-264.9253	-187.7590	-106.4256	-75.5380 (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)												

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(233b)m	-0.3221	-1.4098	-5.0545	-13.7119	-26.8174	-31.0956	-30.6301	-22.3844	-12.7388	-3.5843	-0.6709	-0.2218	(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												2189.7873	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												167.7916	
Water heating fuel used												1926.5590	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1250)													
mechanical ventilation fans (SFP = 1.1250)												962.9169	(230a)
Total electricity for the above, kWh/year												962.9169	(231)
Electricity for lighting (calculated in Appendix L)												367.9585	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3052.1485	(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												2395.0733	(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	2189.7873	0.1564	342.4185	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1926.5590	0.1409	271.5302	(264)
Space and water heating			613.9487	(265)
Pumps, fans and electric keep-hot	962.9169	0.1387	133.5684	(267)
Energy for lighting	367.9585	0.1443	53.1078	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2903.5068	0.1318	-382.6306	
PV Unit electricity exported	-148.6417	0.1145	-17.0217	
Total			-399.6524	(269)
Total CO2, kg/year			400.9726	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.5000	(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	2189.7873	1.5789	3457.4207	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1926.5590	1.5211	2930.5832	(278)
Space and water heating			6388.0038	(279)
Pumps, fans and electric keep-hot	962.9169	1.5128	1456.7007	(281)
Energy for lighting	367.9585	1.5338	564.3871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2903.5068	1.4869	-4317.1789	
PV Unit electricity exported	-148.6417	0.4196	-62.3670	
Total			-4379.5458	(283)
Total Primary energy kWh/year			4029.5458	(286)
Dwelling Primary energy Rate (DPER)			15.1100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

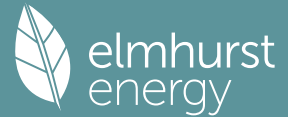
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	133.3800 (1b)	x 2.4100 (2b)	= 321.4458 (1b) - (3b)	
First floor	133.3800 (1c)	x 2.8500 (2c)	= 380.1330 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	266.7600		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	701.5788 (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)

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Number of passive vents
Number of flueless gas fires

0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

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

Air changes per hour
40.0000 / (5) = 0.0570 (8)
Yes
Blower Door
5.0000 (17)
0.3070 (18)
0 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 1.0000 (20)
(21) = (18) x (20) = 0.3070 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.3914	0.3838	0.3761	0.3377	0.3300	0.2917	0.2917	0.2840	0.3070	0.3300	0.3454	0.3607 (22b)
Effective ac	0.5766	0.5736	0.5707	0.5570	0.5545	0.5425	0.5425	0.5403	0.5471	0.5545	0.5596	0.5651 (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			5.7500	1.0000	5.7500		(26)
TER Opening Type			52.6400	1.1450	60.2748		(27)
Heat Loss Floor 1			133.3800	0.1300	17.3394		(28a)
Brick wall	260.1000	58.3900	201.7100	0.1800	36.3078		(29a)
Bay windows	2.8800		2.8800	0.1100	0.3168		(30)
Main roof	111.4500		111.4500	0.1100	12.2595		(30)
Vaulted	23.8200		23.8200	0.1100	2.6202		(30)
Total net area of external elements Aum(A, m2)			531.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	134.8685		(33)

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

205.0599 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	6.7500	0.0500	0.3375
E2 Other lintels (including other steel lintels)	30.5400	0.0500	1.5270
E3 Sill	27.8000	0.0500	1.3900
E4 Jamb	45.6000	0.0500	2.2800
E5 Ground floor (normal)	51.0000	0.1600	8.1600
E6 Intermediate floor within a dwelling	51.0000	0.0000	0.0000
E13 Gable (insulation at rafter level)	4.2000	0.0800	0.3360
E10 Eaves (insulation at ceiling level)	47.7800	0.0600	2.8668
E14 Flat roof	6.8000	0.0800	0.5440
E16 Corner (normal)	51.0000	0.0900	4.5900
E17 Corner (inverted - internal area greater than external area)	30.6000	-0.0900	-2.7540
R4 Ridge (vaulted ceiling)	6.4000	0.0800	0.5120
R6 Flat ceiling	12.8000	0.0600	0.7680

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

20.5573 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 155.4258 (37)

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

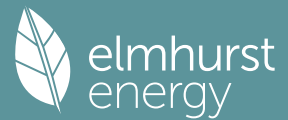
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	133.4982	132.8094	132.1343	128.9632	128.3699	125.6080	125.6080	125.0965	126.6718	128.3699	129.5701	130.8250 (38)
Heat transfer coeff												
	288.9240	288.2353	287.5601	284.3890	283.7957	281.0338	281.0338	280.5223	282.0976	283.7957	284.9960	286.2508 (39)
Average = Sum(39)m / 12 =												284.3862

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0831	1.0805	1.0780	1.0661	1.0639	1.0535	1.0535	1.0516	1.0575	1.0639	1.0684	1.0731 (40)
HLP (average)												1.0661
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0887 (42)
Hot water usage for mixer showers													
	76.0075	74.8653	73.2008	70.0161	67.6659	65.0450	63.5553	65.2071	67.0179	69.8320	73.0851	75.7163	(42a)
Hot water usage for baths													
	32.8089	32.3217	31.6355	30.3704	29.4230	28.3726	27.8052	28.4865	29.2284	30.3524	31.6437	32.6980	(42b)
Hot water usage for other uses													
	46.2616	44.5793	42.8971	41.2148	39.5326	37.8504	37.8504	39.5326	41.2148	42.8971	44.5793	46.2616	(42c)
Average daily hot water use (litres/day)													142.5514 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	155.0780	151.7663	147.7334	141.6014	136.6216	131.2679	129.2108	133.2263	137.4612	143.0815	149.3080	154.6759	(44)
Energy content (annual)	245.6057	216.1132	227.0608	193.8452	183.9189	161.4093	156.2693	164.9620	169.5034	194.1603	212.7167	242.1851	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2367.7496	
	36.8409	32.4170	34.0591	29.0768	27.5878	24.2114	23.4404	24.7443	25.4255	29.1240	31.9075	36.3278	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1127 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1409 (55)
Total storage loss													
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage													
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	304.2345	269.0682	285.6896	250.5827	242.5477	218.1468	214.8981	223.5908	226.2409	252.7891	269.4542	300.8139	(62)
WWHRS	-34.7475	-30.7309	-32.1797	-26.6460	-24.8332	-21.2499	-19.9184	-21.1812	-21.9860	-25.9190	-29.3631	-34.1040	(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													

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269.4871	238.3373	253.5099	223.9367	217.7145	196.8969	194.9797	202.4096	204.2550	226.8700	240.0911	266.7099 (64)
Total per year (kWh/year) = Sum(64)m =											2735.1977 (64)
Electric shower(s)											2735 (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)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month											
128.5669	114.2217	122.4008	109.8436	108.0561	99.0586	98.8626	101.7529	101.7499	111.4613	116.1183	127.4296 (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	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	219.1162	242.5929	219.1162	226.4201	219.1162	226.4201	219.1162	219.1162	226.4201	219.1162	226.4201	219.1162 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	430.7549	435.2248	423.9608	399.9812	369.7111	341.2616	322.2555	317.7857	329.0496	353.0293	383.2993	411.7489 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487 (71)
Water heating gains (Table 5)	172.8050	169.9727	164.5171	152.5605	145.2367	137.5814	132.8798	136.7647	141.3193	149.8136	161.2755	171.2763 (72)
Total internal gains	895.0069	920.1212	879.9249	851.2925	806.3948	774.5938	743.5823	742.9973	766.1198	794.2899	843.3256	874.4722 (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	
Northeast	23.8200	11.2829	0.6300	0.7000	0.7700	82.1364 (75)
Southeast	20.0000	36.7938	0.6300	0.7000	0.7700	224.8935 (77)
Southwest	3.0000	36.7938	0.6300	0.7000	0.7700	33.7340 (79)
Northwest	5.8200	11.2829	0.6300	0.7000	0.7700	20.0686 (81)

Solar gains	360.8325	648.5796	977.5880	1362.4227	1663.9839	1712.6335	1625.9081	1391.6526	1109.3949	741.1317	438.3765	304.7970 (83)
Total gains	1255.8394	1568.7009	1857.5130	2213.7152	2470.3787	2487.2273	2369.4904	2134.6499	1875.5147	1535.4215	1281.7021	1179.2692 (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
52.5915	52.7172	52.8409	53.4301	53.5418	54.0680	54.0680	54.1666	53.8641	53.5418	53.3163	53.0826	53.0826
alpha	4.5061	4.5145	4.5227	4.5620	4.5695	4.6045	4.6045	4.6111	4.5909	4.5695	4.5544	4.5388
util living area												
0.9983	0.9950	0.9855	0.9478	0.8465	0.6694	0.5090	0.5796	0.8360	0.9751	0.9960	0.9987	0.9987 (86)
MIT	19.3030	19.5358	19.8874	20.3596	20.7384	20.9361	20.9855	20.9745	20.8192	20.3061	19.7202	19.2708 (87)
Th 2	20.0147	20.0168	20.0189	20.0286	20.0305	20.0390	20.0390	20.0406	20.0357	20.0305	20.0268	20.0229 (88)
util rest of house												
0.9978	0.9936	0.9812	0.9318	0.8020	0.5876	0.4040	0.4700	0.7717	0.9647	0.9947	0.9984	0.9984 (89)
MIT 2	18.0103	18.3095	18.7584	19.3542	19.7960	19.9979	20.0333	20.0295	19.8964	19.2988	18.5531	17.9747 (90)
Living area fraction												
18.2858	18.5708	18.9990	19.5684	19.9968	20.1978	20.2362	20.2308	20.0930	19.5134	18.8018	18.2509	18.2509 (92)
Temperature adjustment												
adjusted MIT	18.2858	18.5708	18.9990	19.5684	19.9968	20.1978	20.2362	20.2308	20.0930	19.5134	18.8018	18.2509 (93)

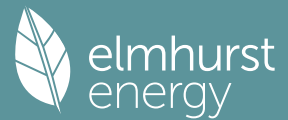
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9964	0.9905	0.9749	0.9224	0.8002	0.6020	0.4261	0.4926	0.7761	0.9572	0.9921	0.9973	0.9973 (94)
Useful gains	1251.3626	1553.8424	1810.9538	2041.8537	1976.8274	1497.1897	1009.6873	1051.6116	1455.5429	1469.7051	1271.5205	1176.0855 (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												
4040.8269	3940.4136	3594.2093	3033.9791	2354.5901	1573.1665	1021.8888	1074.6348	1690.6227	2529.5925	3334.9673	4022.0696	4022.0696 (97)
Space heating kWh												
2075.3614	1603.7758	1326.7420	714.3303	281.0554	0.0000	0.0000	0.0000	0.0000	788.5562	1485.6817	2117.4122	2117.4122 (98a)
Space heating requirement - total per year (kWh/year)												10392.9152
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	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh												
2075.3614	1603.7758	1326.7420	714.3303	281.0554	0.0000	0.0000	0.0000	0.0000	788.5562	1485.6817	2117.4122	2117.4122 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10392.9152
Space heating per m2												(98c) / (4) = 38.9598 (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	2075.3614	1603.7758	1326.7420	714.3303	281.0554	0.0000	0.0000	0.0000	0.0000	788.5562	1485.6817	2117.4122 (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)

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Space heating fuel (main heating system)	2248.4956	1737.5686	1437.4237	773.9223	304.5021	0.0000	0.0000	0.0000	0.0000	854.3404	1609.6226	2294.0544	(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	269.4871	238.3373	253.5099	223.9367	217.7145	196.8969	194.9797	202.4096	204.2550	226.8700	240.0911	266.7099	(64)
Efficiency of water heater	87.6637	87.5229	87.2219	86.4724	84.6335	79.8000	79.8000	79.8000	79.8000	86.6174	87.4282	79.8000	(216)
Fuel for water heating, kWh/month	307.4100	272.3143	290.6494	258.9691	257.2439	246.7380	244.3354	253.6461	255.9586	261.9220	274.6151	304.1384	(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	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	45.5280	36.5243	32.8860	24.0937	18.6107	15.2051	16.9773	22.0677	28.6638	37.6085	42.4787	46.7934	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-106.6427	-141.9700	-192.7138	-204.0450	-209.6579	-191.7418	-188.9424	-183.0051	-171.6592	-155.6051	-114.0208	-93.1726	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-88.6519	-182.2828	-354.9966	-523.1468	-682.5669	-682.8751	-675.2117	-576.1646	-428.0953	-257.6963	-117.3077	-70.4686	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												11259.9297	(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												3227.9403	(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)												367.4372	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-6592.6407	(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												8348.6665	(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	11259.9297	0.2100	2364.5852 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3227.9403	0.2100	677.8675 (264)
Space and water heating			3042.4527 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	367.4372	0.1443	53.0325 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1953.1764	0.1359	-265.4236
PV Unit electricity exported	-4639.4643	0.1265	-586.6739
Total			-852.0976 (269)
Total CO2, kg/year			2255.3169 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.4500 (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	11259.9297	1.1300	12723.7206 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3227.9403	1.1300	3647.5725 (278)
Space and water heating			16371.2931 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	367.4372	1.5338	563.5874 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1953.1764	1.5023	-2934.2775
PV Unit electricity exported	-4639.4643	0.4642	-2153.6068
Total			-5087.8843 (283)
Total Primary energy kWh/year			11977.0970 (286)
Target Primary Energy Rate (TPER)			44.9000 (287)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	133.3800 (1b)	x 2.4100 (2b)	= 321.4458 (1b) - (3b)
First floor	133.3800 (1c)	x 2.8500 (2c)	= 380.1330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	266.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 701.5788 (5)

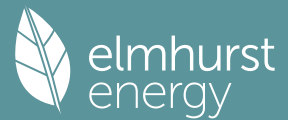
2. Ventilation rate

	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) = 0.0570 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0100 (17)
Infiltration rate	0.3075 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3075 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infilt rate	0.3921 0.3844 0.3767 0.3383 0.3306 0.2921 0.2921 0.2845 0.3075 0.3306 0.3460 0.3613 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000 (23c)
Effective ac	0.5769 0.5739 0.5710 0.5572 0.5546 0.5427 0.5427 0.5405 0.5473 0.5546 0.5598 0.5653 (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													
Entrance door			5.7500	0.8000	4.6000			(26)					
sliding/folding doors			14.1800	1.1450	16.2366			(27)					
Windows			33.3600	1.1450	38.1985			(27)					
Fixed glazing			5.1000	1.1450	5.8397			(27)					
Heat Loss Floor 1			133.3800	0.1100	14.6718	65.5200	8739.0576	(28a)					
Brick wall	260.1000	58.3900	201.7100	0.1800	36.3078	113.6000	22914.2560	(29a)					
Bay windows	2.8800		2.8800	0.1300	0.3744	0.0000	0.0000	(30)					
Main roof	111.4500		111.4500	0.1100	12.2595	12.1700	1356.3465	(30)					
Vaulted	23.8200		23.8200	0.1200	2.8584	12.1700	289.8894	(30)					
Total net area of external elements Aum(A, m2)			531.6300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	131.3467			(33)					
Main dwelling													
Internal Wall 1			209.2200			9.0000	1882.9800	(32c)					
Internal Wall 2			212.2400			75.0000	15918.0000	(32c)					
Internal Floor 1			133.3800			18.0000	2400.8400	(32d)					
Internal Ceiling 1			133.3800			9.0000	1200.4200	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	54701.7895	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							205.0599	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				6.7500	0.0240	0.1620							
E2 Other lintels (including other steel lintels)				30.5400	0.0200	6.1691							
E3 Sill				27.8000	0.0230	0.6394							
E4 Jamb				45.6000	0.0180	0.8208							
E5 Ground floor (normal)				51.0000	0.0730	3.7230							
E6 Intermediate floor within a dwelling				51.0000	0.0010	0.0510							
E13 Gable (insulation at rafter level)				4.2000	0.0380	0.1596							
E10 Eaves (insulation at ceiling level)				47.7800	0.0690	3.2968							
E14 Flat roof				6.8000	0.1520	1.0336							
E16 Corner (normal)				51.0000	0.0360	1.8360							
E17 Corner (inverted - internal area greater than external area)				30.6000	-0.0620	-1.8972							
R4 Ridge (vaulted ceiling)				6.4000	0.1200	0.7680							
R6 Flat ceiling				12.8000	0.0200	0.2560							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.0181	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	148.3648	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 133.5560	Feb 132.8650	Mar 132.1877	Apr 129.0062	May 128.4110	Jun 125.6401	Jul 125.6401	Aug 125.1269	Sep 126.7074	Oct 128.4110	Nov 129.6152	Dec 130.8741	(38)
Heat transfer coeff	281.9209	281.2298	280.5525	277.3711	276.7758	274.0049	274.0049	273.4917	275.0722	276.7758	277.9800	279.2389	(39)
Average = Sum(39)m / 12 =												277.3682	
HLP	Jan 1.0568	Feb 1.0542	Mar 1.0517	Apr 1.0398	May 1.0375	Jun 1.0272	Jul 1.0272	Aug 1.0252	Sep 1.0312	Oct 1.0375	Nov 1.0421	Dec 1.0468	(40)
HLP (average)												1.0398	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0887 (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												
32.8089	32.3217	31.6355	30.3704	29.4230	28.3726	27.8052	28.4865	29.2284	30.3524	31.6437	32.6980	(42b)
Hot water usage for other uses												
46.2616	44.5793	42.8971	41.2148	39.5326	37.8504	37.8504	39.5326	41.2148	42.8971	44.5793	46.2616	(42c)
Average daily hot water use (litres/day)												72.4750 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
79.0705	76.9010	74.5326	71.5852	68.9556	66.2229	65.6555	68.0192	70.4433	73.2495	76.2230	78.9596	(44)
Energy content	125.2284	109.5060	114.5538	97.9966	92.8275	81.4288	79.4047	84.2219	86.8636	99.3989	108.5936	123.6316 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1203.6555
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(61)
Total heat required for water heating calculated for each month												
106.4441	93.0801	97.3708	83.2971	78.9034	69.2145	67.4940	71.5886	73.8341	84.4891	92.3046	105.0869	(62)
WWHRS	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	(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	(63c)
FGHRS	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												
106.4441	93.0801	97.3708	83.2971	78.9034	69.2145	67.4940	71.5886	73.8341	84.4891	92.3046	105.0869	(64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 1023.1072 (64)
Electric shower(s)												1023 (64)
60.8694	54.2351	59.2227	56.5155	57.5760	54.9219	56.7526	57.5760	56.5155	59.2227	58.1090	60.8694	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 692.3855 (64a)												
Heat gains from water heating, kWh/month												
41.8284	36.8288	39.1484	34.9531	34.1198	31.0341	31.0616	32.2911	32.5874	35.9279	37.6034	41.4891	(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	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	219.4271	242.9371	219.4271	226.7413	219.4271	226.7413	219.4271	219.4271	226.7413	219.4271	226.7413	219.4271 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	430.7549	435.2248	423.9608	399.9812	369.7111	341.2616	322.2555	317.7857	329.0496	353.0293	383.2993	411.7489 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436 (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)	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487 (71)
Water heating gains (Table 5)	56.2209	54.8048	52.6188	48.5460	45.8600	43.1029	41.7495	43.4021	45.2602	48.2902	52.2269	55.7649 (72)
Total internal gains	775.7337	802.2975	765.3375	744.5993	704.3290	680.4366	652.7629	649.9456	670.3820	690.0774	731.5984	756.2716 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W		
Southeast				14.1800	36.7938		0.6300		0.7000		0.7700		159.4495 (77)		
Northeast				18.7200	11.2829		0.6300		0.7000		0.7700		64.5506 (75)		
Southeast				5.8200	36.7938		0.6300		0.7000		0.7700		65.4440 (77)		
Southwest				3.0000	36.7938		0.6300		0.7000		0.7700		33.7340 (79)		
Northwest				5.8200	11.2829		0.6300		0.7000		0.7700		20.0686 (81)		
Northeast				5.1000	11.2829		0.5700		0.7000		0.7700		15.9110 (75)		
Solar gains				359.1577	645.1704	971.4457	1352.3353	1650.4245	1698.1777	1612.3850	1380.8718	1101.9104	736.9654	436.2691	303.4293 (83)
Total gains				1134.8914	1447.4679	1736.7832	2096.9346	2354.7535	2378.6143	2265.1479	2030.8174	1772.2924	1427.0428	1167.8675	1059.7009 (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	53.8979	54.0303	54.1608	54.7820	54.8998	55.4550	55.4550	55.5590	55.2398	54.8998	54.6620	54.4156
alpha	4.5932	4.6020	4.6107	4.6521	4.6600	4.6970	4.6970	4.7039	4.6827	4.6600	4.6441	4.6277
util living area	0.9989	0.9964	0.9886	0.9548	0.8579	0.6811	0.5190	0.5930	0.8510	0.9805	0.9973	0.9992 (86)
MIT	19.2919	19.5247	19.8753	20.3505	20.7342	20.9357	20.9856	20.9741	20.8127	20.2901	19.7060	19.2604 (87)
Th 2	20.0362	20.0384	20.0405	20.0503	20.0522	20.0608	20.0608	20.0624	20.0574	20.0522	20.0484	20.0445 (88)
util rest of house	0.9986	0.9954	0.9851	0.9406	0.8156	0.6006	0.4145	0.4841	0.7903	0.9721	0.9964	0.9990 (89)
MIT 2	18.4578	18.6917	19.0416	19.5129	19.8645	20.0282	20.0563	20.0534	19.9430	19.4625	18.8807	18.4326 (90)
Living area fraction	fLA = Living area / (4) = 0.2131 (91)											
MIT	18.6355	18.8692	19.2193	19.6914	20.0498	20.2216	20.2543	20.2496	20.1283	19.6388	19.0566	18.6090 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.6355	18.8692	19.2193	19.6914	20.0498	20.2216	20.2543	20.2496	20.1283	19.6388	19.0566	18.6090 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9936	0.9811	0.9340	0.8155	0.6152	0.4367	0.5068	0.7955	0.9672	0.9949	0.9985	(94)
Useful gains	1132.5002	1438.1976	1703.9807	1958.4923	1920.3435	1463.3370	989.1039	1029.2094	1409.9443	1380.2848	1161.9643	1058.0744	(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	4041.4850	3928.5483	3568.4189	2993.2174	2311.0270	1540.3347	1001.2962	1052.8301	1658.2258	2501.7265	3323.6861	4023.5564	(97)
Space heating kWh	2164.2846	1673.5157	1387.1420	745.0021	290.6685	0.0000	0.0000	0.0000	0.0000	834.3526	1556.4396	2206.3186	(98a)
Space heating requirement - total per year (kWh/year)												10857.7238	
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	2164.2846	1673.5157	1387.1420	745.0021	290.6685	0.0000	0.0000	0.0000	0.0000	834.3526	1556.4396	2206.3186	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10857.7238	
Space heating per m2										(98c) / (4) =		40.7022	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	2575.6459	2027.6361	2078.5373	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8397	0.9039	0.8601	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2162.7406	1832.7281	1787.6929	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2674.9260	2546.4744	2277.0758	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	368.7735	531.0272	364.1009	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	92.1934	132.7568	91.0252	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												315.9754	(107)
Energy for space heating												40.7022	(99)
Energy for space cooling												1.1845	(108)
Total												41.8867	(109)
Fabric Energy Efficiency (DFEE)												41.9	(109)

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

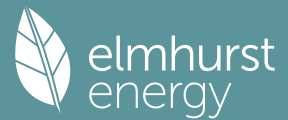
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	133.3800 (1b)	x 2.4100 (2b)	= 321.4458 (1b) - (3b)	
First floor	133.3800 (1c)	x 2.8500 (2c)	= 380.1330 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	266.7600		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	701.5788 (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)
													Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =										40.0000 / (5) =	0.0570 (8)	
Pressure test													Yes
Pressure Test Method													Blower Door
Measured/design AP50													5.0000 (17)
Infiltration rate													0.3070 (18)
Number of sides sheltered													0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3070 (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	0.3914	0.3838	0.3761	0.3377	0.3300	0.2917	0.2917	0.2840	0.3070	0.3300	0.3454	0.3607	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													
Effective ac	0.5766	0.5736	0.5707	0.5570	0.5545	0.5425	0.5425	0.5403	0.5471	0.5545	0.5596	0.5651	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			5.7500	1.0000	5.7500		(26)
TER Opening Type			52.6400	1.1450	60.2748		(27)
Heat Loss Floor 1			133.3800	0.1300	17.3394		(28a)
Brick wall	260.1000	58.3900	201.7100	0.1800	36.3078		(29a)
Bay windows	2.8800		2.8800	0.1100	0.3168		(30)
Main roof	111.4500		111.4500	0.1100	12.2595		(30)
Vaulted	23.8200		23.8200	0.1100	2.6202		(30)
Total net area of external elements Aum(A, m2)			531.6300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	134.8685	(33)

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

205.0599 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	6.7500	0.0500	0.3375
E2 Other lintels (including other steel lintels)	30.5400	0.0500	1.5270
E3 Sill	27.8000	0.0500	1.3900
E4 Jamb	45.6000	0.0500	2.2800
E5 Ground floor (normal)	51.0000	0.1600	8.1600
E6 Intermediate floor within a dwelling	51.0000	0.0000	0.0000
E13 Gable (insulation at rafter level)	4.2000	0.0800	0.3360
E10 Eaves (insulation at ceiling level)	47.7800	0.0600	2.8668
E14 Flat roof	6.8000	0.0800	0.5440
E16 Corner (normal)	51.0000	0.0900	4.5900
E17 Corner (inverted - internal area greater than external area)	30.6000	-0.0900	-2.7540
R4 Ridge (vaulted ceiling)	6.4000	0.0800	0.5120
R6 Flat ceiling	12.8000	0.0600	0.7680

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

20.5573 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 155.4258 (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	133.4982	132.8094	132.1343	128.9632	128.3699	125.6080	125.6080	125.0965	126.6718	128.3699	129.5701	130.8250
Heat transfer coeff	288.9240	288.2353	287.5601	284.3890	283.7957	281.0338	281.0338	280.5223	282.0976	283.7957	284.9960	286.2508
Average = Sum(39)m / 12 =												284.3862

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0831	1.0805	1.0780	1.0661	1.0639	1.0535	1.0535	1.0516	1.0575	1.0639	1.0684	1.0731
HLP (average)												1.0661
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

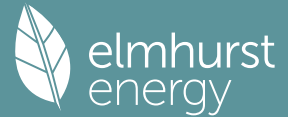
4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0887
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
Hot water usage for baths	32.8089	32.3217	31.6355	30.3704	29.4230	28.3726	27.8052	28.4865	29.2284	30.3524	31.6437	32.6980
Hot water usage for other uses	46.2616	44.5793	42.8971	41.2148	39.5326	37.8504	37.8504	39.5326	41.2148	42.8971	44.5793	46.2616
Average daily hot water use (litres/day)												72.4750
Daily hot water use	79.0705	76.9010	74.5326	71.5852	68.9556	66.2229	65.6555	68.0192	70.4433	73.2495	76.2230	78.9596
Energy conte	125.2284	109.5060	114.5538	97.9966	92.8275	81.4288	79.4047	84.2219	86.8636	99.3989	108.5936	123.6316
Energy content (annual)										Total = Sum(45)m =		1203.6555
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month	106.4441	93.0801	97.3708	83.2971	78.9034	69.2145	67.4940	71.5886	73.8341	84.4891	92.3046	105.0869
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	106.4441	93.0801	97.3708	83.2971	78.9034	69.2145	67.4940	71.5886	73.8341	84.4891	92.3046	105.0869
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1023.1072
Electric shower(s)	60.8694	54.2351	59.2227	56.5155	57.5760	54.9219	56.7526	57.5760	56.5155	59.2227	58.1090	60.8694
Heat gains from water heating, kWh/month	41.8284	36.8288	39.1484	34.9531	34.1198	31.0341	31.0616	32.2911	32.5874	35.9279	37.6034	41.4891

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

Metabolic gains (Table 5), Watts												
(66)m	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359	154.4359
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	219.1162	242.5929	219.1162	226.4201	219.1162	226.4201	219.1162	219.1162	226.4201	219.1162	226.4201	219.1162
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	430.7549	435.2248	423.9608	399.9812	369.7111	341.2616	322.2555	317.7857	329.0496	353.0293	383.2993	411.7489
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436	38.4436
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Losses e.g. evaporation (negative values) (Table 5)	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487
Water heating gains (Table 5)	56.2209	54.8048	52.6188	48.5460	45.8600	43.1029	41.7495	43.4021	45.2602	48.2902	52.2269	55.7649
Total internal gains	775.4228	801.9533	765.0265	744.2780	704.0181	680.1153	652.4520	649.6347	670.0607	689.7665	731.2771	755.9607

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6. Solar gains

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

Northeast				23.8200	11.2829	0.6300		0.7000		0.7700		82.1364 (75)	
Southeast				20.0000	36.7938	0.6300		0.7000		0.7700		224.8935 (77)	
Southwest				3.0000	36.7938	0.6300		0.7000		0.7700		33.7340 (79)	
Northwest				5.8200	11.2829	0.6300		0.7000		0.7700		20.0686 (81)	

Solar gains	360.8325	648.5796	977.5880	1362.4227	1663.9839	1712.6335	1625.9081	1391.6526	1109.3949	741.1317	438.3765	304.7970	(83)
Total gains	1136.2553	1450.5329	1742.6146	2106.7007	2368.0020	2392.7488	2278.3601	2041.2873	1779.4556	1430.8981	1169.6536	1060.7577	(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	52.5915	52.7172	52.8409	53.4301	53.5418	54.0680	54.1666	53.8641	53.5418	53.3163	53.0826	
alpha	4.5061	4.5145	4.5227	4.5620	4.5695	4.6045	4.6111	4.5909	4.5695	4.5544	4.5388	
util living area	0.9989	0.9964	0.9887	0.9558	0.8619	0.6889	0.5274	0.6018	0.8559	0.9808	0.9973	0.9992 (86)
MIT	19.2466	19.4809	19.8361	20.3192	20.7145	20.9281	20.9832	20.9703	20.7977	20.2614	19.6677	19.2147 (87)
Th 2	20.0147	20.0168	20.0189	20.0286	20.0305	20.0390	20.0390	20.0406	20.0357	20.0305	20.0268	20.0229 (88)
util rest of house	0.9985	0.9953	0.9852	0.9417	0.8198	0.6069	0.4194	0.4898	0.7953	0.9725	0.9963	0.9989 (89)
MIT 2	18.3964	18.6317	18.9863	19.4654	19.8287	20.0025	20.0338	20.0303	19.9118	19.4175	18.8261	18.3707 (90)
Living area fraction	fLA = Living area / (4) =											0.2131 (91)
MIT	18.5775	18.8126	19.1674	19.6473	20.0174	20.1997	20.2361	20.2306	20.1006	19.5973	19.0055	18.5505 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5775	18.8126	19.1674	19.6473	20.0174	20.1997	20.2361	20.2306	20.1006	19.5973	19.0055	18.5505 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9978	0.9935	0.9811	0.9349	0.8191	0.6215	0.4423	0.5131	0.8000	0.9675	0.9949	0.9984	(94)	
Useful gains	1133.7855	1441.1050	1709.6710	1969.5136	1939.7161	1487.2042	1007.6662	1047.4310	1423.6309	1384.4435	1163.6404	1059.0700	(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	4125.1261	4010.1040	3642.6278	3056.4240	2360.4489	1573.7082	1021.8695	1074.5762	1692.7489	2553.3901	3393.0075	4107.8429	(97)	
Space heating kWh	2225.5574	1726.3674	1438.1198	782.5755	313.0252	0.0000	0.0000	0.0000	0.0000	869.6963	1605.1443	2268.2870	(98a)	
Space heating requirement - total per year (kWh/year)												11228.7730		
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	2225.5574	1726.3674	1438.1198	782.5755	313.0252	0.0000	0.0000	0.0000	0.0000	869.6963	1605.1443	2268.2870	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												11228.7730		
Space heating per m2												(98c) / (4) =	42.0932	(99)

8c. Space cooling requirement

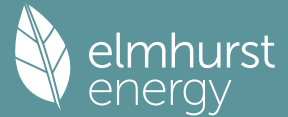
Calculated for June, July and August. see Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
	0.0000	0.0000	0.0000	0.0000	0.0000	2641.7176	2079.6500	2131.9696	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8292	0.8955	0.8498	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2190.5101	1862.3283	1811.7200	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2691.7952	2562.2512	2289.6385	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	360.9253	520.7426	355.5714	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	90.2313	130.1857	88.8928	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												309.3098 (107)
Energy for space heating												42.0932 (99)
Energy for space cooling												1.1595 (108)
Total												43.2527 (109)
Fabric Energy Efficiency (TFEE)												43.3 (109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	133.3800 (1b)	x 2.4100 (2b)	= 321.4458 (1b) - (3b)

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First floor
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 266.7600 133.3800 (1c) x 2.8500 (2c) = 380.1330 (1c) - (3c)
Dwelling volume (4)
(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 701.5788 (5)

2. Ventilation rate

m3 per hour

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

Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0100 (17)
Infiltration rate 0.2505 (18)
Number of sides sheltered 0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2505 (21)

Wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Wind factor 5.1000 5.0000 4.9000 4.4000 4.3000 3.8000 3.8000 3.7000 4.0000 4.3000 4.5000 4.7000 (22)
Adj infilt rate 1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
0.3194 0.3131 0.3069 0.2756 0.2693 0.2380 0.2380 0.2317 0.2505 0.2693 0.2818 0.2943 (22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 81.9000 (23c)

Effective ac 0.4099 0.4036 0.3974 0.3660 0.3598 0.3285 0.3285 0.3222 0.3410 0.3598 0.3723 0.3848 (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							
Entrance door			5.7500	0.8000	4.6000		(26)
sliding/folding doors			14.1800	1.1450	16.2366		(27)
Windows			33.3600	1.1450	38.1985		(27)
Fixed glazing			5.1000	1.1450	5.8397		(27)
Heat Loss Floor 1			133.3800	0.1100	14.6718	65.5200	8739.0576 (28a)
Brick wall	260.1000	58.3900	201.7100	0.1800	36.3078	113.6000	22914.2560 (29a)
Bay windows	2.8800		2.8800	0.1300	0.3744	0.0000	0.0000 (30)
Main roof	111.4500		111.4500	0.1100	12.2595	12.1700	1356.3465 (30)
Vaulted	23.8200		23.8200	0.1200	2.8584	12.1700	289.8894 (30)
Total net area of external elements Aum(A, m2)			531.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	131.3467		(33)
Main dwelling							
Internal Wall 1			209.2200			9.0000	1882.9800 (32c)
Internal Wall 2			212.2400			75.0000	15918.0000 (32c)
Internal Floor 1			133.3800			18.0000	2400.8400 (32d)
Internal Ceiling 1			133.3800			9.0000	1200.4200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 54701.7895 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 205.0599 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	6.7500	0.0240	0.1620
E2 Other lintels (including other steel lintels)	30.5400	0.0200	6.1691
E3 Sill	27.8000	0.0230	0.6394
E4 Jamb	45.6000	0.0180	0.8208
E5 Ground floor (normal)	51.0000	0.0730	3.7230
E6 Intermediate floor within a dwelling	51.0000	0.0010	0.0510
E13 Gable (insulation at rafter level)	4.2000	0.0380	0.1596
E10 Eaves (insulation at ceiling level)	47.7800	0.0690	3.2968
E14 Flat roof	6.8000	0.1520	1.0336
E16 Corner (normal)	51.0000	0.0360	1.8360
E17 Corner (inverted - internal area greater than external area)	30.6000	-0.0620	-1.8972
R4 Ridge (vaulted ceiling)	6.4000	0.1200	0.7680
R6 Flat ceiling	12.8000	0.0200	0.2560

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.0181 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 148.3648 (37)

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

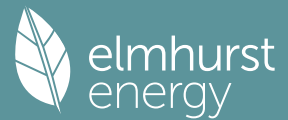
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	94.8976	93.4477	91.9978	84.7483	83.2984	76.0489	76.0489	74.5990	78.9487	83.2984	86.1982	89.0980 (38)
Average = Sum(39)m / 12 =	243.2624	241.8125	240.3626	233.1131	231.6632	224.4137	224.4137	222.9638	227.3135	231.6632	234.5630	237.4628 (39)
												232.7506

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9119	0.9065	0.9010	0.8739	0.8684	0.8413	0.8413	0.8358	0.8521	0.8684	0.8793	0.8902 (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 3.0887 (42)
Hot water usage for mixer showers

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Hot water usage for baths	85.5085	84.2235	82.3509	78.7682	76.1242	73.1756	71.4997	73.3580	75.3951	78.5610	82.2207	85.1809 (42a)
Hot water usage for other uses	32.8089	32.3217	31.6355	30.3704	29.4230	28.3726	27.8052	28.4865	29.2284	30.3524	31.6437	32.6980 (42b)
Average daily hot water use (litres/day)	46.2616	44.5793	42.8971	41.2148	39.5326	37.8504	37.8504	39.5326	41.2148	42.8971	44.5793	46.2616 (42c)
												151.3110 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	164.5790	161.1245	156.8835	150.3534	145.0798	139.3986	137.1552	141.3772	145.8384	151.8105	158.4437	164.1404 (44)
Distribution loss (46)m = 0.15 x (45)m	260.6529	229.4391	241.1241	205.8262	195.3053	171.4068	165.8773	175.0545	179.8333	206.0054	225.7321	257.0043 (45)
	39.0979	34.4159	36.1686	30.8739	29.2958	25.7110	24.8816	26.2582	26.9750	30.9008	33.8598	38.5506 (46)
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2204 (55)
Total storage loss												
	37.8324	34.1712	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324	36.6120	37.8324	36.6120	37.8324 (56)
If cylinder contains dedicated solar storage												
Primary loss	37.8324	34.1712	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324	36.6120	37.8324	36.6120	37.8324 (57)
Combi 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)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
WWHRS	321.7477	284.6215	302.2189	264.9502	256.4001	230.5308	226.9721	236.1493	238.9573	267.1002	284.8561	318.0991 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
	321.7477	284.6215	302.2189	264.9502	256.4001	230.5308	226.9721	236.1493	238.9573	267.1002	284.8561	318.0991 (64)
												3232.6034 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month												
	135.5429	120.4344	129.0496	115.7364	113.8149	104.2920	104.0301	107.0815	107.0938	117.3726	122.3551	134.3298 (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	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.0883	46.2644	37.6247	28.4843	21.2924	17.9759	19.4236	25.2476	33.8872	43.0276	50.2196	53.5360 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	642.9178	649.5893	632.7774	596.9868	551.8077	509.3457	480.9784	474.3069	491.1188	526.9094	572.0885	614.5506 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210 (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)	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487 (71)
Water heating gains (Table 5)	182.1813	179.2179	173.4538	160.7450	152.9770	144.8499	139.8253	143.9267	148.7414	157.7589	169.9377	180.5508 (72)
Total internal gains	995.5829	993.4669	962.2513	904.6116	844.4724	790.5669	758.6228	761.8766	792.1428	846.0913	910.6412	967.0327 (73)

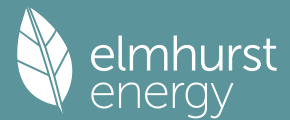
6. Solar gains

[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				14.1800	36.7938		0.6300		0.7000		0.7700		159.4495 (77)
Northeast				18.7200	11.2829		0.6300		0.7000		0.7700		64.5506 (75)
Southeast				5.8200	36.7938		0.6300		0.7000		0.7700		65.4440 (77)
Southwest				3.0000	36.7938		0.6300		0.7000		0.7700		33.7340 (79)
Northwest				5.8200	11.2829		0.6300		0.7000		0.7700		20.0686 (81)
Northeast				5.1000	11.2829		0.5700		0.7000		0.7700		15.9110 (75)
Solar gains	359.1577	645.1704	971.4457	1352.3353	1650.4245	1698.1777	1612.3850	1380.8718	1101.9104	736.9654	436.2691	303.4293	(83)
Total gains	1354.7406	1638.6374	1933.6970	2256.9468	2494.8969	2488.7446	2371.0078	2142.7484	1894.0533	1583.0567	1346.9103	1270.4620	(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	62.4632	62.8377	63.2168	65.1827	65.5907	67.7095	67.7095	68.1498	66.8458	65.5907	64.7798	63.9887
alpha	5.1642	5.1892	5.2145	5.3455	5.3727	5.5140	5.5140	5.5433	5.4564	5.3727	5.3187	5.2659
util living area	0.9977	0.9935	0.9788	0.9198	0.7753	0.5650	0.4145	0.4744	0.7559	0.9614	0.9947	0.9984 (86)
Living	19.9369	20.1011	20.3499	20.6641	20.8601	20.9324	20.9420	20.9406	20.8919	20.6108	20.2258	19.9294
Non living	18.8902	19.1035	19.4224	19.8271	20.0489	20.1384	20.1448	20.1491	20.0976	19.7738	19.2820	18.8952
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	20.4562	20.1011	20.3499	20.6641	20.8601	20.9324	20.9420	20.9406	20.8919	20.6108	20.2258	20.0792 (87)
Th 2	20.1574	20.1620	20.1666	20.1898	20.1944	20.2177	20.2177	20.2224	20.2084	20.1944	20.1851	20.1759 (88)
util rest of house	0.9971	0.9917	0.9730	0.8994	0.7290	0.5006	0.3418	0.3963	0.6915	0.9475	0.9929	0.9979 (89)
MIT 2	19.6522	19.1035	19.4224	19.8271	20.0489	20.1384	20.1448	20.1491	20.0976	19.7738	19.2820	19.1260 (90)
Living area fraction									fLA = Living area / (4) =			0.2131 (91)
MIT	19.8235	19.3161	19.6200	20.0055	20.2218	20.3076	20.3147	20.3178	20.2668	19.9522	19.4831	19.3291 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8235	19.3161	19.6200	20.0055	20.2218	20.3076	20.3147	20.3178	20.2668	19.9522	19.4831	19.3291 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9894	0.9683	0.8941	0.7307	0.5082	0.3509	0.4060	0.6966	0.9423	0.9909	0.9973	(94)
Useful gains	1350.3702	1621.1971	1872.3802	2017.8811	1823.0340	1264.6927	831.9313	869.9297	1319.4920	1491.6898	1334.6915	1267.0121	(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	3776.2859	3485.9813	3153.5646	2588.8308	1974.1779	1280.8609	833.6302	873.5175	1401.8016	2166.5522	2904.6171	3592.5916	(97)
Space heating kWh	1804.8813	1253.1350	953.2012	411.0837	112.4511	0.0000	0.0000	0.0000	0.0000	502.0976	1130.3464	1730.2312	(98a)
Space heating requirement - total per year (kWh/year)												7897.4276	
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	1804.8813	1253.1350	953.2012	411.0837	112.4511	0.0000	0.0000	0.0000	0.0000	502.0976	1130.3464	1730.2312	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7897.4276	
Space heating per m2										(98c) / (4) =		29.6050	(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 %)													373.8177	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													65.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1804.8813	1253.1350	953.2012	411.0837	112.4511	0.0000	0.0000	0.0000	0.0000	502.0976	1130.3464	1730.2312	(98)	
Space heating efficiency (main heating system 1)	373.8177	373.8177	373.8177	373.8177	373.8177	0.0000	0.0000	0.0000	0.0000	373.8177	373.8177	373.8177	(210)	
Space heating fuel (main heating system)	482.8239	335.2262	254.9909	109.9690	30.0818	0.0000	0.0000	0.0000	0.0000	134.3162	302.3791	462.8543	(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	321.7477	284.6215	302.2189	264.9502	256.4001	230.5308	226.9721	236.1493	238.9573	267.1002	284.8561	318.0991	(64)	
Efficiency of water heater (217)m	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	(216)	
Fuel for water heating, kWh/month	191.7544	169.6280	180.1157	157.9044	152.8087	137.3912	135.2703	140.7397	142.4132	159.1857	169.7678	189.5799	(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	81.7820	73.8676	81.7820	79.1439	81.7820	79.1439	81.7820	81.7820	79.1439	81.7820	79.1439	81.7820	(231)	
Lighting	45.5926	36.5761	32.9327	24.1279	18.6371	15.2267	17.0014	22.0990	28.7045	37.6618	42.5389	46.8598	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-90.0861	-148.6889	-248.4382	-322.8411	-386.1823	-373.8197	-369.4413	-329.0830	-264.9253	-187.7219	-106.4165	-75.5343	(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	-0.3281	-1.4281	-5.1314	-13.8218	-26.8848	-31.0956	-30.6301	-22.3844	-12.7388	-3.6213	-0.6800	-0.2255	(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													2112.6414	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													167.7916	
Water heating fuel used													1926.5590	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1250)														
mechanical ventilation fans (SFP = 1.1250)													962.9169	(230a)
Total electricity for the above, kWh/year													962.9169	(231)
Electricity for lighting (calculated in Appendix L)													367.9585	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-3052.1485	(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													2317.9274	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2112.6414	16.4900	348.3746	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1926.5590	16.4900	317.6896	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	962.9169	16.4900	158.7850	(249)
Energy for lighting	367.9585	16.4900	60.6764	(250)
Additional standing charges			0.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2903.1786	16.4900	-478.7342
PV Unit electricity exported	-148.9699	5.5900	-8.3274
Total			-487.0616 (252)
Total energy cost			398.4640 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.4601 (257)
SAP value		92.5415
SAP rating (Section 12)		93 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2112.6414	0.1564	330.4180 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1926.5590	0.1409	271.5302 (264)
Space and water heating			601.9481 (265)
Pumps, fans and electric keep-hot	962.9169	0.1387	133.5684 (267)
Energy for lighting	367.9585	0.1443	53.1078 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2903.1786	0.1318	-382.5833
PV Unit electricity exported	-148.9699	0.1146	-17.0727
Total			-399.6561 (269)
Total CO2, kg/year			388.9683 (272)
CO2 emissions per m2			1.4600 (273)
EI value			98.3281
EI rating			98 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	133.3800 (1b)	x 2.4100 (2b)	= 321.4458 (1b) - (3b)
First floor	133.3800 (1c)	x 2.8500 (2c)	= 380.1330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	266.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	701.5788 (5)

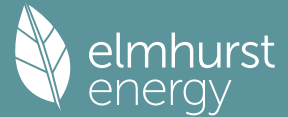
2. Ventilation rate

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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0100	(17)
Infiltration rate		0.2505	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2505	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.2000	4.3000	3.9000	3.8000	3.4000	3.5000	3.3000	3.6000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0500	1.0750	0.9750	0.9500	0.8500	0.8750	0.8250	0.9000	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.2756	0.2630	0.2693	0.2442	0.2380	0.2129	0.2192	0.2067	0.2255	0.2380	0.2317	0.2505 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.9000 (23c)
Effective ac	0.3660	0.3535	0.3598	0.3347	0.3285	0.3034	0.3097	0.2972	0.3159	0.3285	0.3222	0.3410 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Entrance door			5.7500	0.8000	4.6000			(26)
sliding/folding doors			14.1800	1.1450	16.2366			(27)
Windows			33.3600	1.1450	38.1985			(27)
Fixed glazing			5.1000	1.1450	5.8397			(27)
Heat Loss Floor 1			133.3800	0.1100	14.6718	65.5200	8739.0576	(28a)
Brick wall	260.1000	58.3900	201.7100	0.1800	36.3078	113.6000	22914.2560	(29a)
Bay windows	2.8800		2.8800	0.1300	0.3744	0.0000	0.0000	(30)
Main roof	111.4500		111.4500	0.1100	12.2595	12.1700	1356.3465	(30)
Vaulted	23.8200		23.8200	0.1200	2.8584	12.1700	289.8894	(30)
Total net area of external elements Aum (A, m2)			531.6300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		131.3467			(33)
Main dwelling								
Internal Wall 1			209.2200			9.0000	1882.9800	(32c)
Internal Wall 2			212.2400			75.0000	15918.0000	(32c)
Internal Floor 1			133.3800			18.0000	2400.8400	(32d)
Internal Ceiling 1			133.3800			9.0000	1200.4200	(32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	54701.7895	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							205.0599	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	6.7500	0.0240	0.1620	
E2 Other lintels (including other steel lintels)	30.5400	0.2020	6.1691	
E3 Sill	27.8000	0.0230	0.6394	
E4 Jamb	45.6000	0.0180	0.8208	
E5 Ground floor (normal)	51.0000	0.0730	3.7230	
E6 Intermediate floor within a dwelling	51.0000	0.0010	0.0510	
E13 Gable (insulation at rafter level)	4.2000	0.0380	0.1596	
E10 Eaves (insulation at ceiling level)	47.7800	0.0690	3.2968	
E14 Flat roof	6.8000	0.1520	1.0336	
E16 Corner (normal)	51.0000	0.0360	1.8360	
E17 Corner (inverted - internal area greater than external area)	30.6000	-0.0620	-1.8972	
R4 Ridge (vaulted ceiling)	6.4000	0.1200	0.7680	
R6 Flat ceiling	12.8000	0.0200	0.2560	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				17.0181 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	148.3648 (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	84.7483	81.8485	83.2984	77.4988	76.0489	70.2493	71.6992	68.7994	73.1491	76.0489	74.5990	78.9487	(38)
Heat transfer coeff	233.1131	230.2133	231.6632	225.8636	224.4137	218.6141	220.0640	217.1642	221.5139	224.4137	222.9638	227.3135	(39)
Average = Sum(39)m / 12 =												224.7761	
HLP	0.8739	0.8630	0.8684	0.8467	0.8413	0.8195	0.8250	0.8141	0.8304	0.8413	0.8358	0.8521	(40)
HLP (average)												0.8426	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0887 (42)
Hot water usage for mixer showers													
85.5085	84.2235	82.3509	78.7682	76.1242	73.1756	71.4997	73.3580	75.3951	78.5610	82.2207	85.1809	85.1809	(42a)
Hot water usage for baths													
32.8089	32.3217	31.6355	30.3704	29.4230	28.3726	27.8052	28.4865	29.2284	30.3524	31.6437	32.6980	32.6980	(42b)
Hot water usage for other uses													
46.2616	44.5793	42.8971	41.2148	39.5326	37.8504	37.8504	39.5326	41.2148	42.8971	44.5793	46.2616	46.2616	(42c)
Average daily hot water use (litres/day)												151.3110	(43)
Daily hot water use													
164.5790	161.1245	156.8835	150.3534	145.0798	139.3986	137.1552	141.3772	145.8384	151.8105	158.4437	164.1404	164.1404	(44)
Energy conte	260.6529	229.4391	241.1241	205.8262	195.3053	171.4068	165.8773	175.0545	179.8333	206.0054	225.7321	257.0043	(45)
Energy content (annual)												2513.2614	
Distribution loss (46)m = 0.15 x (45)m													
39.0979	34.4159	36.1686	30.8739	29.2958	25.7110	24.8816	26.2582	26.9750	30.9008	33.8598	38.5506	38.5506	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.2204	(55)
Total storage loss													
37.8324	34.1712	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324	(56)
If cylinder contains dedicated solar storage													
37.8324	34.1712	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324	(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													
321.7477	284.6215	302.2189	264.9502	256.4001	230.5308	226.9721	236.1493	238.9573	267.1002	284.8561	318.0991	318.0991	(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													
321.7477	284.6215	302.2189	264.9502	256.4001	230.5308	226.9721	236.1493	238.9573	267.1002	284.8561	318.0991	318.0991	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
135.5429	120.4344	129.0496	115.7364	113.8149	104.2920	104.0301	107.0815	107.0938	117.3726	122.3551	134.3298	134.3298	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	52.0883	46.2644	37.6247	28.4843	21.2924	17.9759	19.4236	25.2476	33.8872	43.0276	50.2196	53.5360 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	642.9178	649.5893	632.7774	596.9868	551.8077	509.3457	480.9784	474.3069	491.1188	526.9094	572.0885	614.5506 (68)
Pumps, fans	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210 (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)	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487 (71)
Total internal gains	182.1813	179.2179	173.4538	160.7450	152.9770	144.8499	139.8253	143.9267	148.7414	157.7589	169.9377	180.5508 (72)
	995.5829	993.4669	962.2513	904.6116	844.4724	790.5669	758.6228	761.8766	792.1428	846.0913	910.6412	967.0327 (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				14.1800	40.6744	0.6300	0.7000	0.7700	176.2662 (77)			
Northeast				18.7200	12.9326	0.6300	0.7000	0.7700	73.9882 (75)			
Southeast				5.8200	40.6744	0.6300	0.7000	0.7700	72.3462 (77)			
Southwest				3.0000	40.6744	0.6300	0.7000	0.7700	37.2919 (79)			
Northwest				5.8200	12.9326	0.6300	0.7000	0.7700	23.0027 (81)			
Northeast				5.1000	12.9326	0.5700	0.7000	0.7700	18.2373 (75)			
Solar gains	401.1325	661.6862	990.9391	1408.0329	1684.0247	1861.6826	1724.4245	1490.8889	1205.6546	794.0848	499.5235	335.4106 (83)
Total gains	1396.7154	1655.1531	1953.1904	2312.6445	2528.4971	2652.2496	2483.0472	2252.7655	1997.7975	1640.1761	1410.1647	1302.4433 (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	65.1827	66.0038	65.5907	67.2749	67.7095	69.5058	69.0478	69.9698	68.5959	67.7095	68.1498	66.8458
alpha	5.3455	5.4003	5.3727	5.4850	5.5140	5.6337	5.6032	5.6647	5.5731	5.5140	5.5433	5.4564
util living area	0.9972	0.9924	0.9736	0.8934	0.7263	0.4663	0.3275	0.3655	0.6756	0.9430	0.9923	0.9980 (86)
Living	20.0263	20.1877	20.4324	20.7354	20.8917	20.9414	20.9442	20.9446	20.9187	20.6900	20.3293	20.0240
Non living	19.0303	19.2437	19.5488	19.9308	20.1025	20.1638	20.1606	20.1707	20.1385	19.8889	19.4439	19.0423
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	20.5019	20.1877	20.4324	20.7354	20.8917	20.9414	20.9442	20.9446	20.9187	20.6900	20.3293	20.1605 (87)
Th 2	20.1898	20.1991	20.1944	20.2130	20.2177	20.2365	20.2318	20.2411	20.2271	20.2177	20.2224	20.2084 (88)
util rest of house	0.9964	0.9904	0.9665	0.8679	0.6763	0.4054	0.2597	0.2930	0.6062	0.9232	0.9898	0.9974 (89)
MIT 2	19.7275	19.2437	19.5488	19.9308	20.1025	20.1638	20.1606	20.1707	20.1385	19.8889	19.4439	19.2524 (90)
Living area fraction									fLA = Living area / (4) =			0.2131 (91)
MIT	19.8925	19.4448	19.7371	20.1023	20.2707	20.3295	20.3276	20.3356	20.3048	20.0596	19.6326	19.4459 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8925	19.4448	19.7371	20.1023	20.2707	20.3295	20.3276	20.3356	20.3048	20.0596	19.6326	19.4459 (93)

8. Space heating requirement

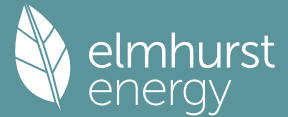
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9879	0.9615	0.8639	0.6799	0.4129	0.2682	0.3020	0.6135	0.9184	0.9874	0.9967	(94)
Useful gains	1391.1992	1635.1079	1877.9851	1997.8307	1719.0637	1094.9964	665.9535	680.3886	1225.6454	1506.3468	1392.3424	1298.1410	(95)
Ext temp.	4.5000	5.1000	6.9000	9.4000	12.2000	15.3000	17.3000	17.2000	14.6000	11.1000	7.4000	4.5000	(96)
Heat loss rate W	3588.2016	3302.3667	2973.8771	2417.2540	1811.1689	1099.5207	666.2602	680.9300	1263.6853	2010.6612	2727.4175	3397.4050	(97)
Space heating kWh	1634.5698	1120.3979	815.3436	301.9848	68.5263	0.0000	0.0000	0.0000	0.0000	375.2099	961.2540	1561.8524	(98a)
Space heating requirement - total per year (kWh/year)												6839.1387	
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	1634.5698	1120.3979	815.3436	301.9848	68.5263	0.0000	0.0000	0.0000	0.0000	375.2099	961.2540	1561.8524	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6839.1387	
Space heating per m2											(98c) / (4) =	25.6378	(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 %)												372.8394 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1634.5698	1120.3979	815.3436	301.9848	68.5263	0.0000	0.0000	0.0000	0.0000	375.2099	961.2540	1561.8524 (98)
Space heating efficiency (main heating system 1)	372.8394	372.8394	372.8394	372.8394	372.8394	0.0000	0.0000	0.0000	0.0000	372.8394	372.8394	372.8394 (210)
Space heating fuel (main heating system)	438.4113	300.5042	218.6850	80.9959	18.3796	0.0000	0.0000	0.0000	0.0000	100.6358	257.8199	418.9076 (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

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Efficiency of water heater	321.7477	284.6215	302.2189	264.9502	256.4001	230.5308	226.9721	236.1493	238.9573	267.1002	284.8561	318.0991 (64)
(217)m	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820 (216)
Fuel for water heating, kWh/month	191.7653	169.6376	180.1259	157.9134	152.8174	137.3990	135.2780	140.7477	142.4213	159.1948	169.7775	189.5907 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
(221)m	81.7820	73.8676	81.7820	79.1439	81.7820	79.1439	81.7820	81.7820	79.1439	81.7820	79.1439	81.7820 (231)
Pumps and Fa	45.5926	36.5761	32.9327	24.1279	18.6371	15.2267	17.0014	22.0990	28.7045	37.6618	42.5389	46.8598 (232)
Lighting	-101.1043	-152.9215	-252.9359	-333.2202	-390.5173	-403.1777	-389.9156	-351.0298	-287.5212	-202.0449	-122.2534	-83.9549 (233a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
(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 (234a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
(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 (235c)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
(235c)m	-0.4535	-1.6002	-5.6406	-15.7877	-28.3980	-37.9242	-35.2795	-26.4326	-15.6513	-4.5971	-1.0088	-0.3049 (233b)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
(235d)m												
Annual totals kWh/year												
Space heating fuel - main system 1												1834.3392 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												167.7820
Water heating fuel used												1926.6684 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1250)												
mechanical ventilation fans (SFP = 1.1250)												962.9169 (230a)
Total electricity for the above, kWh/year												962.9169 (231)
Electricity for lighting (calculated in Appendix L)												367.9585 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-3243.6750 (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												1848.2080 (238)

10a. Fuel costs - using BEDF prices (561)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1834.3392	26.0600	478.0288 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1926.6684	26.0600	502.0898 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	962.9169	26.0600	250.9361 (249)
Energy for lighting	367.9585	26.0600	95.8900 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3070.5966	26.0600	-800.1975
PV Unit electricity exported	-173.0784	5.8100	-10.0559
Total			-810.2533 (252)
Total energy cost			516.6914 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1834.3392	0.1570	287.9082 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1926.6684	0.1409	271.5456 (264)
Space and water heating			559.4538 (265)
Pumps, fans and electric keep-hot	962.9169	0.1387	133.5684 (267)
Energy for lighting	367.9585	0.1443	53.1078 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3070.5966	0.1317	-404.5233
PV Unit electricity exported	-173.0784	0.1142	-19.7694
Total			-424.2927 (269)
Total CO2, kg/year			321.8374 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1834.3392	1.5810	2900.1577 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1926.6684	1.5211	2930.7495 (278)
Space and water heating			5830.9072 (279)
Pumps, fans and electric keep-hot	962.9169	1.5128	1456.7007 (281)
Energy for lighting	367.9585	1.5338	564.3871 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3070.5966	1.4867	-4565.0959
PV Unit electricity exported	-173.0784	0.4184	-72.4242
Total			-4637.5201 (283)
Total Primary energy kWh/year			3214.4748 (286)

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SAP 10 EPC IMPROVEMENTS

Proposed

Current energy efficiency rating: A 93
Current environmental impact rating: A 98

N Solar water heating			Recommended
U Solar photovoltaic panels			Already installed
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 94	-47 kg (14.6%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£94	0.18 kg/m ²	A 94	A 99
Total Savings	£94	0.18 kg/m ²		

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 561 TEST (31 Jan 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£1327	£1228	£99
Space heating	£729	£750	-£21
Water heating	£502	£382	£120
Lighting	£96	£96	£0
Generated (PV)	-£810	-£806	-£5
Total cost of fuels	£517	£422	£94
Total cost of uses	£517	£422	£94
Delivered energy	7 kWh/m ²	6 kWh/m ²	1 kWh/m ²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m ²	1 kg/m ²	1 kg/m ²	0 kg/m ²
Primary energy	12 kWh/m ²	10 kWh/m ²	2 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	133.3800 (1b)	x 2.4100 (2b)	= 321.4458 (1b) - (3b)
First floor	133.3800 (1c)	x 2.8500 (2c)	= 380.1330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	266.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 701.5788 (5)

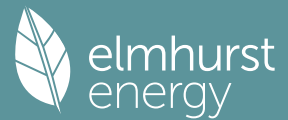
2. Ventilation rate

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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0100 (17)
Infiltration rate		0.2505 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2505 (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	0.3194	0.3131	0.3069	0.2756	0.2693	0.2380	0.2380	0.2317	0.2505	0.2693	0.2818	0.2943 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)

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If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 81.9000 (23c)

Effective ac 0.4099 0.4036 0.3974 0.3660 0.3598 0.3285 0.3285 0.3222 0.3410 0.3598 0.3723 0.3848 (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								
Entrance door			5.7500	0.8000	4.6000			(26)
sliding/folding doors			14.1800	1.1450	16.2366			(27)
Windows			33.3600	1.1450	38.1985			(27)
Fixed glazing			5.1000	1.1450	5.8397			(27)
Heat Loss Floor 1			133.3800	0.1100	14.6718	65.5200	8739.0576	(28a)
Brick wall	260.1000	58.3900	201.7100	0.1800	36.3078	113.6000	22914.2560	(29a)
Bay windows	2.8800		2.8800	0.1300	0.3744	0.0000	0.0000	(30)
Main roof	111.4500		111.4500	0.1100	12.2595	12.1700	1356.3465	(30)
Vaulted	23.8200		23.8200	0.1200	2.8584	12.1700	289.8894	(30)
Total net area of external elements Aum(A, m2)			531.6300					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	131.3467		(33)
Main dwelling								
Internal Wall 1			209.2200			9.0000	1882.9800	(32c)
Internal Wall 2			212.2400			75.0000	15918.0000	(32c)
Internal Floor 1			133.3800			18.0000	2400.8400	(32d)
Internal Ceiling 1			133.3800			9.0000	1200.4200	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 54701.7895 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 205.0599 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	6.7500	0.0240	0.1620
E2 Other lintels (including other steel lintels)	30.5400	0.0200	6.1691
E3 Sill	27.8000	0.0230	0.6394
E4 Jamb	45.6000	0.0180	0.8208
E5 Ground floor (normal)	51.0000	0.0730	3.7230
E6 Intermediate floor within a dwelling	51.0000	0.0010	0.0510
E13 Gable (insulation at rafter level)	4.2000	0.0380	0.1596
E10 Eaves (insulation at ceiling level)	47.7800	0.0690	3.2968
E14 Flat roof	6.8000	0.1520	1.0336
E16 Corner (normal)	51.0000	0.0360	1.8360
E17 Corner (inverted - internal area greater than external area)	30.6000	-0.0620	-1.8972
R4 Ridge (vaulted ceiling)	6.4000	0.1200	0.7680
R6 Flat ceiling	12.8000	0.0200	0.2560

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.0181 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 148.3648 (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	94.8976	93.4477	91.9978	84.7483	83.2984	76.0489	76.0489	74.5990	78.9487	83.2984	86.1982	89.0980
Average = Sum(39)m / 12 =	243.2624	241.8125	240.3626	233.1131	231.6632	224.4137	224.4137	222.9638	227.3135	231.6632	234.5630	237.4628
												232.7506

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9119	0.9065	0.9010	0.8739	0.8684	0.8413	0.8413	0.8358	0.8521	0.8684	0.8793	0.8902
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0887	(42)
Hot water usage for mixer showers														
85.5085	84.2235	82.3509	78.7682	76.1242	73.1756	71.4997	73.3580	75.3951	78.5610	82.2207	85.1809			(42a)
Hot water usage for baths														
32.8089	32.3217	31.6355	30.3704	29.4230	28.3726	27.8052	28.4865	29.2284	30.3524	31.6437	32.6980			(42b)
Hot water usage for other uses														
46.2616	44.5793	42.8971	41.2148	39.5326	37.8504	37.8504	39.5326	41.2148	42.8971	44.5793	46.2616			(42c)
Average daily hot water use (litres/day)													151.3110	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use														
164.5790	161.1245	156.8835	150.3534	145.0798	139.3986	137.1552	141.3772	145.8384	151.8105	158.4437	164.1404			(44)
Energy content	260.6529	229.4391	241.1241	205.8262	195.3053	171.4068	165.8773	175.0545	179.8333	206.0054	225.7321	257.0043		(45)
Energy content (annual)														
Distribution loss (46)m = 0.15 x (45)m														
39.0979	34.4159	36.1686	30.8739	29.2958	25.7110	24.8816	26.2582	26.9750	30.9008	33.8598	38.5506			(46)
Water storage loss:														
Store volume													300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2600	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													1.2204	(55)
Total storage loss														
37.8324	34.1712	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324		(56)
If cylinder contains dedicated solar storage														
37.8324	34.1712	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324		(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624		(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(61)
Total heat required for water heating calculated for each month														
321.7477	284.6215	300.8232	258.1966	243.6058	217.9241	213.9452	224.0528	233.5545	265.7045	284.8561	318.0991			(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000		(63b)
Aperture area of solar collector													3.0000	(H1)
Zero-loss collector efficiency													0.8000	(H2)
Collector linear heat loss coefficient													1.8000	(H3)
Collector 2nd order heat loss coefficient													0.0000	(H4)
Collector loop efficiency													0.9000	(H5)
Incidence angle modifier													1.0000	(H6)
Overshading factor													0.8000	(H8)
Overall heat loss coefficient of system													6.5000	(H10)
Heat loss coefficient of collector loop													3.9667	(H11)
Dedicated solar storage volume													75.0000	(H12)
Effective solar volume													75.0000	(H14)
Reference volume													225.0000	(H15)
Storage tank correction coefficient													1.3161	(H16)

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Heat delivered to hot water												645.6256 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												645.6256
Solar input	-0.0000	-16.1753	-59.4978	-82.8109	-109.6200	-101.3275	-100.7462	-87.2759	-59.3261	-28.8460	-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	321.7477	268.4462	241.3254	175.3857	133.9857	116.5966	113.1990	136.7770	174.2284	236.8585	284.8561	318.0991 (64)
								Total per year (kWh/year) = Sum(64)m =				2521.5054 (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	135.5429	120.4344	127.9330	110.3335	103.5794	94.2066	93.6085	97.4043	102.7715	116.2560	122.3551	134.3298 (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	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.0883	46.2644	37.6247	28.4843	21.2924	17.9759	19.4236	25.2476	33.8872	43.0276	50.2196	53.5360 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	642.9178	649.5893	632.7774	596.9868	551.8077	509.3457	480.9784	474.3069	491.1188	526.9094	572.0885	614.5506 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210 (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)	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487 (71)
Water heating gains (Table 5)	182.1813	179.2179	171.9530	153.2410	139.2196	130.8425	125.8179	130.9198	142.7382	156.2581	169.9377	180.5508 (72)
Total internal gains	995.5829	993.4669	960.7505	897.1076	830.7151	776.5595	744.6153	748.8696	786.1396	844.5905	910.6412	967.0327 (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				14.1800	36.7938	0.6300	0.7000	0.7700	159.4495 (77)			
Northeast				18.7200	11.2829	0.6300	0.7000	0.7700	64.5506 (75)			
Southeast				5.8200	36.7938	0.6300	0.7000	0.7700	65.4440 (77)			
Southwest				3.0000	36.7938	0.6300	0.7000	0.7700	33.7340 (79)			
Northwest				5.8200	11.2829	0.6300	0.7000	0.7700	20.0686 (81)			
Northeast				5.1000	11.2829	0.5700	0.7000	0.7700	15.9110 (75)			
Solar gains	359.1577	645.1704	971.4457	1352.3353	1650.4245	1698.1777	1612.3850	1380.8718	1101.9104	736.9654	436.2691	303.4293 (83)
Total gains	1354.7406	1638.6374	1932.1962	2249.4428	2481.1395	2474.7371	2357.0003	2129.7415	1888.0501	1581.5559	1346.9103	1270.4620 (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	62.4632	62.8377	63.2168	65.1827	65.5907	67.7095	67.7095	68.1498	66.8458	65.5907	64.7798	63.9887
alpha	5.1642	5.1892	5.2145	5.3455	5.3727	5.5140	5.5140	5.5433	5.4564	5.3727	5.3187	5.2659
util living area	0.9977	0.9935	0.9789	0.9207	0.7781	0.5679	0.4169	0.4772	0.7575	0.9616	0.9947	0.9984 (86)
Living	19.9369	20.1011	20.3494	20.6623	20.8586	20.9321	20.9420	20.9405	20.8913	20.6103	20.2258	19.9294
Non living	18.8902	19.1035	19.4218	19.8250	20.0476	20.1382	20.1448	20.1491	20.0971	19.7733	19.2820	18.8952
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	20.4562	20.1011	20.3494	20.6623	20.8586	20.9321	20.9420	20.9405	20.8913	20.6103	20.2258	20.0792 (87)
Th 2	20.1574	20.1620	20.1666	20.1898	20.1944	20.2177	20.2177	20.2224	20.2084	20.1944	20.1851	20.1759 (88)
util rest of house	0.9971	0.9917	0.9731	0.9005	0.7319	0.5033	0.3438	0.3987	0.6932	0.9477	0.9929	0.9979 (89)
MIT 2	19.6522	19.1035	19.4218	19.8250	20.0476	20.1382	20.1448	20.1491	20.0971	19.7733	19.2820	19.1260 (90)
Living area fraction												0.2131 (91)
MIT	19.8235	19.3161	19.6194	20.0034	20.2204	20.3074	20.3147	20.3177	20.2664	19.9516	19.4831	19.3291 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8235	19.3161	19.6194	20.0034	20.2204	20.3074	20.3147	20.3177	20.2664	19.9516	19.4831	19.3291 (93)

8. Space heating requirement

Utilisation	0.9968	0.9894	0.9684	0.8951	0.7335	0.5109	0.3529	0.4084	0.6983	0.9425	0.9909	0.9973 (94)
Useful gains	1350.3702	1621.1971	1871.1034	2013.5008	1819.9355	1264.2304	831.8744	869.8093	1318.4467	1490.5733	1334.6915	1267.0121 (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	3776.2859	3485.9813	3153.4223	2588.3563	1973.8569	1280.8146	833.6241	873.5049	1401.6948	2166.4311	2904.6171	3592.5916 (97)
Space heating kWh	1804.8813	1253.1350	954.0453	413.8960	114.5175	0.0000	0.0000	0.0000	0.0000	502.8382	1130.3464	1730.2312 (98a)
Space heating requirement - total per year (kWh/year)												7903.8910
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	1804.8813	1253.1350	954.0453	413.8960	114.5175	0.0000	0.0000	0.0000	0.0000	502.8382	1130.3464	1730.2312 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7903.8910
Space heating per m2										(98c) / (4) =		29.6292 (99)

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

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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 %)													373.8177	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													65.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1804.8813	1253.1350	954.0453	413.8960	114.5175	0.0000	0.0000	0.0000	0.0000	502.8382	1130.3464	1730.2312	(98)	
Space heating efficiency (main heating system 1)	373.8177	373.8177	373.8177	373.8177	373.8177	0.0000	0.0000	0.0000	0.0000	373.8177	373.8177	373.8177	(210)	
Space heating fuel (main heating system)	482.8239	335.2262	255.2167	110.7213	30.6346	0.0000	0.0000	0.0000	0.0000	134.5143	302.3791	462.8543	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	321.7477	268.4462	241.3254	175.3857	133.9857	116.5966	113.1990	136.7770	174.2284	236.8585	284.8561	318.0991	(64)	
Efficiency of water heater	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	167.7916	(216)	
Fuel for water heating, kWh/month	191.7544	159.9879	143.8245	104.5260	79.8525	69.4889	67.4641	81.5160	103.8362	141.1624	169.7678	189.5799	(219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	88.5765	80.0046	88.5765	85.7192	88.5765	85.7192	88.5765	88.5765	85.7192	88.5765	85.7192	88.5765	(231)	
Lighting	45.5926	36.5761	32.9327	24.1279	18.6371	15.2267	17.0014	22.0990	28.7045	37.6618	42.5389	46.8598	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-90.0884	-148.6825	-248.2346	-321.7210	-382.5046	-369.2160	-364.8824	-326.2760	-263.9888	-187.6548	-106.4225	-75.5360	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	-0.3257	-1.4346	-5.3350	-14.9418	-30.5624	-35.6992	-35.1889	-25.1914	-13.6753	-3.6885	-0.6740	-0.2239	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													2114.3704	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													167.7916	
Water heating fuel used													1502.7606	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1250)														
mechanical ventilation fans (SFP = 1.1250)													962.9169	(230a)
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													1042.9169	(231)
Electricity for lighting (calculated in Appendix L)													367.9585	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-3052.1485	(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													1975.8580	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2114.3704	16.4900	348.6597	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1502.7606	16.4900	247.8052	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	962.9169	16.4900	158.7850	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	367.9585	16.4900	60.6764	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2885.2076	16.4900	-475.7707	
PV Unit electricity exported	-166.9409	5.5900	-9.3320	
Total			-485.1027	(252)
Total energy cost			344.0155	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.3972	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	93.5606	
SAP rating (Section 12)		94	(258)
SAP band		A	

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

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2114.3704	0.1564	330.6600 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1502.7606	0.1449	217.7065 (264)
Space and water heating			548.3665 (265)
Pumps, fans and electric keep-hot	1042.9169	0.1387	144.6654 (267)
Energy for lighting	367.9585	0.1443	53.1078 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2885.2076	0.1318	-380.4108
PV Unit electricity exported	-166.9409	0.1140	-19.0343
Total			-399.4451 (269)
Total CO2, kg/year			346.6945 (272)
CO2 emissions per m2			1.3000 (273)
EI value			98.5098
EI rating			99 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	133.3800 (1b)	x 2.4100 (2b)	= 321.4458 (1b) - (3b)
First floor	133.3800 (1c)	x 2.8500 (2c)	= 380.1330 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	266.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 701.5788 (5)

2. Ventilation rate

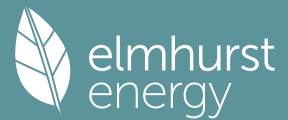
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0100 (17)
Infiltration rate	0.2505 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2505 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.2000	4.3000	3.9000	3.8000	3.4000	3.5000	3.3000	3.6000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0500	1.0750	0.9750	0.9500	0.8500	0.8750	0.8250	0.9000	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.2756	0.2630	0.2693	0.2442	0.2380	0.2129	0.2192	0.2067	0.2255	0.2380	0.2317	0.2505 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.9000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3660	0.3535	0.3598	0.3347	0.3285	0.3034	0.3097	0.2972	0.3159	0.3285	0.3222	0.3410 (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							
Entrance door			5.7500	0.8000	4.6000		(26)
sliding/folding doors			14.1800	1.1450	16.2366		(27)
Windows			33.3600	1.1450	38.1985		(27)
Fixed glazing			5.1000	1.1450	5.8397		(27)
Heat Loss Floor 1			133.3800	0.1100	14.6718	65.5200	8739.0576 (28a)
Brick wall	260.1000	58.3900	201.7100	0.1800	36.3078	113.6000	22914.2560 (29a)
Bay windows	2.8800		2.8800	0.1300	0.3744	0.0000	0.0000 (30)
Main roof	111.4500		111.4500	0.1100	12.2595	12.1700	1356.3465 (30)
Vaulted	23.8200		23.8200	0.1200	2.8584	12.1700	289.8894 (30)
Total net area of external elements Aum(A, m2)			531.6300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		131.3467		(33)
Main dwelling							
Internal Wall 1			209.2200			9.0000	1882.9800 (32c)
Internal Wall 2			212.2400			75.0000	15918.0000 (32c)
Internal Floor 1			133.3800			18.0000	2400.8400 (32d)
Internal Ceiling 1			133.3800			9.0000	1200.4200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 54701.7895 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							205.0599 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.7500	0.0240	0.1620
E2 Other lintels (including other steel lintels)	30.5400	0.0200	6.1691
E3 Sill	27.8000	0.0230	0.6394
E4 Jamb	45.6000	0.0180	0.8208
E5 Ground floor (normal)	51.0000	0.0730	3.7230
E6 Intermediate floor within a dwelling	51.0000	0.0010	0.0510
E13 Gable (insulation at rafter level)	4.2000	0.0380	0.1596
E10 Eaves (insulation at ceiling level)	47.7800	0.0690	3.2968
E14 Flat roof	6.8000	0.1520	1.0336
E16 Corner (normal)	51.0000	0.0360	1.8360
E17 Corner (inverted - internal area greater than external area)	30.6000	-0.0620	-1.8972
R4 Ridge (vaulted ceiling)	6.4000	0.1200	0.7680
R6 Flat ceiling	12.8000	0.0200	0.2560
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			17.0181 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	148.3648 (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	84.7483	81.8485	83.2984	77.4988	76.0489	70.2493	71.6992	68.7994	73.1491	76.0489	74.5990	78.9487	(38)
Heat transfer coeff	233.1131	230.2133	231.6632	225.8636	224.4137	218.6141	220.0640	217.1642	221.5139	224.4137	222.9638	227.3135	(39)
Average = Sum(39)m / 12 =												224.7761	
HLP	0.8739	0.8630	0.8684	0.8467	0.8413	0.8195	0.8250	0.8141	0.8304	0.8413	0.8358	0.8521	(40)
HLP (average)												0.8426	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

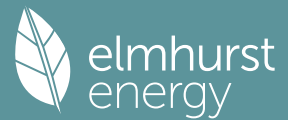
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0887 (42)
Hot water usage for mixer showers	85.5085	84.2235	82.3509	78.7682	76.1242	73.1756	71.4997	73.3580	75.3951	78.5610	82.2207	85.1809	(42a)
Hot water usage for baths	32.8089	32.3217	31.6355	30.3704	29.4230	28.3726	27.8052	28.4865	29.2284	30.3524	31.6437	32.6980	(42b)
Hot water usage for other uses	46.2616	44.5793	42.8971	41.2148	39.5326	37.8504	37.8504	39.5326	41.2148	42.8971	44.5793	46.2616	(42c)
Average daily hot water use (litres/day)												151.3110	(43)
Daily hot water use	164.5790	161.1245	156.8835	150.3534	145.0798	139.3986	137.1552	141.3772	145.8384	151.8105	158.4437	164.1404	(44)
Energy conte	260.6529	229.4391	241.1241	205.8262	195.3053	171.4068	165.8773	175.0545	179.8333	206.0054	225.7321	257.0043	(45)
Energy content (annual)										Total = Sum(45)m =		2513.2614	
Distribution loss (46)m = 0.15 x (45)m	39.0979	34.4159	36.1686	30.8739	29.2958	25.7110	24.8816	26.2582	26.9750	30.9008	33.8598	38.5506	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.2204	(55)
Total storage loss	37.8324	34.1712	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324	36.6120	37.8324	36.6120	37.8324	(56)
If cylinder contains dedicated solar storage	37.8324	34.1712	37.8324	36.6120	37.8324	36.6120	37.8324	37.8324	36.6120	37.8324	36.6120	37.8324	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	321.7477	284.6215	300.8232	258.1966	243.6058	217.9241	213.9452	224.0528	233.5545	265.7045	284.8561	318.0991	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												706.7555	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												706.7555	
Solar input	-0.0000	-18.1384	-62.0934	-87.7543	-112.2467	-112.8305	-109.1827	-96.7379	-68.8063	-35.5748	-3.3904	-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	321.7477	266.4830	238.7298	170.4423	131.3591	105.0936	104.7625	127.3149	164.7481	230.1297	281.4657	318.0991	(64)
								Total per year (kWh/year) = Sum(64)m =				2460.3755	(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	135.5429	120.4344	127.9330	110.3335	103.5794	94.2066	93.6085	97.4043	102.7715	116.2560	122.3551	134.3298	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	185.3231	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.0883	46.2644	37.6247	28.4843	21.2924	17.9759	19.4236	25.2476	33.8872	43.0276	50.2196	53.5360	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	642.9178	649.5893	632.7774	596.9868	551.8077	509.3457	480.9784	474.3069	491.1188	526.9094	572.0885	614.5506	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	56.6210	(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)	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	-123.5487	(71)

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Water heating gains (Table 5)	182.1813	179.2179	171.9530	153.2410	139.2196	130.8425	125.8179	130.9198	142.7382	156.2581	169.9377	180.5508 (72)
Total internal gains	995.5829	993.4669	960.7505	897.1076	830.7151	776.5595	744.6153	748.8696	786.1396	844.5905	910.6412	967.0327 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Southeast	14.1800	40.6744		0.6300	0.7000		0.7700	176.2662 (77)
Northeast	18.7200	12.9326		0.6300	0.7000		0.7700	73.9882 (75)
Southeast	5.8200	40.6744		0.6300	0.7000		0.7700	72.3462 (77)
Southwest	3.0000	40.6744		0.6300	0.7000		0.7700	37.2919 (79)
Northwest	5.8200	12.9326		0.6300	0.7000		0.7700	23.0027 (81)
Northeast	5.1000	12.9326		0.5700	0.7000		0.7700	18.2373 (75)

Solar gains	401.1325	661.6862	990.9391	1408.0329	1684.0247	1861.6826	1724.4245	1490.8889	1205.6546	794.0848	499.5235	335.4106 (83)
Total gains	1396.7154	1655.1531	1951.6896	2305.1405	2514.7398	2638.2421	2469.0398	2239.7586	1991.7943	1638.6753	1410.1647	1302.4433 (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	65.1827	66.0038	65.5907	67.2749	67.7095	69.5058	69.0478	69.9698	68.5959	67.7095	68.1498	66.8458
alpha	5.3455	5.4003	5.3727	5.4850	5.5140	5.6337	5.6032	5.6647	5.5731	5.5140	5.5433	5.4564
util living area	0.9972	0.9924	0.9737	0.8944	0.7292	0.4687	0.3293	0.3676	0.6772	0.9432	0.9923	0.9980 (86)
Living	20.0263	20.1877	20.4319	20.7339	20.8907	20.9413	20.9442	20.9445	20.9184	20.6896	20.3293	20.0240
Non living	19.0303	19.2437	19.5482	19.9291	20.1016	20.1638	20.1606	20.1706	20.1383	19.8885	19.4439	19.0423
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	20.5019	20.1877	20.4319	20.7339	20.8907	20.9413	20.9442	20.9445	20.9184	20.6896	20.3293	20.1605 (87)
Th 2	20.1898	20.1991	20.1944	20.2130	20.2177	20.2365	20.2318	20.2411	20.2271	20.2177	20.2224	20.2084 (88)
util rest of house	0.9964	0.9904	0.9666	0.8691	0.6793	0.4075	0.2612	0.2947	0.6078	0.9235	0.9898	0.9974 (89)
MIT 2	19.7275	19.2437	19.5482	19.9291	20.1016	20.1638	20.1606	20.1706	20.1383	19.8885	19.4439	19.2524 (90)
Living area fraction												0.2131 (91)
MIT	19.8925	19.4448	19.7365	20.1006	20.2697	20.3294	20.3276	20.3355	20.3045	20.0592	19.6326	19.4459 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8925	19.4448	19.7365	20.1006	20.2697	20.3294	20.3276	20.3355	20.3045	20.0592	19.6326	19.4459 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9961	0.9879	0.9616	0.8651	0.6828	0.4150	0.2697	0.3038	0.6151	0.9186	0.9874	0.9967 (94)
Useful gains	1391.1992	1635.1079	1876.7556	1994.1468	1716.9677	1094.8635	665.9431	680.3699	1225.1187	1505.3654	1392.3424	1298.1410 (95)
Ext temp.	4.5000	5.1000	6.9000	9.4000	12.2000	15.3000	17.3000	17.2000	14.6000	11.1000	7.4000	4.5000 (96)
Heat loss rate W	3588.2016	3302.3667	2973.7440	2416.8681	1810.9593	1099.5074	666.2590	680.9279	1263.6328	2010.5577	2727.4175	3397.4050 (97)
Space heating kWh	1634.5698	1120.3979	816.1594	304.3593	69.9297	0.0000	0.0000	0.0000	0.0000	375.8631	961.2540	1561.8524 (98a)
Space heating requirement - total per year (kWh/year)												6844.3856
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	1634.5698	1120.3979	816.1594	304.3593	69.9297	0.0000	0.0000	0.0000	0.0000	375.8631	961.2540	1561.8524 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6844.3856
Space heating per m ²										(98c) / (4) =		25.6575 (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 %)												372.8394 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1634.5698	1120.3979	816.1594	304.3593	69.9297	0.0000	0.0000	0.0000	0.0000	375.8631	961.2540	1561.8524 (98)
Space heating efficiency (main heating system 1)	372.8394	372.8394	372.8394	372.8394	372.8394	0.0000	0.0000	0.0000	0.0000	372.8394	372.8394	372.8394 (210)
Space heating fuel (main heating system)	438.4113	300.5042	218.9038	81.6328	18.7560	0.0000	0.0000	0.0000	0.0000	100.8110	257.8199	418.9076 (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	321.7477	266.4830	238.7298	170.4423	131.3591	105.0936	104.7625	127.3149	164.7481	230.1297	281.4657	318.0991 (64)
Efficiency of water heater	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820	167.7820 (216)
Fuel for water heating, kWh/month	191.7653	158.8269	142.2857	101.5856	78.2915	62.6370	62.4396	75.8811	98.1918	137.1599	167.7567	189.5907 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	88.5765	80.0046	88.5765	85.7192	88.5765	85.7192	88.5765	88.5765	85.7192	88.5765	85.7192	88.5765 (231)

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Lighting	45.5926	36.5761	32.9327	24.1279	18.6371	15.2267	17.0014	22.0990	28.7045	37.6618	42.5389	46.8598	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-101.1076	-152.9115	-252.6911	-331.7987	-386.4490	-396.8842	-384.1958	-347.3305	-286.1567	-201.9229	-122.2598	-83.9572	(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	-0.4501	-1.6102	-5.8854	-17.2092	-32.4664	-44.2177	-40.9992	-30.1318	-17.0158	-4.7192	-1.0024	-0.3025	(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												1835.7465	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												167.7820	
Water heating fuel used												1466.4118	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1250)													
mechanical ventilation fans (SFP = 1.1250)												962.9169	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												1042.9169	(231)
Electricity for lighting (calculated in Appendix L)												367.9585	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3243.6750	(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												1469.3587	(238)

10a. Fuel costs - using BEDF prices (561)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1835.7465	26.0600	478.3955	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1466.4118	26.0600	382.1469	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	962.9169	26.0600	250.9361	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	367.9585	26.0600	95.8900	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3047.6651	26.0600	-794.2215	
PV Unit electricity exported	-196.0099	5.8100	-11.3882	
Total			-805.6097	(252)
Total energy cost			422.6069	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1835.7465	0.1569	288.1063	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1466.4118	0.1453	213.1146	(264)
Space and water heating			501.2209	(265)
Pumps, fans and electric keep-hot	1042.9169	0.1387	144.6654	(267)
Energy for lighting	367.9585	0.1443	53.1078	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3047.6651	0.1318	-401.7583	
PV Unit electricity exported	-196.0099	0.1136	-22.2585	
Total			-424.0169	(269)
Total CO2, kg/year			274.9772	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1835.7465	1.5810	2902.2984	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1466.4118	1.5376	2254.7252	(278)
Space and water heating			5157.0236	(279)
Pumps, fans and electric keep-hot	1042.9169	1.5128	1577.7247	(281)
Energy for lighting	367.9585	1.5338	564.3871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3047.6651	1.4870	-4531.9692	
PV Unit electricity exported	-196.0099	0.4159	-81.5256	
Total			-4613.4948	(283)
Total Primary energy kWh/year			2685.6406	(286)

Summary for Input Data



Property Reference	7358-0001-KW-578		Issued on Date	03/03/2025
Assessment Reference	Proposed	Prop Type Ref		
Property	Proposed dwelling, 1 The Drive, Blackmore End, Herts, AL4 8LE			

SAP Rating	93 A	DER	1.50	TER	8.45
Environmental	98 A	% DER < TER			82.25
CO ₂ Emissions (t/year)	0.32	DFEE	41.89	TFEE	43.25
Compliance Check	See BREL	% DFEE < TFEE			3.16
% DPER < TPER	66.36	DPER	15.11	TPER	44.90

Assessor Details	Mr. James Turner	Assessor ID	7358-0001
Client	603, Luke Kenton		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	Northeast
Property Tenure	ND
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
Thermal Mass	205.06 kJ/m ² K

7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements	Ground floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	1st Storey:	51.00 m	133.38 m ²	2.41 m
		51.00 m	133.38 m ²	2.85 m

8.0 Living Area	56.84 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
	Brick wall	Cavity Wall	Other	0.18	113.60	260.10	201.71	0.00	None	58.39	Enter Gross Area

9.2 Internal Walls	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Internal Wall 1	Plasterboard on timber frame	9.00	209.22
	Internal Wall 2	Dense block, plasterboard on dabs	75.00	212.24

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
	Bay windows	External Flat Roof	Other	0.13	0.00	2.88	2.88	None	0.00	Enter Gross Area	0.00
	Main roof	External Plane Roof	Other	0.11	12.17	111.45	111.45	None	0.00	Enter Gross Area	0.00
	Vaulted	External Slope Roof	Other	0.12	12.17	23.82	23.82	None	0.00	Enter Gross Area	0.00

10.2 Internal Ceilings	Description	Storey	Construction	Area (m ²)
	Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	133.38

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)
	Heat Loss Floor 1	Ground Floor - Solid	Lowest occupied	Other	0.11	None	0.00	65.52	133.38

Summary for Input Data

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	133.38

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Entrance door	Manufacturer	Solid Door				0.63			0.80
sliding/folding doors	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.20
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.20
Fixed glazing	Manufacturer	Window	Triple Low-E Soft 0.05			0.57		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Opening 1	Entrance door	Brick wall	North East	3.78	
Opening 2	Entrance door	Brick wall	South West	1.97	
Opening 3	sliding/folding doors	Brick wall	South East	14.18	
Opening 4	Windows	Brick wall	South West	3.00	
Opening 5	Windows	Brick wall	North West	5.82	
Opening 6	Windows	Brick wall	South East	5.82	
Opening 7	Windows	Brick wall	North East	18.72	
Opening 8	Fixed glazing	Brick wall	North East	5.10	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	6.75	0.02	0.02 MHF-150-E2-02	No
E2 Other lintels (including other steel lintels)	Independently assessed	30.54	0.20	0.20 Kingspan K106 detail	No
E3 Sill	Independently assessed	27.80	0.02	0.02 MHF-150-E3-01	No
E4 Jamb	Independently assessed	45.60	0.02	0.02 MHF-150-E4-01	No
E5 Ground floor (normal)	Independently assessed	51.00	0.07	0.07 MHF-150-E5-04	No
E6 Intermediate floor within a dwelling	Independently assessed	51.00	0.00	0.00 MHF-150-E6-01	No
E13 Gable (insulation at rafter level)	Independently assessed	4.20	0.04	0.04 MHF-150-E13-01	No
E10 Eaves (insulation at ceiling level)	Independently assessed	47.78	0.07	0.07 MHF-150-E10-01	No
E14 Flat roof	Independently assessed	6.80	0.15	0.15 ROI detail 1.20	No
E16 Corner (normal)	Independently assessed	51.00	0.04	0.04 MHF-150-E16-01	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	30.60	-0.06	-0.06 MHF-150-E17-01	No
R4 Ridge (vaulted ceiling)	Table K1 - Default	6.40	0.12	0.12	No
R6 Flat ceiling	Independently assessed	12.80	0.02	0.02 ROI detail 1.13.2	No

Y-value W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500289
Configuration	6
Manufacturer SFP	0.90
Duct Type	Rigid
MVHR Efficiency	91.00
Wet Rooms	6
SFP from Installer Commissioning Certificate	No
MVHR System Location	Inside heated envelope (installed exclusively)
Duct Installation Specification	Level 1

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

Summary for Input Data

Number of flues attached to other heater	0
Number of blocked chimneys	0
Number of intermittent extract fans	0
Number of passive vents	0
Number of flueless gas fires	0

21.0 Fixed Cooling System	No
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22.0 Pressure Testing	Yes	
Designed AP ₅₀	5.01	m ² /(h.m ²) @ 50 Pa
Test Method	Blower Door	

22.0 Lighting	No				
No Fixed Lighting	No				
	Name	Efficacy	Power	Capacity	Count
	Low energy Lighting	80.00	8.00	640.00	48

24.0 Main Heating 1	Database	
Description	Air Source heat pump	
Percentage of Heat	100.00	%
Database Ref. No.	105057	
Fuel Type	Electricity	
In Winter	373.82	
In Summer	167.79	
Model Name	Ecodan 14.0 kW	
Manufacturer	Mitsubishi Electric Europe B.V.	
System Type	Heat Pump	
Controls SAP Code	2207	
PCDF Controls	0	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	Enter value	
Flow Temperature Value	35.00	

25.0 Main Heating 2	None
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26.0 Heat Networks	None
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27.0 Secondary Heating	SAP table	
SAP Code	633	
Heating System Description	Solid fuel Closed room heater	
Fuel Type	Wood Logs	
SHS efficiency	60.00	%
HETAS Approved System	Yes	

28.0 Water Heating	Main Heating 1
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

Summary for Input Data

Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From mains
Bath Count	2
Immersion Only Heating Hot Water	Yes

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
Family bathroom	Combi boiler or unvented hot water system	9.00		No	
Ensuite 1	Combi boiler or unvented hot water system	9.00		No	
Ensuite 2	Combi boiler or unvented hot water system	9.00		No	

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	300.00	L
Loss	2.26	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store

None

32.0 Photovoltaic Unit

One Dwelling	One Dwelling
Export Capable Meter?	Yes
Connected To Dwelling	Yes
Diverter	Yes
Battery Capacity [kWh]	10.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
3.80	South East	45°	None Or Little		No	1.00		

34.0 Small-scale Hydro

None

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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	£94	SAP rating	Environmental Impact
		A 94	A 99
		0	0
		0	0

Thermal Bridging

Property Reference	7358-0001-KW-578	Issued on Date	03/03/2025
Assessment Reference	Proposed	Prop Type Ref	Detached House
Property	Proposed dwelling, 1 The Drive, Blackmore End, Herts, AL4 8LE		

SAP Rating	93 A	DER	1.50	TER	8.45
Environmental	98 A	% DER < TER			82.25
CO ₂ Emissions (t/year)	0.32	DFEE	41.89	TFEE	43.25
Compliance Check	See BREL	% DFEE < TFEE			3.16
% DPER < TPER	66.36	DPER	15.11	TPER	44.90

Assessor Details	Mr. James Turner	Assessor ID	7358-0001
Client	603, Luke Kenton		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.024	6.75	0.16	MHF-150-E2-02
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.202	30.54	6.17	Kingspan K106 detail
External wall	E3 Sill	Independently assessed	0.023	27.80	0.64	MHF-150-E3-01
External wall	E4 Jamb	Independently assessed	0.018	45.60	0.82	MHF-150-E4-01
External wall	E5 Ground floor (normal)	Independently assessed	0.073	51.00	3.72	MHF-150-E5-04
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.001	51.00	0.05	MHF-150-E6-01
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.038	4.20	0.16	MHF-150-E13-01
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.069	47.78	3.30	MHF-150-E10-01
External wall	E14 Flat roof	Independently assessed	0.152	6.80	1.03	ROI detail 1.20
External wall	E16 Corner (normal)	Independently assessed	0.036	51.00	1.84	MHF-150-E16-01
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.062	30.60	-1.90	MHF-150-E17-01
External roof	R4 Ridge (vaulted ceiling)	Table K1 - Default	0.120	6.40	0.77	
External roof	R6 Flat ceiling	Independently assessed	0.020	12.80	0.26	ROI detail 1.13.2

Total: 372.27 W/mK:
Y-Value: 0.03 W/m²K: