

Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 05 Feb 2024 15:06:55

Project Information			
Assessed By	Matthew Carter	Building Type	House, Detached
OCDEA Registration	EES/003584	Assessment Date	2024-02-05

Dwelling Details			
Assessment Type	As designed	Total Floor Area	139 m ²
Site Reference	00809	Plot Reference	00001
Address	10 Kindersley Way, Abbots Langley, WD5 0DQ		

Client Details	
Name	Mr. Wysmolinski
Company	Gid builders
Address	32 New Park Drive , Hemel Hempstead , HP2 4QE

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	10.06 kgCO ₂ /m ²	
Dwelling carbon dioxide emission rate	2.95 kgCO ₂ /m ²	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	52.59 kWh _{PE} /m ²	
Dwelling primary energy	30.65 kWh _{PE} /m ²	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	41.5 kWh/m ²	
Dwelling fabric energy efficiency	41.2 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	0.1	Heatloss Floor 1 (0.1)	OK
Roofs	0.16	0.11	Roof (2) (0.12)	OK
Windows, doors, and roof windows	1.6	1.39	Opening (1.4)	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)	177.58	0.18	
Exposed wall: Walls (2)	3.02	0.18	
Exposed wall: Walls (3)	9.12	0.18	
Ground floor: Heatloss Floor 1, Heatloss Floor 1	63.9	0.1 (!)	
Exposed roof: Roof (1)	23	0.1 (!)	
Exposed roof: Roof (2)	31.46	0.12	
Exposed roof: Roof (3)	10.8	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]
Door, Door	1.89	North	N/A	1.2
Opening, Windows	9.59	North	0.7	1.4
Opening, Roof lights	0.7	North	0.7	1.4
Opening, Windows	0.7	West	0.7	1.4
Opening, Windows	1.13	East	0.7	1.4
Opening, Windows	10.03	South	0.7	1.4
Opening, Windows	2.52	South	0.7	1.4
Opening, Roof lights	1.2	South	0.7	1.4

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling : 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	0.06	High Therm
External wall	E3: Sill	Calculated by person with suitable expertise	0.022 (!)	RCD
External wall	E4: Jamb	Calculated by person with suitable expertise	0.017 (!)	RCD
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.064	RCD
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.001 (!)	RCD
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.001 (!)	RCD
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.057	RCD
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.043	RCD
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.036 (!)	RCD
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.042	RCD
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.085	RCD
External wall	E14: Flat roof	SAP table default	0.16	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	
Roof	R7: Flat ceiling (inverted)	SAP table default	0.12	
Roof	R6: Flat ceiling	SAP table default	0.12	
Roof	R8: Roof to wall (rafter)	SAP table default	0.12	
Roof	R9: Roof to wall (flat ceiling)	SAP table default	0.32	
Roof	R4: Ridge (vaulted ceiling)	SAP table default	0.12	
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		4.5 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	345.9%			
Emitter type	Both radiators and underfloor			
Flow temperature	35°C			
System type	Heat Pump			
Manufacturer	Daikin Europe NV			
Model	ERGA06EVA + EHVH08SU18E6V			
Commissioning				
Secondary heating system: N/A				
Fuel	N/A			
Efficiency	N/A			
Commissioning				
5 Hot water				
Cylinder/store - type: N/A				
Capacity	N/A			
Declared heat loss	N/A			
Primary pipework insulated	N/A			
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: N/A		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
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	00809		Issued on Date	05/02/2024	
Assessment Reference	00001	Prop Type Ref			
Property	10, Kindersley Way, Abbots Langley, WD5 0DQ				
SAP Rating	86 B	DER	2.95	TER	10.06
Environmental	97 A	% DER < TER	70.68		
CO ₂ Emissions (t/year)	0.38	DFEE	41.19	TFEE	41.50
Compliance Check	See BREL	% DFEE < TFEE	0.74		
% DPER < TPER	41.72	DPER	30.65	TPER	52.59
Assessor Details	Mr. Matthew Carter			Assessor ID	7869-0001
Client	113, Mr. Wysmolinski				

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)
Ground floor	63.9000 (1b)	x 2.4000 (2b)	= 153.3600 (1b) - (3b)
First floor	49.0000 (1c)	x 2.7200 (2c)	= 133.2800 (1c) - (3c)
Second floor	26.0000 (1d)	x 2.0600 (2d)	= 53.5600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 340.2000 (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	4.5000 (17)
Infiltration rate	0.2250 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1913 (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	0.2438	0.2391	0.2343	0.2104	0.2056	0.1817	0.1817	0.1769	0.1913	0.2056	0.2152	0.2247 (22b)
Effective ac	0.5297	0.5286	0.5274	0.5221	0.5211	0.5165	0.5165	0.5156	0.5183	0.5211	0.5231	0.5252 (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
Door			1.8900	1.2000	2.2680		(26)
Windows (Uw = 1.40)			23.9700	1.3258	31.7784		(27)
Opening			0.7000	1.3258	0.9280		(27a)
Opening			1.2000	1.3258	1.5909		(27a)
Heatloss Floor 1			63.9000	0.1000	6.3900	110.0000	7029.0000 (28a)
Main	200.9200	23.3400	177.5800	0.1800	31.9644	70.0000	12430.6000 (29a)
Dormer	5.5400	2.5200	3.0200	0.1800	0.5436	9.0000	27.1800 (29a)
Dwarf Wall	9.1200		9.1200	0.1800	1.6416	9.0000	82.0800 (29a)
Plane	23.0000		23.0000	0.1000	2.3000	9.0000	207.0000 (30)
Slope	32.1600	0.7000	31.4600	0.1200	3.7752	9.0000	283.1400 (30)
Flat roof	12.0000	1.2000	10.8000	0.1200	1.2960	9.0000	97.2000 (30)
Total net area of external elements Aum (A, m ²)			346.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.4761		(33)
Internal Floor 1			26.0000			18.0000	468.0000 (32d)
Internal Floor 2			63.9000			18.0000	1150.2000 (32d)
Internal Ceiling 1			63.9000			9.0000	575.1000 (32e)
Internal Ceiling 2			49.0000			9.0000	441.0000 (32e)

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

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	19.4400	0.0600	1.1664
E3 Sill	14.4400	0.0220	0.3177
E4 Jamb	48.8000	0.0170	0.8296
E5 Ground floor (normal)	41.2400	0.0640	2.6394
E6 Intermediate floor within a dwelling	30.8000	0.0010	0.0308
E6 Intermediate floor within a dwelling	20.4400	0.0010	0.0204
E10 Eaves (insulation at ceiling level)	17.5200	0.0570	0.9986
E12 Gable (insulation at ceiling level)	7.2100	0.0430	0.3100
E13 Gable (insulation at rafter level)	12.0000	0.0360	0.4320
E16 Corner (normal)	33.7400	0.0420	1.4171
E17 Corner (inverted - internal area greater than external area)	9.9000	-0.0850	-0.8415
E14 Flat roof	13.7000	0.1600	2.1920
R1 Head of roof window	1.7800	0.2400	0.4272
R2 Sill of roof window	1.7800	0.2400	0.4272
R3 Jamb of roof window	4.2000	0.2400	1.0080
R7 Flat ceiling (inverted)	8.8000	0.1200	1.0560
R6 Flat ceiling	5.3600	0.1200	0.6432
R8 Roof to wall (rafter)	5.3600	0.1200	0.6432
R9 Roof to wall (flat ceiling)	5.6800	0.3200	1.8176
R4 Ridge (vaulted ceiling)	5.3000	0.1200	0.6360

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.1709 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 100.6471 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
 (38)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 Heat transfer coeff 59.4707 59.3411 59.2140 58.6173 58.5057 57.9860 57.9860 57.8897 58.1862 58.5057 58.7315 58.9676 (38)
 Average = Sum(39)m / 12 = 160.1177 159.9881 159.8611 159.2644 159.1528 158.6330 158.6330 158.5368 158.8332 159.1528 159.3786 159.6147 (39)
 159.2639

HLP (average)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1528	1.1518	1.1509	1.1466	1.1458	1.1421	1.1421	1.1414	1.1435	1.1458	1.1474	1.1491 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

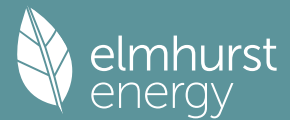
4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	80.1534	78.9262	77.1178	74.3357	71.8431	68.3559	65.5977	68.8222	70.4439	73.8978	77.4948	80.0811 (42a)
Hot water usage for baths	30.8526	30.3869	29.7243	28.7321	27.8379	26.6069	25.6730	26.8150	27.4143	28.6341	29.9022	30.8282 (42b)
Hot water usage for other uses	44.4821	42.8646	41.2471	39.6295	38.0120	36.3945	36.3945	38.0120	39.6295	41.2471	42.8646	44.4821 (42c)
Average daily hot water use (litres/day)	155.4882	152.1777	148.0892	142.6973	137.6930	131.3572	127.6652	133.6492	137.4878	143.7790	150.2616	155.3914 (44)
Energy content (annual)	228.9054	201.3619	211.6164	186.3984	177.4313	151.9103	141.0738	157.3075	159.4790	185.2737	203.0835	228.2037 (45)
Distribution loss (46)m = 0.15 x (45)m	34.3358	30.2043	31.7425	27.9598	26.6147	22.7865	21.1611	23.5961	23.9218	27.7911	30.4625	34.2306 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397 (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	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397 (64)
Total per year (kWh/year)												2507.9849 (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	76.1111	66.9528	70.3625	61.9775	58.9959	50.5102	46.9070	52.3047	53.0268	61.6035	67.5253	75.8777 (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	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	157.5964	174.4817	157.5964	162.8496	157.5964	162.8496	157.5964	157.5964	162.8496	157.5964	162.8496	157.5964 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	308.1579	311.3556	303.2974	286.1426	264.4877	244.1352	230.5385	227.3408	235.3989	252.5537	274.2086	294.5611 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748 (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)	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985 (71)
Water heating gains (Table 5)	102.2998	99.6322	94.5732	86.0798	79.2956	70.1530	63.0471	70.3021	73.6483	82.8004	93.7851	101.9862 (72)
Total internal gains	634.7785	652.1939	622.1914	601.7965	568.1041	543.8622	517.9064	521.9636	538.6212	559.6750	597.5677	620.8681 (73)

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6. Solar gains

[Jan]			Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North			9.5900	10.6334	0.6300	0.7000	0.7700	31.1646 (74)				
East			1.1300	19.6403	0.6300	0.7000	0.7700	6.7826 (76)				
South			12.5500	46.7521	0.6300	0.7000	0.7700	179.3149 (78)				
West			0.7000	19.6403	0.6300	0.7000	0.7700	4.2016 (80)				
North			0.7000	26.0000	0.6300	0.7000	1.0000	7.2236 (82)				
South			1.2000	26.0000	0.6300	0.7000	1.0000	12.3833 (82)				
Solar gains	241.0706	415.4383	583.0692	750.0808	867.5991	873.9924	837.3066	747.3027	640.3335	462.9155	289.5766	205.7942 (83)
Total gains	875.8491	1067.6322	1205.2607	1351.8773	1435.7033	1417.8546	1355.2129	1269.2663	1178.9547	1022.5904	887.1443	826.6623 (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	39.5377	39.5698	39.6012	39.7496	39.7775	39.9078	39.9078	39.9320	39.8575	39.7775	39.7211	39.6623
alpha	3.6358	3.6380	3.6401	3.6500	3.6518	3.6605	3.6605	3.6621	3.6572	3.6518	3.6481	3.6442
util living area	0.9883	0.9758	0.9534	0.8987	0.7968	0.6402	0.4920	0.5398	0.7557	0.9263	0.9784	0.9905 (86)
Living	19.4790	19.6967	19.9865	20.3490	20.6482	20.8301	20.8909	20.8807	20.7525	20.3524	19.8440	19.4347
Non living	18.1740	18.4504	18.8156	19.2636	19.6110	19.7993	19.8475	19.8422	19.7306	19.2777	18.6425	18.1197
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	20.2219	19.6967	19.9865	20.3490	20.6482	20.8301	20.8909	20.8807	20.7525	20.3524	19.8440	19.6536 (87)
Th 2	19.9580	19.9587	19.9595	19.9629	19.9636	19.9666	19.9666	19.9672	19.9655	19.9636	19.9623	19.9609 (88)
util rest of house	0.9857	0.9705	0.9428	0.8751	0.7494	0.5596	0.3861	0.4325	0.6850	0.9040	0.9727	0.9883 (89)
MIT 2	19.2468	18.4504	18.8156	19.2636	19.6110	19.7993	19.8475	19.8422	19.7306	19.2777	18.6425	18.4515 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.3370	18.5657	18.9240	19.3641	19.7070	19.8948	19.9441	19.9383	19.8252	19.3772	18.7538	18.5628 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3370	18.5657	18.9240	19.3641	19.7070	19.8948	19.9441	19.9383	19.8252	19.3772	18.7538	18.5628 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9837	0.9609	0.9292	0.8586	0.7360	0.5535	0.3837	0.4293	0.6740	0.8880	0.9636	0.9843 (94)
Useful gains	861.6162	1025.8646	1119.9375	1160.7096	1056.6569	784.7557	519.9275	544.8613	794.6730	908.0306	854.8204	813.7015 (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	2407.6974	2186.3576	1986.1100	1666.5629	1274.3368	839.9274	530.4819	560.9558	909.3521	1396.9121	1857.3627	2292.5071 (97)
Space heating kWh	1150.2844	779.8513	644.4324	364.2143	161.9538	0.0000	0.0000	0.0000	0.0000	363.7278	721.8305	1100.2313 (98a)
Space heating requirement - total per year (kWh/year)												5286.5260
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	1150.2844	779.8513	644.4324	364.2143	161.9538	0.0000	0.0000	0.0000	0.0000	363.7278	721.8305	1100.2313 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5286.5260
Space heating per m ²										(98c) / (4) =		38.0599 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												345.8502 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	1150.2844	779.8513	644.4324	364.2143	161.9538	0.0000	0.0000	0.0000	0.0000	363.7278	721.8305	1100.2313 (98)
Space heating efficiency (main heating system 1)	345.8502	345.8502	345.8502	345.8502	345.8502	0.0000	0.0000	0.0000	0.0000	345.8502	345.8502	345.8502 (210)
Space heating fuel (main heating system)	332.5961	225.4882	186.3328	105.3098	46.8277	0.0000	0.0000	0.0000	0.0000	105.1692	208.7119	318.1236 (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	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397 (64)
Efficiency of water heater (217)m	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704 (216)
Fuel for water heating, kWh/month	93.0221	82.0325	86.6487	77.0738	74.0469	64.3602	60.6442	66.6285	67.1503	76.9379	83.2245	92.7634 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	35.6570	28.6054	25.7560	18.8699	14.5757	11.9085	13.2964	17.2832	22.4492	29.4545	33.2688	36.6481 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												

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(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1528.5593	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												271.2704	
Water heating fuel used												924.5331	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												287.7727	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2740.8650	(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	1528.5593	0.1555	237.7134	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	924.5331	0.1413	130.6012	(264)
Space and water heating			368.3146	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	287.7727	0.1443	41.5345	(268)
Total CO2, kg/year			409.8490	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.9500	(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	1528.5593	1.5757	2408.5661	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	924.5331	1.5224	1407.4642	(278)
Space and water heating			3816.0303	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	287.7727	1.5338	441.3953	(282)
Total Primary energy kWh/year			4257.4256	(286)
Dwelling Primary energy Rate (DPER)			30.6500	(287)

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

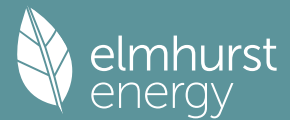
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	63.9000 (1b)	x 2.4000 (2b)	= 153.3600 (1b)	- (3b)
First floor	49.0000 (1c)	x 2.7200 (2c)	= 133.2800 (1c)	- (3c)
Second floor	26.0000 (1d)	x 2.0600 (2d)	= 53.5600 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.9000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 340.2000	(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)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1176	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	

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Measured/design AP50 5.0000 (17)
 Infiltration rate 0.3676 (18)
 Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3124 (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												
Effective ac	0.3984	0.3906	0.3827	0.3437	0.3359	0.2968	0.2968	0.2890	0.3124	0.3359	0.3515	0.3671 (22b)
	0.5793	0.5763	0.5732	0.5591	0.5564	0.5441	0.5441	0.5418	0.5488	0.5564	0.5618	0.5674 (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
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			23.9700	1.1450	27.4466		(27)
Opening			0.7000	1.5918	1.1142		(27a)
Opening			1.2000	1.5918	1.9101		(27a)
Heatloss Floor 1			63.9000	0.1300	8.3070		(28a)
Main	200.9200	23.3400	177.5800	0.1800	31.9644		(29a)
Dormer	5.5400	2.5200	3.0200	0.1800	0.5436		(29a)
Dwarf Wall	9.1200		9.1200	0.1800	1.6416		(29a)
Plane	23.0000		23.0000	0.1100	2.5300		(30)
Slope	32.1600	0.7000	31.4600	0.1100	3.4606		(30)
Flat roof	12.0000	1.2000	10.8000	0.1100	1.1880		(30)
Total net area of external elements Aum(A, m2)			346.6400				(31)
Fabric heat loss, W/K = Sum (A x U)					81.9961		(32)
							(26)...(30) + (32) = 164.0785 (35)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 164.0785 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	19.4400	0.0500	0.9720
E3 Sill	14.4400	0.0500	0.7220
E4 Jamb	48.8000	0.0500	2.4400
E5 Ground floor (normal)	41.2400	0.1600	6.5984
E6 Intermediate floor within a dwelling	30.8000	0.0000	0.0000
E6 Intermediate floor within a dwelling	20.4400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	17.5200	0.0600	1.0512
E12 Gable (insulation at ceiling level)	7.2100	0.0600	0.4326
E13 Gable (insulation at rafter level)	12.0000	0.0800	0.9600
E16 Corner (normal)	33.7400	0.0900	3.0366
E17 Corner (inverted - internal area greater than external area)	9.9000	-0.0900	-0.8910
E14 Flat roof	13.7000	0.0800	1.0960
R1 Head of roof window	1.7800	0.0800	0.1424
R2 Sill of roof window	1.7800	0.0600	0.1068
R3 Jamb of roof window	4.2000	0.0800	0.3360
R7 Flat ceiling (inverted)	8.8000	0.0400	0.3520
R6 Flat ceiling	5.3600	0.0600	0.3216
R8 Roof to wall (rafter)	5.3600	0.0600	0.3216
R9 Roof to wall (flat ceiling)	5.6800	0.0400	0.2272
R4 Ridge (vaulted ceiling)	5.3000	0.0800	0.4240

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.6494 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 100.6455 (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	65.0409	64.6950	64.3559	62.7634	62.4655	61.0784	61.0784	60.8215	61.6127	62.4655	63.0682	63.6984 (38)
Average = Sum(39)m / 12 =	165.6864	165.3405	165.0014	163.4089	163.1110	161.7239	161.7239	161.4671	162.2582	163.1110	163.7137	164.3439 (39)
												163.4075

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1928	1.1904	1.1879	1.1765	1.1743	1.1643	1.1643	1.1625	1.1682	1.1743	1.1786	1.1832 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9150 (42)
Hot water usage for mixer showers	73.0942	71.9957	70.3950	67.3324	65.0723	62.5518	61.1192	62.7078	64.4491	67.1553	70.2837	72.8141 (42a)	
Hot water usage for baths	31.5561	31.0875	30.4275	29.2106	28.2995	27.2891	26.7434	27.3988	28.1123	29.1934	30.4353	31.4494 (42b)	
Hot water usage for other uses	44.4821	42.8646	41.2471	39.6295	38.0120	36.3945	36.3945	38.0120	39.6295	41.2471	42.8646	44.4821 (42c)	
Average daily hot water use (litres/day)													137.0862 (43)
Daily hot water use	149.1324	145.9478	142.0696	136.1726	131.3838	126.2354	124.2571	128.1185	132.1910	137.5958	143.5836	148.7457 (44)	
Energy conte	236.1893	207.8277	218.3557	186.4135	176.8678	155.2212	150.2782	158.6375	163.0047	186.7162	204.5612	232.8998 (45)	
Energy content (annual)													Total = Sum(45)m = 2276.9725
Distribution loss (46)m = 0.15 x (45)m	35.4284	31.1741	32.7533	27.9620	26.5302	23.2832	22.5417	23.7956	24.4507	28.0074	30.6842	34.9350 (46)	
Water storage loss:													150.0000 (47)
Store volume													1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.7527 (55)
Enter (49) or (54) in (55)													
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)	
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	282.7842	249.9134	264.9506	231.5053	223.4627	200.3130	196.8731	205.2324	208.0965	233.3111	249.6530	279.4947 (62)	
WWHRS	-33.4156	-29.5530	-30.9462	-25.6247	-23.8813	-20.4354	-19.1549	-20.3693	-21.1433	-24.9256	-28.2376	-32.7968 (63a)	

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PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	249.3686	220.3603	234.0043	205.8806	199.5814	179.8776	177.7181	184.8630	186.9533	208.3855	221.4154	246.6979	(64)
	Total per year (kWh/year) = Sum(64) m =											2515.1061 (64)	
12Total per year (kWh/year)												2515 (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	115.8089	102.7713	109.8792	98.0560	96.0845	87.6845	87.2434	90.0229	90.2725	99.3591	104.0901	114.7151	(65)

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

Metabolic gains (Table 5), Watts													
(66m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	157.5964	174.4817	157.5964	162.8496	157.5964	162.8496	157.5964	157.5964	162.8496	157.5964	162.8496	157.5964	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.1579	311.3556	303.2974	286.1426	264.4877	244.1352	230.5385	227.3408	235.3989	252.5537	274.2086	294.5611	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	(71)
Water heating gains (Table 5)													
	155.6571	152.9334	147.6871	136.1888	129.1458	121.7841	117.2626	120.9985	125.3785	133.5471	144.5695	154.1870	(72)
Total internal gains	691.1357	708.4952	678.3053	654.9055	620.9544	595.4933	572.1219	572.6601	590.3514	613.4216	651.3522	676.0689	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	9.5900	10.6334	0.6300	0.7000	0.7700	31.1646 (74)							
East	1.1300	19.6403	0.6300	0.7000	0.7700	6.7826 (76)							
South	12.5500	46.7521	0.6300	0.7000	0.7700	179.3149 (78)							
West	0.7000	19.6403	0.6300	0.7000	0.7700	4.2016 (80)							
North	0.7000	26.0000	0.6300	0.7000	1.0000	7.2236 (82)							
South	1.2000	26.0000	0.6300	0.7000	1.0000	12.3833 (82)							
Solar gains	241.0706	415.4383	583.0692	750.0808	867.5991	873.9924	837.3066	747.3027	640.3335	462.9155	289.5766	205.7942	(83)
Total gains	932.2064	1123.9334	1261.3746	1404.9863	1488.5535	1469.4857	1409.4285	1319.9628	1230.6849	1076.3371	940.9288	881.8631	(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	38.2089	38.2888	38.3675	38.7414	38.8122	39.1451	39.1451	39.2073	39.0162	38.8122	38.6693	38.5210	
alpha	3.5473	3.5526	3.5578	3.5828	3.5875	3.6097	3.6097	3.6138	3.6011	3.5875	3.5780	3.5681	
util living area	0.9859	0.9725	0.9488	0.8924	0.7893	0.6310	0.4827	0.5296	0.7442	0.9184	0.9747	0.9883	(86)
MIT	19.0626	19.3540	19.7448	20.2385	20.6398	20.8862	20.9670	20.9538	20.7851	20.2545	19.5707	19.0143	(87)
Th 2	19.9257	19.9277	19.9297	19.9389	19.9406	19.9487	19.9487	19.9501	19.9456	19.9406	19.9371	19.9335	(88)
util rest of house													
	0.9828	0.9664	0.9372	0.8675	0.7405	0.5495	0.3767	0.4220	0.6716	0.8941	0.9680	0.9857	(89)
MIT 2	17.6752	18.0451	18.5372	19.1487	19.6137	19.8707	19.9342	19.9281	19.7805	19.1821	18.3295	17.6188	(90)
Living area fraction													
	fLA = Living area / (4) =											0.0926 (91)	
MIT	17.8037	18.1663	18.6490	19.2496	19.7087	19.9647	20.0298	20.0231	19.8735	19.2814	18.4444	17.7480	(92)
Temperature adjustment													
												0.0000	
adjusted MIT	17.8037	18.1663	18.6490	19.2496	19.7087	19.9647	20.0298	20.0231	19.8735	19.2814	18.4444	17.7480	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9734	0.9524	0.9188	0.8479	0.7284	0.5508	0.3852	0.4298	0.6660	0.8747	0.9547	0.9775	(94)
Useful gains	907.3830	1070.4310	1158.9967	1191.2272	1084.1996	809.4348	542.9077	567.3841	819.6872	941.5119	898.2827	862.0215	(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	2237.3719	2193.4505	2004.5975	1691.2148	1306.3081	867.6020	554.6800	585.0045	936.8046	1416.0343	1857.2379	2226.5258	(97)
Space heating kWh	989.5118	754.6691	629.1270	359.9911	165.2487	0.0000	0.0000	0.0000	0.0000	353.0447	690.4478	1015.1912	(98a)
Space heating requirement - total per year (kWh/year)													
												4957.2314	
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	
Solar heating kWh	989.5118	754.6691	629.1270	359.9911	165.2487	0.0000	0.0000	0.0000	0.0000	353.0447	690.4478	1015.1912	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													
												4957.2314	
Space heating per m ²												(98c) / (4) =	35.6892 (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)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	989.5118	754.6691	629.1270	359.9911	165.2487	0.0000	0.0000	0.0000	0.0000	353.0447	690.4478	1015.1912	(98)	
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)	
Space heating fuel (main heating system)	1072.0604	817.6263	681.6111	390.0228	179.0344	0.0000	0.0000	0.0000	0.0000	382.4969	748.0474	1099.8821	(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	249.3686	220.3603	234.0043	205.8806	199.5814	179.8776	177.7181	184.8630	186.9533	208.3855	221.4154	246.6979	(64)	
Efficiency of water heater (217)m	86.8289	86.5928	86.1654	85.2999	83.6396	79.8000	79.8000	79.8000	79.8000	85.2321	86.4330	86.8843	(217)	
Fuel for water heating, kWh/month	287.1955	254.4788	271.5758	241.3610	238.6206	225.4106	222.7044	231.6579	234.2773	244.4919	256.1700	283.9383	(219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)	
Lighting	32.7454	26.2696	23.6529	17.3291	13.3855	10.9361	12.2107	15.8719	20.6161	27.0494	30.5522	33.6555	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-57.4133	-79.7572	-112.9560	-125.0190	-133.0781	-123.4908	-121.8398	-115.7853	-104.9645	-90.1330	-62.6460	-49.7666	(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	-36.1489	-75.5865	-149.4424	-223.3657	-294.3711	-295.5227	-292.1611	-247.9195	-182.3673	-107.8724	-48.1794	-28.6310	(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													5370.7815	(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													2991.8821	(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)													264.2743	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-3158.4176	(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													5554.5203	(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	5370.7815	0.2100	1127.8641 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2991.8821	0.2100	628.2953 (264)
Space and water heating			1756.1594 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	264.2743	0.1443	38.1429 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1176.8495	0.1349	-158.7921
PV Unit electricity exported	-1981.5681	0.1260	-249.7380
Total			-408.5302 (269)
Total CO2, kg/year			1397.7014 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.0600 (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	5370.7815	1.1300	6068.9831 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2991.8821	1.1300	3380.8268 (278)
Space and water heating			9449.8100 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	264.2743	1.5338	405.3527 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1176.8495	1.4987	-1763.7411
PV Unit electricity exported	-1981.5681	0.4626	-916.7210
Total			-2680.4620 (283)
Total Primary energy kWh/year			7304.8014 (286)
Target Primary Energy Rate (TPER)			52.5900 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.9000 (1b)	x 2.4000 (2b)	= 153.3600 (1b) - (3b)
First floor	49.0000 (1c)	x 2.7200 (2c)	= 133.2800 (1c) - (3c)
Second floor	26.0000 (1d)	x 2.0600 (2d)	= 53.5600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 340.2000 (5)

2. Ventilation rate

	m3 per hour												
Number of open chimneys	0 * 80 =											0.0000 (6a)	
Number of open flues	0 * 20 =											0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =											0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =											0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =											0.0000 (6e)	
Number of blocked chimneys	0 * 20 =											0.0000 (6f)	
Number of intermittent extract fans	4 * 10 =											40.0000 (7a)	
Number of passive vents	0 * 10 =											0.0000 (7b)	
Number of flueless gas fires	0 * 40 =											0.0000 (7c)	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1176 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												4.5000 (17)	
Infiltration rate												0.3426 (18)	
Number of sides sheltered												2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.2912 (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)
	0.3713	0.3640	0.3567	0.3203	0.3130	0.2766	0.2766	0.2694	0.2912	0.3130	0.3276	0.3421	(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	0.5689	0.5662	0.5636	0.5513	0.5490	0.5383	0.5383	0.5363	0.5424	0.5490	0.5537	0.5585	(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
Door			1.8900	1.2000	2.2680		(26)
Windows (Uw = 1.40)			23.9700	1.3258	31.7784		(27)
Opening			0.7000	1.3258	0.9280		(27a)
Opening			1.2000	1.3258	1.5909		(27a)
Heatloss Floor 1			63.9000	0.1000	6.3900	110.0000	7029.0000 (28a)
Main	200.9200	23.3400	177.5800	0.1800	31.9644	70.0000	12430.6000 (29a)
Dormer	5.5400	2.5200	3.0200	0.1800	0.5436	9.0000	27.1800 (29a)
Dwarf Wall	9.1200		9.1200	0.1800	1.6416	9.0000	82.0800 (29a)
Plane	23.0000		23.0000	0.1000	2.3000	9.0000	207.0000 (30)
Slope	32.1600	0.7000	31.4600	0.1200	3.7752	9.0000	283.1400 (30)
Flat roof	12.0000	1.2000	10.8000	0.1200	1.2960	9.0000	97.2000 (30)
Total net area of external elements Aum(A, m ²)			346.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.4761		(33)
Internal Floor 1			26.0000			18.0000	468.0000 (32d)
Internal Floor 2			63.9000			18.0000	1150.2000 (32d)
Internal Ceiling 1			63.9000			9.0000	575.1000 (32e)
Internal Ceiling 2			49.0000			9.0000	441.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	22790.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							164.0785 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				19.4400	0.0600	1.1664	
E3 Sill				14.4400	0.0220	0.3177	
E4 Jamb				48.8000	0.0170	0.8296	
E5 Ground floor (normal)				41.2400	0.0640	2.6394	
E6 Intermediate floor within a dwelling				30.8000	0.0010	0.0308	
E6 Intermediate floor within a dwelling				20.4400	0.0010	0.0204	
E10 Eaves (insulation at ceiling level)				17.5200	0.0570	0.9986	
E12 Gable (insulation at ceiling level)				7.2100	0.0430	0.3100	
E13 Gable (insulation at rafter level)				12.0000	0.0360	0.4320	
E16 Corner (normal)				33.7400	0.0420	1.4171	
E17 Corner (inverted - internal area greater than external area)				9.9000	-0.0850	-0.8415	
E14 Flat roof				13.7000	0.1600	2.1920	
R1 Head of roof window				1.7800	0.2400	0.4272	
R2 Sill of roof window				1.7800	0.2400	0.4272	
R3 Jamb of roof window				4.2000	0.2400	1.0080	
R7 Flat ceiling (inverted)				8.8000	0.1200	1.0560	
R6 Flat ceiling				5.3600	0.1200	0.6432	
R8 Roof to wall (rafter)				5.3600	0.1200	0.6432	
R9 Roof to wall (flat ceiling)				5.6800	0.3200	1.8176	
R4 Ridge (vaulted ceiling)				5.3000	0.1200	0.6360	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1709 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	100.6471 (37)

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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	63.8704	63.5699	63.2754	61.8922	61.6334	60.4286	60.4286	60.2055	60.8926	61.6334	62.1569	62.7043 (38)
Heat transfer coeff	164.5175	164.2170	163.9225	162.5393	162.2804	161.0757	161.0757	160.8526	161.5397	162.2804	162.8040	163.3514 (39)
Average = Sum(39)m / 12 =												162.5380

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1844	1.1823	1.1801	1.1702	1.1683	1.1597	1.1597	1.1580	1.1630	1.1683	1.1721	1.1760 (40)
HLP (average)												1.1702
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.9150 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	30.8526	30.3869	29.7243	28.7321	27.8379	26.6069	25.6730	26.8150	27.4143	28.6341	29.9022	30.8282 (42b)
Hot water usage for other uses	44.4821	42.8646	41.2471	39.6295	38.0120	36.3945	36.3945	38.0120	39.6295	41.2471	42.8646	44.4821 (42c)
Average daily hot water use (litres/day)												69.0460 (43)
Daily hot water use	75.3348	73.2515	70.9714	68.3616	65.8499	63.0014	62.0674	64.8270	67.0439	69.8811	72.7668	75.3103 (44)
Energy conte	110.9058	96.9266	101.4167	89.2974	84.8542	72.8590	68.5863	76.3026	77.7675	90.0489	98.3468	110.5987 (45)
Energy content (annual)												Total = Sum(45)m = 1077.9104
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
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												
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 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	94.2699	82.3876	86.2042	75.9028	72.1261	61.9301	58.2984	64.8572	66.1024	76.5416	83.5947	94.0089 (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)
FV 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	94.2699	82.3876	86.2042	75.9028	72.1261	61.9301	58.2984	64.8572	66.1024	76.5416	83.5947	94.0089 (64)
Total per year (kWh/year)												916.2238 (64)
Electric shower(s)	58.5362	52.1563	56.9527	54.3492	55.3691	52.8167	54.5773	55.3691	54.3492	56.9527	55.8817	58.5362 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												665.8464 (64a)
Heat gains from water heating, kWh/month	38.2015	33.6360	35.7892	32.5630	31.8738	28.6867	28.2189	30.0566	30.1129	33.3736	34.8691	38.1363 (65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5), Watts												
(66)m	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	157.5964	174.4817	157.5964	162.8496	157.5964	162.8496	157.5964	157.5964	162.8496	157.5964	162.8496	157.5964 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	308.1579	311.3556	303.2974	286.1426	264.4877	244.1352	230.5385	227.3408	235.3989	252.5537	274.2086	294.5611 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748 (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)	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985 (71)
Water heating gains (Table 5)	51.3462	50.0535	48.1038	45.2264	42.8411	39.8427	37.9287	40.3986	41.8235	44.8569	48.4293	51.2584 (72)
Total internal gains	583.8248	602.6152	575.7220	560.9430	531.6497	513.5519	492.7879	492.0602	506.7964	521.7315	552.2120	570.1404 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	9.5900	10.6334	0.6300	0.7000	0.7700	31.1646 (74)
East	1.1300	19.6403	0.6300	0.7000	0.7700	6.7826 (76)
South	12.5500	46.7521	0.6300	0.7000	0.7700	179.3149 (78)
West	0.7000	19.6403	0.6300	0.7000	0.7700	4.2016 (80)
North	0.7000	26.0000	0.6300	0.7000	1.0000	7.2236 (82)
South	1.2000	26.0000	0.6300	0.7000	1.0000	12.3833 (82)

Solar gains	241.0706	415.4393	583.0692	750.0808	867.5991	873.9924	837.3066	747.3027	640.3335	462.9155	289.5766	205.7942 (83)
Total gains	824.8955	1018.0535	1158.7913	1311.0239	1399.2488	1387.5443	1330.0945	1239.3629	1147.1299	984.6469	841.7885	775.9346 (84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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	38.4804	38.5508	38.6200	38.9487	39.0108	39.3026	39.3026	39.3571	39.1897	39.0108	38.8854	38.7551
alpha	3.5654	3.5701	3.5747	3.5966	3.6007	3.6202	3.6202	3.6238	3.6126	3.6007	3.5924	3.5837
util living area	0.9904	0.9794	0.9592	0.9082	0.8112	0.6557	0.5059	0.5561	0.7718	0.9347	0.9818	0.9922 (86)

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MIT	18.9718	19.2689	19.6691	20.1818	20.6054	20.8720	20.9621	20.9464	20.7579	20.1905	19.4862	18.9213 (87)
Th 2	19.9325	19.9342	19.9359	19.9439	19.9454	19.9524	19.9524	19.9537	19.9497	19.9454	19.9424	19.9392 (88)
util rest of house	0.9881	0.9747	0.9496	0.8860	0.7648	0.5741	0.3966	0.4457	0.7018	0.9142	0.9769	0.9904 (89)
MIT 2	18.0869	18.3821	18.7769	19.2760	19.6628	19.8831	19.9392	19.9334	19.8020	19.2952	18.6056	18.0415 (90)
Living area fraction									fLA = Living area / (4) =			0.0926 (91)
MIT	18.1688	18.4642	18.8595	19.3599	19.7501	19.9747	20.0339	20.0272	19.8905	19.3781	18.6872	18.1230 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1688	18.4642	18.8595	19.3599	19.7501	19.9747	20.0339	20.0272	19.8905	19.3781	18.6872	18.1230 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9829	0.9659	0.9370	0.8711	0.7550	0.5760	0.4055	0.4540	0.6973	0.9000	0.9687	0.9859 (94)
Useful gains	810.7580	983.3101	1085.8035	1142.0227	1056.4423	799.1790	539.4010	562.6738	799.9348	886.2159	815.4594	765.0184 (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	2281.6583	2227.4654	2025.9949	1700.1425	1306.3742	865.7261	553.1238	583.4464	935.3953	1424.5115	1886.4372	2274.3355 (97)
Space heating kWh	1094.3498	836.0724	699.5024	401.8462	185.9494	0.0000	0.0000	0.0000	0.0000	400.4920	771.1040	1122.9319 (98a)
Space heating requirement - total per year (kWh/year)												5512.2481
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	1094.3498	836.0724	699.5024	401.8462	185.9494	0.0000	0.0000	0.0000	0.0000	400.4920	771.1040	1122.9319 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5512.2481
Space heating per m2												(98c) / (4) = 39.6850 (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	1514.1112	1191.9599	1222.4794	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7871	0.8563	0.8250	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1191.7127	1020.6518	1008.5904	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1527.8027	1465.2265	1366.2660	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	241.9848	330.7636	266.1107	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	60.4962	82.6909	66.5277	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												209.7148 (107)
Energy for space heating												39.6850 (99)
Energy for space cooling												1.5098 (108)
Total												41.1948 (109)
Fabric Energy Efficiency (DFEE)												41.2 (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)
Ground floor	63.9000 (1b)	x 2.4000 (2b)	= 153.3600 (1b) - (3b)
First floor	49.0000 (1c)	x 2.7200 (2c)	= 133.2800 (1c) - (3c)
Second floor	26.0000 (1d)	x 2.0600 (2d)	= 53.5600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	340.2000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1176 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3676 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)

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Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3124 (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
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
Adj infilt rate	0.3984	0.3906	0.3827	0.3437	0.3359	0.2968	0.2968	0.2890	0.3124	0.3359	0.3515	0.3671
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	0.5793	0.5763	0.5732	0.5591	0.5564	0.5441	0.5441	0.5418	0.5488	0.5564	0.5618	0.5674

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
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			23.9700	1.1450	27.4466		(27)
Opening			0.7000	1.5918	1.1142		(27a)
Opening			1.2000	1.5918	1.9101		(27a)
Heatloss Floor 1			63.9000	0.1300	8.3070		(28a)
Main	200.9200	23.3400	177.5800	0.1800	31.9644		(29a)
Dormer	5.5400	2.5200	3.0200	0.1800	0.5436		(29a)
Dwarf Wall	9.1200		9.1200	0.1800	1.6416		(29a)
Plane	23.0000		23.0000	0.1100	2.5300		(30)
Slope	32.1600	0.7000	31.4600	0.1100	3.4606		(30)
Flat roof	12.0000	1.2000	10.8000	0.1100	1.1880		(30)
Total net area of external elements Aum(A, m2)			346.6400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	81.9961	(33)

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

164.0785 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	19.4400	0.0500	0.9720
E3 Sill	14.4400	0.0500	0.7220
E4 Jamb	48.8000	0.0500	2.4400
E5 Ground floor (normal)	41.2400	0.1600	6.5984
E6 Intermediate floor within a dwelling	30.8000	0.0000	0.0000
E6 Intermediate floor within a dwelling	20.4400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	17.5200	0.0600	1.0512
E12 Gable (insulation at ceiling level)	7.2100	0.0600	0.4326
E13 Gable (insulation at rafter level)	12.0000	0.0800	0.9600
E16 Corner (normal)	33.7400	0.0900	3.0366
E17 Corner (inverted - internal area greater than external area)	9.9000	-0.0900	-0.8910
E14 Flat roof	13.7000	0.0800	1.0960
R1 Head of roof window	1.7800	0.0800	0.1424
R2 Sill of roof window	1.7800	0.0600	0.1068
R3 Jamb of roof window	4.2000	0.0800	0.3360
R7 Flat ceiling (inverted)	8.8000	0.0400	0.3520
R6 Flat ceiling	5.3600	0.0600	0.3216
R8 Roof to wall (rafter)	5.3600	0.0600	0.3216
R9 Roof to wall (flat ceiling)	5.6800	0.0400	0.2272
R4 Ridge (vaulted ceiling)	5.3000	0.0800	0.4240

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

18.6494 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 100.6455 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	65.0409	64.6950	64.3559	62.7634	62.4655	61.0784	61.0784	60.8215	61.6127	62.4655	63.0682	63.6984
Heat transfer coeff	165.6864	165.3405	165.0014	163.4089	163.1110	161.7239	161.7239	161.4671	162.2582	163.1110	163.7137	164.3439
Average = Sum(39)m / 12 =												163.4075

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1928	1.1904	1.1879	1.1765	1.1743	1.1643	1.1643	1.1625	1.1682	1.1743	1.1786	1.1832
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.9150
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
Hot water usage for baths												
31.5561	31.0875	30.4275	29.2106	28.2995	27.2891	26.7434	27.3988	28.1123	29.1934	30.4353	31.4494	31.4494
Hot water usage for other uses												
44.4821	42.8646	41.2471	39.6295	38.0120	36.3945	36.3945	38.0120	39.6295	41.2471	42.8646	44.4821	44.4821
Average daily hot water use (litres/day)												69.6958
Daily hot water use	76.0382	73.9520	71.6746	68.8402	66.3115	63.6836	63.1379	65.4108	67.7418	70.4405	73.2999	75.9316
Energy conte	120.4260	105.3067	110.1611	94.2388	89.2680	78.3064	76.3598	80.9922	83.5325	95.5870	104.4292	118.8905
Energy content (annual)												1157.4981
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	102.3621	89.5107	93.6370	80.1029	75.8778	66.5605	64.9058	68.8434	71.0026	81.2490	88.7648	101.0569
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
FV 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	102.3621	89.5107	93.6370	80.1029	75.8778	66.5605	64.9058	68.8434	71.0026	81.2490	88.7648	101.0569
Total per year (kWh/year) = Sum(64)m =												983.8734
												984

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Electric shower(s)	58.5362	52.1563	56.9527	54.3492	55.3691	52.8167	54.5773	55.3691	54.3492	56.9527	55.8817	58.5362 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a) m =												665.8464 (64a)
Heat gains from water heating, kWh/month	40.2246	35.4168	37.6474	33.6130	32.8117	29.8443	29.8708	31.0531	31.3380	34.5504	36.1616	39.8983 (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	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481	145.7481 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	157.5964	174.4817	157.5964	162.8496	157.5964	162.8496	157.5964	157.5964	162.8496	157.5964	162.8496	157.5964 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	308.1579	311.3556	303.2974	286.1426	264.4877	244.1352	230.5385	227.3408	235.3989	252.5537	274.2086	294.5611 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748	37.5748 (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)												
	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985 (71)
Water heating gains (Table 5)												
	54.0653	52.7035	50.6013	46.6848	44.1018	41.4504	40.1489	41.7380	43.5249	46.4387	50.2245	53.6267 (72)
Total internal gains	586.5440	605.2652	578.2196	562.4014	532.9103	515.1597	495.0082	493.3996	508.4979	523.3133	554.0071	572.5087 (73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North		9.5900	10.6334	0.6300	0.7000	0.7700	31.1646 (74)					
East		1.1300	19.6403	0.6300	0.7000	0.7700	6.7826 (76)					
South		12.5500	46.7521	0.6300	0.7000	0.7700	179.3149 (78)					
West		0.7000	19.6403	0.6300	0.7000	0.7700	4.2016 (80)					
North		0.7000	26.0000	0.6300	0.7000	1.0000	7.2236 (82)					
South		1.2000	26.0000	0.6300	0.7000	1.0000	12.3833 (82)					
Solar gains	241.0706	415.4383	583.0692	750.0808	867.5991	873.9924	837.3066	747.3027	640.3335	462.9155	289.5766	205.7942 (83)
Total gains	827.6146	1020.7035	1161.2889	1312.4823	1400.5095	1389.1521	1332.3147	1240.7023	1148.8314	986.2287	843.5837	778.3028 (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	38.2089	38.2888	38.3675	38.7414	38.8122	39.1451	39.1451	39.2073	39.0162	38.8122	38.6693	38.5210
alpha	3.5473	3.5526	3.5578	3.5828	3.5875	3.6097	3.6097	3.6138	3.6011	3.5875	3.5780	3.5681
util living area	0.9903	0.9793	0.9592	0.9086	0.8121	0.6566	0.5067	0.5571	0.7725	0.9348	0.9817	0.9921 (86)
MIT	18.9583	19.2560	19.6578	20.1739	20.6002	20.8703	20.9615	20.9456	20.7551	20.1843	19.4771	18.9099 (87)
Th 2	19.9257	19.9277	19.9297	19.9389	19.9406	19.9487	19.9487	19.9501	19.9456	19.9406	19.9371	19.9335 (88)
util rest of house	0.9880	0.9746	0.9496	0.8864	0.7657	0.5748	0.3970	0.4463	0.7024	0.9142	0.9768	0.9903 (89)
MIT 2	18.0687	18.3647	18.7612	19.2646	19.6543	19.8784	19.9353	19.9296	19.7962	19.2856	18.5929	18.0261 (90)
Living area fraction									FLA = Living area / (4) =			
MIT	18.1510	18.4472	18.8442	19.3488	19.7419	19.9702	20.0303	20.0236	19.8850	19.3688	18.6748	18.1079 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1510	18.4472	18.8442	19.3488	19.7419	19.9702	20.0303	20.0236	19.8850	19.3688	18.6748	18.1079 (93)

8. Space heating requirement

Utilisation	0.9827	0.9657	0.9369	0.8713	0.7557	0.5766	0.4059	0.4546	0.6978	0.9000	0.9686	0.9858 (94)
Useful gains	813.2736	985.6730	1088.0027	1143.6070	1058.3898	801.0138	540.8127	563.9971	801.6143	887.6226	817.0645	767.2327 (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	2294.9294	2239.8980	2036.8060	1707.4265	1311.7233	868.4960	554.7590	585.0961	938.6603	1430.2860	1894.9514	2285.6807 (97)
Space heating kWh	1102.3519	842.8392	705.9096	405.9501	188.4801	0.0000	0.0000	0.0000	0.0000	403.7416	776.0785	1129.7253 (98a)
Space heating requirement - total per year (kWh/year)												
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)												
Space heating kWh	1102.3519	842.8392	705.9096	405.9501	188.4801	0.0000	0.0000	0.0000	0.0000	403.7416	776.0785	1129.7253 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												
Space heating per m ²												39.9334 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
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	1520.2048	1196.7570	1227.1496	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7854	0.8550	0.8236	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1194.0029	1023.2221	1010.6309	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1529.4105	1467.4468	1367.6055	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	241.4935	330.5032	265.5891	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												

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Space cooling kWh	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 requirement	0.0000	0.0000	0.0000	0.0000	0.0000	60.3734	82.6258	66.3973	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												209.3964 (107)
Energy for space cooling												39.9934 (99)
Total												1.5075 (108)
Fabric Energy Efficiency (TFEE)												41.5009 (109)
												41.5 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	63.9000 (1b)	x 2.4000 (2b)	= 153.3600 (1b) - (3b)
First floor	49.0000 (1c)	x 2.7200 (2c)	= 133.2800 (1c) - (3c)
Second floor	26.0000 (1d)	x 2.0600 (2d)	= 53.5600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 340.2000 (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	4.5000 (17)
Infiltration rate	0.2250 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1913 (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												
Effective ac	0.2438	0.2391	0.2343	0.2104	0.2056	0.1817	0.1817	0.1769	0.1913	0.2056	0.2152	0.2247 (22b)
	0.5297	0.5286	0.5274	0.5221	0.5211	0.5165	0.5165	0.5156	0.5183	0.5211	0.5231	0.5252 (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
Door			1.8900	1.2000	2.2680		(26)
Windows (Uw = 1.40)			23.9700	1.3258	31.7784		(27)
Opening			0.7000	1.3258	0.9280		(27a)
Opening			1.2000	1.3258	1.5909		(27a)
Heatloss Floor 1			63.9000	0.1000	6.3900	110.0000	7029.0000 (28a)
Main	200.9200	23.3400	177.5800	0.1800	31.9644	70.0000	12430.6000 (29a)
Dormer	5.5400	2.5200	3.0200	0.1800	0.5436	9.0000	27.1800 (29a)
Dwarf Wall	9.1200		9.1200	0.1800	1.6416	9.0000	82.0800 (29a)
Plane	23.0000		23.0000	0.1000	2.3000	9.0000	207.0000 (30)
Slope	32.1600	0.7000	31.4600	0.1200	3.7752	9.0000	283.1400 (30)
Flat roof	12.0000	1.2000	10.8000	0.1200	1.2960	9.0000	97.2000 (30)
Total net area of external elements Aum(A, m2)			346.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.4761		(33)
Internal Floor 1			26.0000			18.0000	468.0000 (32d)
Internal Floor 2			63.9000			18.0000	1150.2000 (32d)
Internal Ceiling 1			63.9000			9.0000	575.1000 (32e)
Internal Ceiling 2			49.0000			9.0000	441.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	22790.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							164.0785 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	19.4400	0.0600	1.1664
E3 Sill	14.4400	0.0220	0.3177
E4 Jamb	48.8000	0.0170	0.8296
E5 Ground floor (normal)	41.2400	0.0640	2.6394
E6 Intermediate floor within a dwelling	30.8000	0.0010	0.0308
E6 Intermediate floor within a dwelling	20.4400	0.0010	0.0204
E10 Eaves (insulation at ceiling level)	17.5200	0.0570	0.9986
E12 Gable (insulation at ceiling level)	7.2100	0.0430	0.3100
E13 Gable (insulation at rafter level)	12.0000	0.0360	0.4320
E16 Corner (normal)	33.7400	0.0420	1.4171
E17 Corner (inverted - internal area greater than external area)	9.9000	-0.0850	-0.8415

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E14 Flat roof	13.7000	0.1600	2.1920
R1 Head of roof window	1.7800	0.2400	0.4272
R2 Sill of roof window	1.7800	0.2400	0.4272
R3 Jamb of roof window	4.2000	0.2400	1.0080
R7 Flat ceiling (inverted)	8.8000	0.1200	1.0560
R6 Flat ceiling	5.3600	0.1200	0.6432
R8 Roof to wall (rafter)	5.3600	0.1200	0.6432
R9 Roof to wall (flat ceiling)	5.6800	0.3200	1.8176
R4 Ridge (vaulted ceiling)	5.3000	0.1200	0.6360

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 16.1709 (36)
 Total fabric heat loss (33) + (36) + (36a) = 100.6471 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	59.4707	59.3411	59.2140	58.6173	58.5057	57.9860	57.9860	57.8897	58.1862	58.5057	58.7315	58.9676 (38)
Average = Sum(39)m / 12 =	160.1177	159.9881	159.8611	159.2644	159.1528	158.6330	158.6330	158.5368	158.8332	159.1528	159.3786	159.6147 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1528	1.1518	1.1509	1.1466	1.1458	1.1421	1.1421	1.1414	1.1435	1.1458	1.1474	1.1491 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9150 (42)

Hot water usage for mixer showers 80.1534 78.9262 77.1178 74.3357 71.8431 68.3559 65.5977 68.8222 70.4439 73.8978 77.4948 80.0811 (42a)

Hot water usage for baths 30.8526 30.3869 29.7243 28.7321 27.8379 26.6069 25.6730 26.8150 27.4143 28.6341 29.9022 30.8282 (42b)

Hot water usage for other uses 44.4821 42.8646 41.2471 39.6295 38.0120 36.3945 36.3945 38.0120 39.6295 41.2471 42.8646 44.4821 (42c)

Average daily hot water use (litres/day) 142.9412 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	155.4882	152.1777	148.0892	142.6973	137.6930	131.3572	127.6652	133.6492	137.4878	143.7790	150.2616	155.3914 (44)
Energy content (annual)	228.9054	201.3619	211.6164	186.3984	177.4313	151.9103	141.0738	157.3075	159.4790	185.2737	203.0835	228.2037 (45)
Distribution loss (46)m = 0.15 x (45)m	34.3358	30.2043	31.7425	27.9598	26.6147	22.7865	21.1611	23.5961	23.9218	27.7911	30.4625	34.2306 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397 (62)
MWHRS	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	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397 (64)
Total per year (kWh/year) = Sum(64)m =												2507.9849 (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	76.1111	66.9528	70.3625	61.9775	58.9959	50.5102	46.9070	52.3047	53.0268	61.6035	67.5253	75.8777 (65)

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

Metabolic gains (Table 5), Watts

(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.7372	36.1824	29.4255	22.2770	16.6523	14.0586	15.1908	19.7456	26.5025	33.6510	39.2757	41.8694 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	459.9371	464.7098	452.6828	427.0786	394.7578	364.3809	344.0873	339.3146	351.3416	376.9458	409.2666	439.6435 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047 (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)	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985 (71)
Water heating gains (Table 5)	102.2998	99.6322	94.5732	86.0798	79.2956	70.1530	63.0471	70.3021	73.6483	82.8004	93.7851	101.9862 (72)
Total internal gains	716.6781	714.2284	690.3854	649.1394	604.4097	562.2965	536.0291	543.0662	565.1964	607.1012	656.0313	697.2031 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	9.5900	10.6334	0.6300	0.7000	0.7700	31.1646 (74)
East	1.1300	19.6403	0.6300	0.7000	0.7700	6.7826 (76)
South	12.5500	46.7521	0.6300	0.7000	0.7700	179.3149 (78)
West	0.7000	19.6403	0.6300	0.7000	0.7700	4.2016 (80)
North	0.7000	26.0000	0.6300	0.7000	1.0000	7.2236 (82)
South	1.2000	26.0000	0.6300	0.7000	1.0000	12.3833 (82)

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Solar gains	241.0706	415.4383	583.0692	750.0808	867.5991	873.9924	837.3066	747.3027	640.3335	462.9155	289.5766	205.7942 (83)
Total gains	957.7487	1129.6667	1273.4547	1399.2202	1472.0089	1436.2889	1373.3357	1290.3689	1205.5299	1070.0167	945.6079	902.9972 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.5377	39.5698	39.6012	39.7496	39.7775	39.9078	39.9078	39.9320	39.8575	39.7775	39.7211	39.6623
alpha	3.6358	3.6380	3.6401	3.6500	3.6518	3.6605	3.6605	3.6621	3.6572	3.6518	3.6481	3.6442
util living area	0.9845	0.9714	0.9457	0.8900	0.7872	0.6342	0.4863	0.5325	0.7464	0.9173	0.9738	0.9874 (86)
Living	19.5404	19.7408	20.0304	20.3733	20.6599	20.8327	20.8918	20.8822	20.7596	20.3796	19.8860	19.4925
Non living	18.2518	18.5056	18.8693	19.2916	19.6229	19.8013	19.8479	19.8430	19.7368	19.3094	18.6951	18.1932
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	20.2533	19.7408	20.0304	20.3733	20.6599	20.8327	20.8918	20.8822	20.7596	20.3796	19.8860	19.7034 (87)
Th 2	19.9580	19.9587	19.9595	19.9629	19.9636	19.9666	19.9666	19.9672	19.9655	19.9636	19.9623	19.9609 (88)
util rest of house	0.9811	0.9652	0.9337	0.8650	0.7388	0.5537	0.3813	0.4260	0.6749	0.8930	0.9671	0.9845 (89)
MIT 2	19.2778	18.5056	18.8693	19.2916	19.6229	19.8013	19.8479	19.8430	19.7368	19.3094	18.6951	18.5117 (90)
Living area fraction										FLA = Living area / (4) =		0.0926 (91)
MIT	19.3681	18.6200	18.9768	19.3918	19.7189	19.8968	19.9446	19.9392	19.8315	19.4084	18.8054	18.6220 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3681	18.6200	18.9768	19.3918	19.7189	19.8968	19.9446	19.9392	19.8315	19.4084	18.8054	18.6220 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9787	0.9546	0.9193	0.8486	0.7259	0.5478	0.3789	0.4229	0.6644	0.8766	0.9568	0.9797 (94)
Useful gains	937.3897	1078.3927	1170.7357	1187.3459	1068.4721	786.8684	520.4222	545.7583	800.9637	937.9923	904.7788	884.6307 (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	2412.6694	2195.0340	1994.5616	1670.9626	1276.2264	840.2518	530.5593	561.0953	910.3465	1401.8887	1865.5867	2301.9689 (97)
Space heating kWh	1097.6081	750.3830	612.9265	348.2040	154.5692	0.0000	0.0000	0.0000	0.0000	345.1389	691.7817	1054.4997 (98a)
Space heating requirement - total per year (kWh/year)												5055.1111
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	1097.6081	750.3830	612.9265	348.2040	154.5692	0.0000	0.0000	0.0000	0.0000	345.1389	691.7817	1054.4997 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5055.1111
Space heating per m2										(98c) / (4) =		36.3939 (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 %)												345.8502 (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	1097.6081	750.3830	612.9265	348.2040	154.5692	0.0000	0.0000	0.0000	0.0000	345.1389	691.7817	1054.4997 (98)
Space heating efficiency (main heating system 1)	345.8502	345.8502	345.8502	345.8502	345.8502	0.0000	0.0000	0.0000	0.0000	345.8502	345.8502	345.8502 (210)
Space heating fuel (main heating system)	317.3651	216.9676	177.2231	100.6806	44.6925	0.0000	0.0000	0.0000	0.0000	99.7943	200.0235	304.9007 (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	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397 (64)
Efficiency of water heater (217)m	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704 (216)
Fuel for water heating, kWh/month	93.0221	82.0325	86.6487	77.0738	74.0469	64.3602	60.6442	66.6285	67.1503	76.9379	83.2245	92.7634 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	35.6570	28.6054	25.7560	18.8699	14.5757	11.9085	13.2964	17.2832	22.4492	29.4545	33.2688	36.6481 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1461.6474 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												271.2704

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Water heating fuel used	924.5331 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	287.7727 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2673.9531 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1461.6474	16.4900	241.0257 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	924.5331	16.4900	152.4555 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	287.7727	16.4900	47.4537 (250)
Additional standing charges			0.0000 (251)
Total energy cost			440.9349 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] = 0.8632 (257)$
SAP value	86.0081 (258)
SAP rating (Section 12)	86 (259)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1461.6474	0.1555	227.3316 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	924.5331	0.1413	130.6012 (264)
Space and water heating			357.9327 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	287.7727	0.1443	41.5345 (268)
Total CO2, kg/year			399.4672 (272)
CO2 emissions per m2			2.8800 (273)
EI value			97.0893 (274)
EI rating			97 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.9000 (1b)	x 2.4000 (2b)	= 153.3600 (1b) - (3b)
First floor	49.0000 (1c)	x 2.7200 (2c)	= 133.2800 (1c) - (3c)
Second floor	26.0000 (1d)	x 2.0600 (2d)	= 53.5600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	340.2000 (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)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.5000 (17)

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Infiltration rate 0.2250 (18)
 Number of sides sheltered 2 (19)
 Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1913 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.9000	3.9000	4.0000	3.7000	3.4000	3.1000	3.4000	3.0000	3.4000	3.6000	3.3000	3.6000 (22)
Wind factor	0.9750	0.9750	1.0000	0.9250	0.8500	0.7750	0.8500	0.7500	0.8500	0.9000	0.8250	0.9000 (22a)
Adj infiltr rate	0.1865	0.1865	0.1913	0.1769	0.1626	0.1482	0.1626	0.1434	0.1626	0.1721	0.1578	0.1721 (22b)
Effective ac	0.5174	0.5174	0.5183	0.5156	0.5132	0.5110	0.5132	0.5103	0.5132	0.5148	0.5124	0.5148 (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
Door			1.8900	1.2000	2.2680		(26)
Windows (Uw = 1.40)			23.9700	1.3258	31.7784		(27)
Opening			0.7000	1.3258	0.9280		(27a)
Opening			1.2000	1.3258	1.5909		(27a)
Heatloss Floor 1			63.9000	0.1000	6.3900	110.0000	7029.0000 (28a)
Main	200.9200	23.3400	177.5800	0.1800	31.9644	70.0000	12430.6000 (29a)
Dormer	5.5400	2.5200	3.0200	0.1800	0.5436	9.0000	27.1800 (29a)
Dwarf Wall	9.1200		9.1200	0.1800	1.6416	9.0000	82.0800 (29a)
Plane	23.0000		23.0000	0.1000	2.3000	9.0000	207.0000 (30)
Slope	32.1600	0.7000	31.4600	0.1200	3.7752	9.0000	283.1400 (30)
Flat roof	12.0000	1.2000	10.8000	0.1200	1.2960	9.0000	97.2000 (30)
Total net area of external elements Aum (A, m2)			346.6400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 84.4761		(33)
Internal Floor 1			26.0000			18.0000	468.0000 (32d)
Internal Floor 2			63.9000			18.0000	1150.2000 (32d)
Internal Ceiling 1			63.9000			9.0000	575.1000 (32e)
Internal Ceiling 2			49.0000			9.0000	441.0000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 22790.5000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 164.0785 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	19.4400	0.0600	1.1664
E3 Sill	14.4400	0.0220	0.3177
E4 Jamb	48.8000	0.0170	0.8296
E5 Ground floor (normal)	41.2400	0.0640	2.6394
E6 Intermediate floor within a dwelling	30.8000	0.0010	0.0308
E6 Intermediate floor within a dwelling	20.4400	0.0010	0.0204
E10 Eaves (insulation at ceiling level)	17.5200	0.0570	0.9986
E12 Gable (insulation at ceiling level)	7.2100	0.0430	0.3100
E13 Gable (insulation at rafter level)	12.0000	0.0360	0.4320
E16 Corner (normal)	33.7400	0.0420	1.4171
E17 Corner (inverted - internal area greater than external area)	9.9000	-0.0850	-0.8415
E14 Flat roof	13.7000	0.1600	2.1920
R1 Head of roof window	1.7800	0.2400	0.4272
R2 Sill of roof window	1.7800	0.2400	0.4272
R3 Jamb of roof window	4.2000	0.2400	1.0080
R7 Flat ceiling (inverted)	8.8000	0.1200	1.0560
R6 Flat ceiling	5.3600	0.1200	0.6432
R8 Roof to wall (rafter)	5.3600	0.1200	0.6432
R9 Roof to wall (flat ceiling)	5.6800	0.3200	1.8176
R4 Ridge (vaulted ceiling)	5.3000	0.1200	0.6360

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.1709 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 100.6471 (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	58.0848	58.0848	58.1862	57.8897	57.6164	57.3662	57.6164	57.2879	57.6164	57.7961	57.5304	57.7961 (38)
Average = Sum(39)m / 12 =	158.7319	158.7319	158.8332	158.5368	158.2635	158.0133	158.2635	157.9350	158.2635	158.4431	158.1775	158.4431 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1428	1.1428	1.1435	1.1414	1.1394	1.1376	1.1394	1.1370	1.1394	1.1407	1.1388	1.1407 (40)
HLP (average)												1.1403
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9150 (42)											
Hot water usage for mixer showers	80.1534	78.9262	77.1178	74.3357	71.8431	68.3559	65.5977	68.8222	70.4439	73.8978	77.4948	80.0811 (42a)
Hot water usage for baths	30.8526	30.3869	29.7243	28.7321	27.8379	26.6069	25.6730	26.8150	27.4143	28.6341	29.9022	30.8282 (42b)
Hot water usage for other uses	44.4821	42.8646	41.2471	39.6295	38.0120	36.3945	36.3945	38.0120	39.6295	41.2471	42.8646	44.4821 (42c)
Average daily hot water use (litres/day)												142.9412 (43)
Daily hot water use	155.4882	152.1777	148.0892	142.6973	137.6930	131.3572	127.6652	133.6492	137.4878	143.7790	150.2616	155.3914 (44)
Energy conte	228.9054	201.3619	211.6164	186.3984	177.4313	151.9103	141.0738	157.3075	159.4790	185.2737	203.0835	228.2037 (45)
Energy content (annual)												Total = Sum(45)m = 2232.0449
Distribution loss (46)m = 0.15 x (45)m	34.3358	30.2043	31.7425	27.9598	26.6147	22.7865	21.1611	23.5961	23.9218	27.7911	30.4625	34.2306 (46)
Water storage loss:												180.0000 (47)
Store volume												1.4000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7560 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

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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	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397	(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	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397	(64)
	Total per year (kWh/year) = Sum(64)m =											2507.9849	(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	76.1111	66.9528	70.3625	61.9775	58.9959	50.5102	46.9070	52.3047	53.0268	61.6035	67.5253	75.8777	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.7372	36.1824	29.4255	22.2770	16.6523	14.0586	15.1908	19.7456	26.5025	33.6510	39.2757	41.8694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	459.9371	464.7098	452.6828	427.0786	394.7578	364.3809	344.0873	339.3146	351.3416	376.9458	409.2666	439.6435	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	(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)	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	(71)
Water heating gains (Table 5)	102.2998	99.6322	94.5732	86.0798	79.2956	70.1530	63.0471	70.3021	73.6483	82.8004	93.7851	101.9862	(72)
Total internal gains	716.6781	714.2284	690.3854	649.1394	604.4097	562.2965	536.0291	543.0662	565.1964	607.1012	656.0313	697.2031	(73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
North		9.5900	11.9957	0.6300	0.7000	0.7700	35.1575 (74)						
East		1.1300	22.3485	0.6300	0.7000	0.7700	7.7179 (76)						
South		12.5500	51.1372	0.6300	0.7000	0.7700	196.1337 (78)						
West		0.7000	22.3485	0.6300	0.7000	0.7700	4.7810 (80)						
North		0.7000	30.0000	0.6300	0.7000	1.0000	8.3349 (82)						
South		1.2000	30.0000	0.6300	0.7000	1.0000	14.2884 (82)						
Solar gains	266.4134	420.8610	586.7787	771.4970	876.8424	950.4454	892.0774	802.5365	691.3362	492.3581	327.8981	225.2173	(83)
Total gains	983.0915	1135.0894	1277.1641	1420.6364	1481.2521	1512.7419	1428.1065	1345.6027	1256.5326	1099.4593	983.9294	922.4204	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)														
Utilisation factor for gains for living area, nil,m (see Table 9a)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(85)	
tau	39.8829	39.8829	39.8575	39.9320	40.0010	40.0643	40.0010	40.0842	40.0010	39.9556	40.0227	39.9556		
alpha	3.6589	3.6589	3.6572	3.6621	3.6667	3.6710	3.6667	3.6723	3.6667	3.6637	3.6682	3.6637		
util living area	0.9822	0.9697	0.9394	0.8737	0.7513	0.5480	0.3906	0.4226	0.6872	0.8995	0.9684	0.9857	(86)	
Living	19.6119	19.7827	20.1006	20.4397	20.7181	20.8715	20.9064	20.9035	20.8095	20.4541	19.9609	19.5575		
Non living	18.3485	18.5640	18.9615	19.3740	19.6898	19.8361	19.8579	19.8588	19.7861	19.4013	18.7944	18.2809		
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	20.2899	19.7827	20.1006	20.4397	20.7181	20.8715	20.9064	20.9035	20.8095	20.4541	19.9609	19.7593	(87)	
Th 2	19.9661	19.9661	19.9655	19.9672	19.9688	19.9702	19.9688	19.9707	19.9688	19.9677	19.9693	19.9677	(88)	
util rest of house	0.9782	0.9631	0.9258	0.8451	0.6957	0.4603	0.2826	0.3104	0.6054	0.8700	0.9602	0.9824	(89)	
MIT 2	19.3212	18.5640	18.9615	19.3740	19.6898	19.8361	19.8579	19.8588	19.7861	19.4013	18.7944	18.5849	(90)	
Living area fraction	FLA = Living area / (4) =												0.0926	(91)
MIT	19.4109	18.6768	19.0670	19.4726	19.7850	19.9319	19.9550	19.9555	19.8808	19.4988	18.9024	18.6936	(92)	
Temperature adjustment													0.0000	
adjusted MIT	19.4109	18.6768	19.0670	19.4726	19.7850	19.9319	19.9550	19.9555	19.8808	19.4988	18.9024	18.6936	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)	
Useful gains	959.1307	1080.9025	1163.4309	1177.5393	1014.1882	691.1248	401.5171	415.3863	750.9794	938.4050	933.6906	901.3088	(95)	
Ext temp.	4.6000	5.1000	7.0000	9.4000	12.4000	15.4000	17.4000	17.3000	14.7000	11.1000	7.4000	4.5000	(96)	
Heat loss rate W	2350.9593	2155.0777	1916.6372	1596.8821	1168.7808	716.1052	404.3621	419.3953	819.9380	1330.7346	1819.4224	2248.8849	(97)	
Space heating kWh	1035.5205	721.8457	560.3855	301.9268	115.0169	0.0000	0.0000	0.0000	0.0000	291.8932	637.7270	1002.5966	(98a)	
Space heating requirement - total per year (kWh/year)													4666.9122	
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	1035.5205	721.8457	560.3855	301.9268	115.0169	0.0000	0.0000	0.0000	0.0000	291.8932	637.7270	1002.5966	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)													4666.9122	
Space heating per m2													(98c) / (4) =	33.5991 (99)

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 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 %)													346.0379 (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	1035.5205	721.8457	560.3855	301.9268	115.0169	0.0000	0.0000	0.0000	0.0000	291.8932	637.7270	1002.5966	(98)
Space heating efficiency (main heating system 1)	346.0379	346.0379	346.0379	346.0379	346.0379	0.0000	0.0000	0.0000	0.0000	346.0379	346.0379	346.0379	(210)
Space heating fuel (main heating system)	299.2506	208.6031	161.9434	87.2525	33.2382	0.0000	0.0000	0.0000	0.0000	84.3529	184.2939	289.7360	(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	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397	(64)
Efficiency of water heater (217)m	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	(216)
Fuel for water heating, kWh/month	93.0993	82.1006	86.7206	77.1377	74.1083	64.4136	60.6945	66.6838	67.2060	77.0017	83.2936	92.8404	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	35.6570	28.6054	25.7560	18.8699	14.5757	11.9085	13.2964	17.2832	22.4492	29.4545	33.2688	36.6481	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													1348.6706 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													271.0455
Water heating fuel used													925.3002 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													287.7727 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													0.0000 (233)
Wind generation													0.0000 (234)
Hydro-electric generation (Appendix N)													0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (235)
Appendix Q - special features													
Energy saved or generated													-0.0000 (236)
Energy used													0.0000 (237)
Total delivered energy for all uses													2561.7435 (238)

 10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1348.6706	25.1600	339.3255	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	925.3002	25.1600	232.8055	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	287.7727	25.1600	72.4036	(250)
Additional standing charges			0.0000	(251)
Total energy cost			644.5347	(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	1348.6706	0.1559	210.3236	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	925.3002	0.1413	130.7095	(264)
Space and water heating			341.0331	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	287.7727	0.1443	41.5345	(268)
Total CO2, kg/year			382.5676	(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	1348.6706	1.5773	2127.2862	(275)

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Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	925.3002	1.5224	1408.6321 (278)
Space and water heating			3535.9183 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	287.7727	1.5338	441.3953 (282)
Total Primary energy kWh/year			3977.3136 (286)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating: B 86
Current environmental impact rating: A 97

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

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.8	-£ 241	-129 kg (33.6%)

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.7 -£ 38 -18 kg (4.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£241	0.93 kg/m ²	B 91 A 98
Total Savings	£241	0.93 kg/m ²	

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

Fuel prices for cost data on this page from database revision number 536 TEST (31 Jan 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £645	Potential £645	£0	Saving
Electricity				
Space heating	£339	£339	£0	
Water heating	£233	£233	£0	
Lighting	£72	£72	£0	
Generated (PV)	-£0	-£241	£241	
Total cost of fuels	£645	£404	£241	
Total cost of uses	£644	£403	£241	
Delivered energy	18 kWh/m ²	12 kWh/m ²	7 kWh/m ²	
Carbon dioxide emissions	0.4 tonnes	0.3 tonnes	0.1 tonnes	
CO2 emissions per m ²	3 kg/m ²	2 kg/m ²	1 kg/m ²	
Primary energy	29 kWh/m ²	18 kWh/m ²	10 kWh/m ²	

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.9000 (1b)	x 2.4000 (2b)	= 153.3600 (1b) - (3b)
First floor	49.0000 (1c)	x 2.7200 (2c)	= 133.2800 (1c) - (3c)
Second floor	26.0000 (1d)	x 2.0600 (2d)	= 53.5600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	340.2000 (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	4.5000 (17)
Infiltration rate	0.2250 (18)
Number of sides sheltered	2 (19)

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Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1913 (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												
Effective ac	0.2438	0.2391	0.2343	0.2104	0.2056	0.1817	0.1817	0.1769	0.1913	0.2056	0.2152	0.2247 (22b)
	0.5297	0.5286	0.5274	0.5221	0.5211	0.5165	0.5165	0.5156	0.5183	0.5211	0.5231	0.5252 (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
Door			1.8900	1.2000	2.2680		(26)
Windows (Uw = 1.40)			23.9700	1.3258	31.7784		(27)
Opening			0.7000	1.3258	0.9280		(27a)
Opening			1.2000	1.3258	1.5909		(27a)
Heatloss Floor 1			63.9000	0.1000	6.3900	110.0000	7029.0000 (28a)
Main	200.9200	23.3400	177.5800	0.1800	31.9644	70.0000	12430.6000 (29a)
Dormer	5.5400	2.5200	3.0200	0.1800	0.5436	9.0000	27.1800 (29a)
Dwarf Wall	9.1200		9.1200	0.1800	1.6416	9.0000	82.0800 (29a)
Plane	23.0000		23.0000	0.1000	2.3000	9.0000	207.0000 (30)
Slope	32.1600	0.7000	31.4600	0.1200	3.7752	9.0000	283.1400 (30)
Flat roof	12.0000	1.2000	10.8000	0.1200	1.2960	9.0000	97.2000 (30)
Total net area of external elements Aum(A, m2)			346.6400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 84.4761		(33)
Internal Floor 1			26.0000			18.0000	468.0000 (32d)
Internal Floor 2			63.9000			18.0000	1150.2000 (32d)
Internal Ceiling 1			63.9000			9.0000	575.1000 (32e)
Internal Ceiling 2			49.0000			9.0000	441.0000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 22790.5000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 164.0785 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	19.4400	0.0600	1.1664
E3 Sill	14.4400	0.0220	0.3177
E4 Jamb	48.8000	0.0170	0.8296
E5 Ground floor (normal)	41.2400	0.0640	2.6394
E6 Intermediate floor within a dwelling	30.8000	0.0010	0.0308
E6 Intermediate floor within a dwelling	20.4400	0.0010	0.0204
E10 Eaves (insulation at ceiling level)	17.5200	0.0570	0.9986
E12 Gable (insulation at ceiling level)	7.2100	0.0430	0.3100
E13 Gable (insulation at rafter level)	12.0000	0.0360	0.4320
E16 Corner (normal)	33.7400	0.0420	1.4171
E17 Corner (inverted - internal area greater than external area)	9.9000	-0.0850	-0.8415
E14 Flat roof	13.7000	0.1600	2.1920
R1 Head of roof window	1.7800	0.2400	0.4272
R2 Sill of roof window	1.7800	0.2400	0.4272
R3 Jamb of roof window	4.2000	0.2400	1.0080
R7 Flat ceiling (inverted)	8.8000	0.1200	1.0560
R6 Flat ceiling	5.3600	0.1200	0.6432
R8 Roof to wall (rafter)	5.3600	0.1200	0.6432
R9 Roof to wall (flat ceiling)	5.6800	0.3200	1.8176
R4 Ridge (vaulted ceiling)	5.3000	0.1200	0.6360

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.1709 (36)
 Point Thermal bridges 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 100.6471 (37)

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

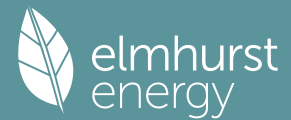
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	59.4707	59.3411	59.2140	58.6173	58.5057	57.9860	57.9860	57.8897	58.1862	58.5057	58.7315	58.9676 (38)
Heat transfer coeff	160.1177	159.9881	159.8611	159.2644	159.1528	158.6330	158.6330	158.5368	158.8332	159.1528	159.3786	159.6147 (39)
Average = Sum(39)m / 12 =												159.2639

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1528	1.1518	1.1509	1.1466	1.1458	1.1421	1.1421	1.1414	1.1435	1.1458	1.1474	1.1491 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9150 (42)
Hot water usage for mixer showers												80.0811 (42a)
Hot water usage for baths												30.8282 (42b)
Hot water usage for other uses												44.4821 (42c)
Average daily hot water use (litres/day)												142.9412 (43)
Daily hot water use	155.4882	152.1777	148.0892	142.6973	137.6930	131.3572	127.6652	133.6492	137.4878	143.7790	150.2616	155.3914 (44)
Energy conte	228.9054	201.3619	211.6164	186.3984	177.4313	151.9103	141.0738	157.3075	159.4790	185.2737	203.0835	228.2037 (45)
Energy content (annual)												2232.0449
Distribution loss (46)m = 0.15 x (45)m	34.3358	30.2043	31.7425	27.9598	26.6147	22.7865	21.1611	23.5961	23.9218	27.7911	30.4625	34.2306 (46)
Water storage loss:												180.0000 (47)
Store volume												1.4000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7560 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397 (62)

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WVHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397	(64)
	Total per year (kWh/year) = Sum(64)m =											2507.9849 (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	76.1111	66.9528	70.3625	61.9775	58.9959	50.5102	46.9070	52.3047	53.0268	61.6035	67.5253	75.8777	(65)

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

Metabolic gains (Table 5), Watts													
(66m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.7372	36.1824	29.4255	22.2770	16.6523	14.0586	15.1908	19.7456	26.5025	33.6510	39.2757	41.8694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	459.9371	464.7098	452.6828	427.0786	394.7578	364.3809	344.0873	339.3146	351.3416	376.9458	409.2666	439.6435	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	(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)	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	(71)
Water heating gains (Table 5)	102.2998	99.6322	94.5732	86.0798	79.2956	70.1530	63.0471	70.3021	73.6483	82.8004	93.7851	101.9862	(72)
Total internal gains	716.6781	714.2284	690.3854	649.1394	604.4097	562.2965	536.0291	543.0662	565.1964	607.1012	656.0313	697.2031	(73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains						
		m ²	Table 6a	Specific data	Specific data	factor	W						
			W/m ²	or Table 6b	or Table 6c	Table 6d							
North		9.5900	10.6334	0.6300	0.7000	0.7700	31.1646 (74)						
East		1.1300	19.6403	0.6300	0.7000	0.7700	6.7826 (76)						
South		12.5500	46.7521	0.6300	0.7000	0.7700	179.3149 (78)						
West		0.7000	19.6403	0.6300	0.7000	0.7700	4.2016 (80)						
North		0.7000	26.0000	0.6300	0.7000	1.0000	7.2236 (82)						
South		1.2000	26.0000	0.6300	0.7000	1.0000	12.3833 (82)						
Solar gains	241.0706	415.4383	583.0692	750.0808	867.5991	873.9924	837.3066	747.3027	640.3335	462.9155	289.5766	205.7942	(83)
Total gains	957.7487	1129.6667	1273.4547	1399.2202	1472.0089	1436.2889	1373.3357	1290.3689	1205.5299	1070.0167	945.6079	902.9972	(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	39.5377	39.5698	39.6012	39.7496	39.7775	39.9078	39.9078	39.9320	39.8575	39.7775	39.7211	39.6623	
alpha	3.6358	3.6380	3.6401	3.6500	3.6518	3.6605	3.6605	3.6621	3.6572	3.6518	3.6481	3.6442	
util living area	0.9845	0.9714	0.9457	0.8900	0.7872	0.6342	0.4863	0.5325	0.7464	0.9173	0.9738	0.9874	(86)
Living	19.5404	19.7408	20.0304	20.3733	20.6599	20.8327	20.8918	20.8822	20.7596	20.3796	19.8860	19.4925	
Non living	18.2518	18.5056	18.8693	19.2916	19.6229	19.8013	19.8479	19.8430	19.7368	19.3094	18.6951	18.1932	
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	20.2533	19.7408	20.0304	20.3733	20.6599	20.8327	20.8918	20.8822	20.7596	20.3796	19.8860	19.7034	(87)
Th 2	19.9580	19.9587	19.9595	19.9629	19.9636	19.9666	19.9666	19.9672	19.9655	19.9636	19.9623	19.9609	(88)
util rest of house	0.9811	0.9652	0.9337	0.8650	0.7388	0.5537	0.3813	0.4260	0.6749	0.8930	0.9671	0.9845	(89)
MIT 2	19.2778	18.5056	18.8693	19.2916	19.6229	19.8013	19.8479	19.8430	19.7368	19.3094	18.6951	18.5117	(90)
Living area fraction									fLA = Living area / (4) =			0.0926	(91)
MIT	19.3681	18.6200	18.9768	19.3918	19.7189	19.8968	19.9446	19.9392	19.8315	19.4084	18.8054	18.6220	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3681	18.6200	18.9768	19.3918	19.7189	19.8968	19.9446	19.9392	19.8315	19.4084	18.8054	18.6220	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	937.3897	1078.3927	1170.7357	1187.3459	1068.4721	786.8684	520.4222	545.7583	800.9637	937.9923	904.7788	884.6307	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2412.6694	2195.0340	1994.5616	1670.9626	1276.2264	840.2518	530.5593	561.0953	910.3465	1401.8887	1865.5867	2301.9689	(97)
Space heating kWh	1097.6081	750.3830	612.9265	348.2040	154.5692	0.0000	0.0000	0.0000	0.0000	345.1389	691.7817	1054.4997	(98a)
Space heating requirement - total per year (kWh/year)	5055.1111												
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	1097.6081	750.3830	612.9265	348.2040	154.5692	0.0000	0.0000	0.0000	0.0000	345.1389	691.7817	1054.4997	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5055.1111												
Space heating per m ²												(98c) / (4) =	36.3939 (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 %)	345.8502	(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	1097.6081	750.3830	612.9265	348.2040	154.5692	0.0000	0.0000	0.0000	0.0000	345.1389	691.7817	1054.4997	(98)	
Space heating efficiency (main heating system 1)	345.8502	345.8502	345.8502	345.8502	345.8502	0.0000	0.0000	0.0000	0.0000	345.8502	345.8502	345.8502	(210)	
Space heating fuel (main heating system)	317.3651	216.9676	177.2231	100.6806	44.6925	0.0000	0.0000	0.0000	0.0000	99.7943	200.0235	304.9007	(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	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397	(64)	
Efficiency of water heater (217)m	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	271.2704	(216)	
Fuel for water heating, kWh/month	93.0221	82.0325	86.6487	77.0738	74.0469	64.3602	60.6442	66.6285	67.1503	76.9379	83.2245	92.7634	(219)	
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)	
Lighting	35.6570	28.6054	25.7560	18.8699	14.5757	11.9085	13.2964	17.2832	22.4492	29.4545	33.2688	36.6481	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-39.0772	-58.4154	-88.5614	-103.2394	-112.2498	-101.6465	-99.8971	-92.8983	-80.0304	-67.1580	-43.6815	-33.2831	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													1461.6474	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													271.2704	
Water heating fuel used													924.5331	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													287.7727	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-920.1380	(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													1753.8152	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1461.6474	16.4900	241.0257	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	924.5331	16.4900	152.4555	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	287.7727	16.4900	47.4537	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-920.1380	16.4900	-151.7308	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-151.7308	(252)
Total energy cost			289.2041	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5661	(257)
SAP value		90.8228	
SAP rating (Section 12)		91	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1461.6474	0.1555	227.3316	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	924.5331	0.1413	130.6012	(264)

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Space and water heating			357.9327 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	287.7727	0.1443	41.5345 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-920.1380	0.1342	-123.4552
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-123.4552 (269)
Total CO2, kg/year			276.0121 (272)
CO2 emissions per m2			1.9900 (273)
EI value			97.9888
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 FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.9000 (1b)	x	2.4000 (2b)	=	153.3600 (1b)	- (3b)
First floor	49.0000 (1c)	x	2.7200 (2c)	=	133.2800 (1c)	- (3c)
Second floor	26.0000 (1d)	x	2.0600 (2d)	=	53.5600 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.9000					(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 340.2000 (5)

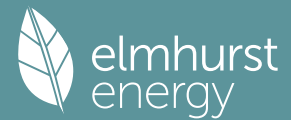
2. Ventilation rate

	m3 per hour											
Number of open chimneys		0 * 80 =	0.0000 (6a)									
Number of open flues		0 * 20 =	0.0000 (6b)									
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)									
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)									
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)									
Number of blocked chimneys		0 * 20 =	0.0000 (6f)									
Number of intermittent extract fans		0 * 10 =	0.0000 (7a)									
Number of passive vents		0 * 10 =	0.0000 (7b)									
Number of flueless gas fires		0 * 40 =	0.0000 (7c)									
			Air changes per hour									
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)									
Pressure test			Yes									
Pressure Test Method			Blower Door									
Measured/design AP50			4.5000 (17)									
Infiltration rate			0.2250 (18)									
Number of sides sheltered			2 (19)									
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)									
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1913 (21)									
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	3.9000	3.9000	4.0000	3.7000	3.4000	3.1000	3.4000	3.0000	3.4000	3.6000	3.3000	3.6000 (22)
Adj infilt rate	0.9750	0.9750	1.0000	0.9250	0.8500	0.7750	0.8500	0.7500	0.8500	0.9000	0.8250	0.9000 (22a)
Effective ac	0.1865	0.1865	0.1913	0.1769	0.1626	0.1482	0.1626	0.1434	0.1626	0.1721	0.1578	0.1721 (22b)
	0.5174	0.5174	0.5183	0.5156	0.5132	0.5110	0.5132	0.5103	0.5132	0.5148	0.5124	0.5148 (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
Door			1.8900	1.2000	2.2680		(26)
Windows (Uw = 1.40)			23.9700	1.3258	31.7784		(27)
Opening			0.7000	1.3258	0.9280		(27a)
Opening			1.2000	1.3258	1.5909		(27a)
Heatloss Floor 1			63.9000	0.1000	6.3900	110.0000	7029.0000 (28a)
Main	200.9200	23.3400	177.5800	0.1800	31.9644	70.0000	12430.6000 (29a)
Dormer	5.5400	2.5200	3.0200	0.1800	0.5436	9.0000	27.1800 (29a)
Dwarf Wall	9.1200		9.1200	0.1800	1.6416	9.0000	82.0800 (29a)
Plane	23.0000		23.0000	0.1000	2.3000	9.0000	207.0000 (30)
Slope	32.1600	0.7000	31.4600	0.1200	3.7752	9.0000	283.1400 (30)
Flat roof	12.0000	1.2000	10.8000	0.1200	1.2960	9.0000	97.2000 (30)
Total net area of external elements Aum(A, m2)			346.6400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	84.4761	(33)
Internal Floor 1			26.0000			18.0000	468.0000 (32d)
Internal Floor 2			63.9000			18.0000	1150.2000 (32d)
Internal Ceiling 1			63.9000			9.0000	575.1000 (32e)
Internal Ceiling 2			49.0000			9.0000	441.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 22790.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							164.0785 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				19.4400	0.0600	1.1664	
E3 Sill				14.4400	0.0220	0.3177	
E4 Jamb				48.8000	0.0170	0.8296	
E5 Ground floor (normal)				41.2400	0.0640	2.6394	
E6 Intermediate floor within a dwelling				30.8000	0.0010	0.0308	
E6 Intermediate floor within a dwelling				20.4400	0.0010	0.0204	

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E10 Eaves (insulation at ceiling level)	17.5200	0.0570	0.9986
E12 Gable (insulation at ceiling level)	7.2100	0.0430	0.3100
E13 Gable (insulation at rafter level)	12.0000	0.0360	0.4320
E16 Corner (normal)	33.7400	0.0420	1.4171
E17 Corner (inverted - internal area greater than external area)	9.9000	-0.0850	-0.8415
E14 Flat roof	13.7000	0.1600	2.1920
R1 Head of roof window	1.7800	0.2400	0.4272
R2 Sill of roof window	1.7800	0.2400	0.4272
R3 Jamb of roof window	4.2000	0.2400	1.0080
R7 Flat ceiling (inverted)	8.8000	0.1200	1.0560
R6 Flat ceiling	5.3600	0.1200	0.6432
R8 Roof to wall (rafter)	5.3600	0.1200	0.6432
R9 Roof to wall (flat ceiling)	5.6800	0.3200	1.8176
R4 Ridge (vaulted ceiling)	5.3000	0.1200	0.6360
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.1709 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	100.6471 (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	58.0848	58.0848	58.1862	57.8897	57.6164	57.3662	57.6164	57.2879	57.6164	57.7961	57.5304	57.7961 (38)
Average = Sum(39)m / 12 =	158.7319	158.7319	158.8332	158.5368	158.2635	158.0133	158.2635	157.9350	158.2635	158.4431	158.1775	158.4431 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1428	1.1428	1.1435	1.1414	1.1394	1.1376	1.1394	1.1370	1.1394	1.1407	1.1388	1.1407 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9150 (42)
Hot water usage for mixer showers	80.1534	78.9262	77.1178	74.3357	71.8431	68.3559	65.5977	68.8222	70.4439	73.8978	77.4948	80.0811	(42a)
Hot water usage for baths	30.8526	30.3869	29.7243	28.7321	27.8379	26.6069	25.6730	26.8150	27.4143	28.6341	29.9022	30.8282	(42b)
Hot water usage for other uses	44.4821	42.8646	41.2471	39.6295	38.0120	36.3945	36.3945	38.0120	39.6295	41.2471	42.8646	44.4821	(42c)
Average daily hot water use (litres/day)													142.9412 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	155.4882	152.1777	148.0892	142.6973	137.6930	131.3572	127.6652	133.6492	137.4878	143.7790	150.2616	155.3914	(44)
Energy content (annual)	228.9054	201.3619	211.6164	186.3984	177.4313	151.9103	141.0738	157.3075	159.4790	185.2737	203.0835	228.2037	(45)
Distribution loss (46)m = 0.15 x (45)m	34.3358	30.2043	31.7425	27.9598	26.6147	22.7865	21.1611	23.5961	23.9218	27.7911	30.4625	34.2306	(46)
Water storage loss:													180.0000 (47)
Store volume													1.4000 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.7560 (55)
Enter (49) or (54) in (55)													
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397	(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	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397	(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	76.1111	66.9528	70.3625	61.9775	58.9959	50.5102	46.9070	52.3047	53.0268	61.6035	67.5253	75.8777	(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	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	174.8977	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.7372	36.1824	29.4255	22.2770	16.6523	14.0586	15.1908	19.7456	26.5025	33.6510	39.2757	41.8694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	459.9371	464.7098	452.6828	427.0786	394.7578	364.3809	344.0873	339.3146	351.3416	376.9458	409.2666	439.6435	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	55.4047	(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)	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	-116.5985	(71)
Water heating gains (Table 5)	102.2998	99.6322	94.5732	86.0798	79.2956	70.1530	63.0471	70.3021	73.6483	82.8004	93.7851	101.9862	(72)
Total internal gains	716.6781	714.2284	690.3854	649.1394	604.4097	562.2965	536.0291	543.0662	565.1964	607.1012	656.0313	697.2031	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	9.5900	11.9957	0.6300	0.7000	0.7700	35.1575 (74)
East	1.1300	22.3485	0.6300	0.7000	0.7700	7.7179 (76)

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South			12.5500		51.1372		0.6300		0.7000		0.7700		196.1337 (78)
West			0.7000		22.3485		0.6300		0.7000		0.7700		4.7810 (80)
North			0.7000		30.0000		0.6300		0.7000		1.0000		8.3349 (82)
South			1.2000		30.0000		0.6300		0.7000		1.0000		14.2884 (82)

Solar gains	266.4134	420.8610	586.7787	771.4970	876.8424	950.4454	892.0774	802.5365	691.3362	492.3581	327.8981	225.2173	(83)
Total gains	983.0915	1135.0894	1277.1641	1420.6364	1481.2521	1512.7419	1428.1065	1345.6027	1256.5326	1099.4593	983.9294	922.4204	(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	39.8829	39.8829	39.8575	39.9320	40.0010	40.0643	40.0010	40.0842	40.0010	39.9556	40.0227	39.9556	
alpha	3.6589	3.6589	3.6572	3.6621	3.6667	3.6710	3.6667	3.6723	3.6667	3.6637	3.6682	3.6637	
util living area	0.9822	0.9697	0.9394	0.8737	0.7513	0.5480	0.3906	0.4226	0.6872	0.8995	0.9684	0.9857	(86)
Living	19.6119	19.7827	20.1006	20.4397	20.7181	20.8715	20.9064	20.9035	20.8095	20.4541	19.9609	19.5575	
Non living	18.3485	18.5640	18.9615	19.3740	19.6898	19.8361	19.8579	19.8588	19.7861	19.4013	18.7944	18.2809	
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	20.2899	19.7827	20.1006	20.4397	20.7181	20.8715	20.9064	20.9035	20.8095	20.4541	19.9609	19.7593	(87)
Th 2	19.9661	19.9661	19.9655	19.9672	19.9688	19.9702	19.9688	19.9707	19.9688	19.9677	19.9693	19.9677	(88)
util rest of house	0.9782	0.9631	0.9258	0.8451	0.6957	0.4603	0.2826	0.3104	0.6054	0.8700	0.9602	0.9824	(89)
MIT 2	19.3212	18.5640	18.9615	19.3740	19.6898	19.8361	19.8579	19.8588	19.7861	19.4013	18.7944	18.5849	(90)
Living area fraction									fLA = Living area / (4) =			0.0926	(91)
MIT	19.4109	18.6768	19.0670	19.4726	19.7850	19.9319	19.9550	19.9555	19.8808	19.4988	18.9024	18.6936	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4109	18.6768	19.0670	19.4726	19.7850	19.9319	19.9550	19.9555	19.8808	19.4988	18.9024	18.6936	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9756	0.9523	0.9109	0.8289	0.6847	0.4569	0.2812	0.3087	0.5977	0.8535	0.9489	0.9771	(94)
Useful gains	959.1307	1080.9025	1163.4309	1177.5393	1014.1248	691.1248	401.5171	415.3863	750.9794	938.4050	933.6906	901.3088	(95)
Ext temp.	4.6000	5.1000	7.0000	9.4000	12.4000	15.4000	17.4000	17.3000	14.7000	11.1000	7.4000	4.5000	(96)
Heat loss rate W	2350.9593	2155.0777	1916.6372	1596.8821	1168.7808	716.1052	404.3621	419.3953	819.9380	1330.7346	1819.4224	2248.8849	(97)
Space heating kWh	1035.5205	721.8457	560.3855	301.9268	115.0169	0.0000	0.0000	0.0000	0.0000	291.8932	637.7270	1002.5966	(98a)
Space heating requirement - total per year (kWh/year)												4666.9122	
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	1035.5205	721.8457	560.3855	301.9268	115.0169	0.0000	0.0000	0.0000	0.0000	291.8932	637.7270	1002.5966	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4666.9122	
Space heating per m2										(98c) / (4) =		33.5991	(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 %) 346.0379 (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	1035.5205	721.8457	560.3855	301.9268	115.0169	0.0000	0.0000	0.0000	0.0000	291.8932	637.7270	1002.5966	(98)
Space heating efficiency (main heating system 1)	346.0379	346.0379	346.0379	346.0379	346.0379	0.0000	0.0000	0.0000	0.0000	346.0379	346.0379	346.0379	(210)
Space heating fuel (main heating system)	299.2506	208.6031	161.9434	87.2525	33.2382	0.0000	0.0000	0.0000	0.0000	84.3529	184.2939	289.7360	(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	252.3414	222.5299	235.0524	209.0784	200.8673	174.5903	164.5098	180.7435	182.1590	208.7097	225.7635	251.6397	(64)
Efficiency of water heater (217)m	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	271.0455	(216)
Fuel for water heating, kWh/month	93.0993	82.1006	86.7206	77.1377	74.1083	64.4136	60.6945	66.6838	67.2060	77.0017	83.2936	92.8404	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	35.6570	28.6054	25.7560	18.8699	14.5757	11.9085	13.2964	17.2832	22.4492	29.4545	33.2688	36.6481	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.0811	-59.6582	-89.3680	-104.9693	-112.1523	-106.7680	-103.7558	-97.3478	-84.7568	-70.6425	-48.9096	-36.4362	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

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Annual totals kWh/year		
Space heating fuel - main system 1	1348.6706	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	271.0455	
Water heating fuel used	925.3002	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	287.7727	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-957.8456	(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	1603.8980	(238)

 10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1348.6706	25.1600	339.3255	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	925.3002	25.1600	232.8055	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	287.7727	25.1600	72.4036	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-957.8456	25.1600	-240.9939	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-240.9939	(252)
Total energy cost			403.5407	(255)

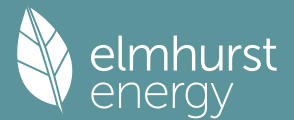
 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1348.6706	0.1559	210.3236	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	925.3002	0.1413	130.7095	(264)
Space and water heating			341.0331	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	287.7727	0.1443	41.5345	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-957.8456	0.1342	-128.5597	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-128.5597	(269)
Total CO2, kg/year			254.0079	(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	1348.6706	1.5773	2127.2862	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	925.3002	1.5224	1408.6321	(278)
Space and water heating			3535.9183	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	287.7727	1.5338	441.3953	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-957.8456	1.4960	-1432.9585	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1432.9585	(283)
Total Primary energy kWh/year			2544.3552	(286)

Predicted Energy Assessment



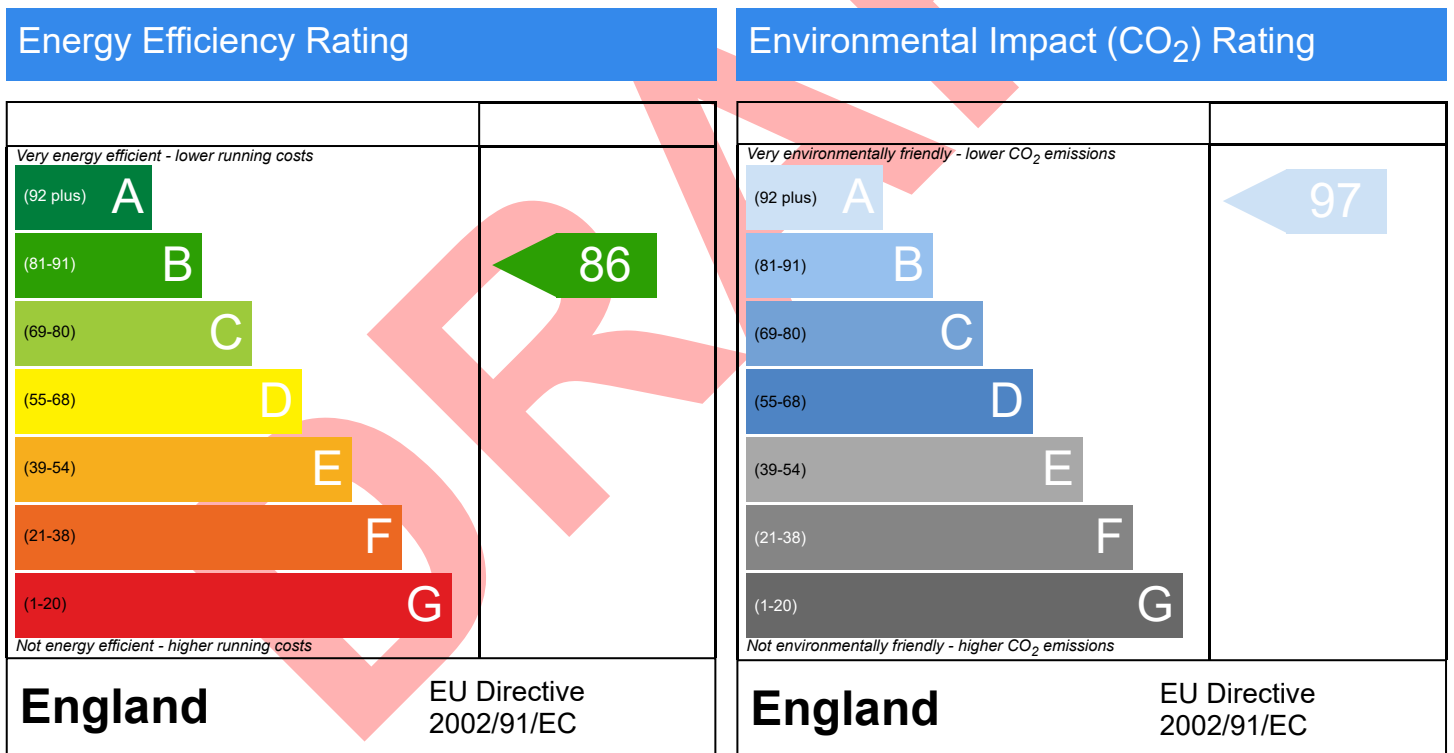
10, Kindersley Way, Abbots Langley, WD5 0DQ

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

House, Detached
05/02/2024
Matthew Carter
138.9 m²

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

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



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

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

Summary for Input Data



Property Reference	00809	Issued on Date	05/02/2024
Assessment Reference	00001	Prop Type Ref	
Property	10, Kindersley Way, Abbots Langley, WD5 0DQ		

SAP Rating	86 B	DER	2.95	TER	10.06
Environmental	97 A	% DER < TER			70.68
CO ₂ Emissions (t/year)	0.38	DFEE	41.19	TFEE	41.50
Compliance Check	See BREL	% DFEE < TFEE			0.74
% DPER < TPER	41.72	DPER	30.65	TPER	52.59

Assessor Details	Mr. Matthew Carter	Assessor ID	7869-0001
Client	113, Mr. Wysmolinski		

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

Orientation	North
Property Tenure	ND
Transaction Type	6
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	3
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation

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

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	41.24 m	63.90 m ²	2.40 m
1st Storey:	30.80 m	49.00 m ²	2.72 m
2nd Storey:	20.44 m	26.00 m ²	2.06 m

8.0 Living Area	12.86	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
	Main	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	200.92	177.58	0.00	None	23.34	Enter Gross Area
	Dormer	Timber Frame	Timber framed wall (one layer of plasterboard)	0.18	9.00	5.54	3.02	0.00	None	2.52	Enter Gross Area
	Dwarf Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.18	9.00	9.12	9.12	0.00	None	0.00	Enter Gross Area

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
	Plane	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	23.00	23.00	None	0.00	Enter Gross Area	0.00
	Slope	External Slope Roof	Plasterboard, insulated slope	0.12	9.00	32.16	31.46	None	0.00	Enter Gross Area	0.70
	Flat roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.12	9.00	12.00	10.80	None	0.00	Enter Gross Area	1.20

10.2 Internal Ceilings	Description	Storey	Construction	Area (m ²)
	Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	63.90
	Internal Ceiling 2	+1	Plasterboard ceiling, carpeted chipboard floor	49.00

11.0 Heat Loss Floors	Description	Type	Storey Index	Construction	U-Value (W/m ² K)	Shelter Code	Shelter Factor	Kappa (kJ/m ² K)	Area (m ²)
	Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.10	None	0.00	110.00	63.90

11.2 Internal Floors	Description	Storey Index	Construction	Kappa (kJ/m ² K)	Area (m ²)

Summary for Input Data



Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	9.00	26.00
Internal Floor 2	Plasterboard ceiling, carpeted chipboard floor	9.00	63.90

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door	Manufacturer	Solid Door							1.20
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Roof lights	Manufacturer	Roof Window	Double Low-E Soft 0.05			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Door	Door	Main	North	1.89	
Opening	Windows	Main	North	9.59	
Opening	Roof lights	Slope	North	0.70	0
Opening	Windows	Main	West	0.70	
Opening	Windows	Main	East	1.13	
Opening	Windows	Main	South	10.03	
Opening	Windows	Dormer	South	2.52	
Opening	Roof lights	Flat roof	South	1.20	0

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	19.44	0.06	0.06 High Therm	No
E3 Sill	Independently assessed	14.44	0.02	0.02 RCD	No
E4 Jamb	Independently assessed	48.80	0.02	0.02 RCD	No
E5 Ground floor (normal)	Independently assessed	41.24	0.06	0.06 RCD	No
E6 Intermediate floor within a dwelling	Independently assessed	30.80	0.00	0.00 RCD	No
E6 Intermediate floor within a dwelling	Independently assessed	20.44	0.00	0.00 RCD	No
E10 Eaves (insulation at ceiling level)	Independently assessed	17.52	0.06	0.06 RCD	No
E12 Gable (insulation at ceiling level)	Independently assessed	7.21	0.04	0.04 RCD	No
E13 Gable (insulation at rafter level)	Independently assessed	12.00	0.04	0.04 RCD	No
E16 Corner (normal)	Independently assessed	33.74	0.04	0.04 RCD	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	9.90	-0.09	-0.09 RCD	No
E14 Flat roof	Table K1 - Default	13.70	0.16	0.16	No
R1 Head of roof window	Table K1 - Default	1.78	0.24	0.24	No
R2 Sill of roof window	Table K1 - Default	1.78	0.24	0.24	No
R3 Jamb of roof window	Table K1 - Default	4.20	0.24	0.24	No
R7 Flat ceiling (inverted)	Table K1 - Default	8.80	0.12	0.12	No
R6 Flat ceiling	Table K1 - Default	5.36	0.12	0.12	No
R8 Roof to wall (rafter)	Table K1 - Default	5.36	0.12	0.12	No
R9 Roof to wall (flat ceiling)	Table K1 - Default	5.68	0.32	0.32	No
R4 Ridge (vaulted ceiling)	Table K1 - Default	5.30	0.12	0.12	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Test Method

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting 1	90.00	5	450	24

24.0 Main Heating 1

Percentage of Heat %

Database Ref. No.

Fuel Type

In Winter

In Summer

Summary for Input Data



Model Name	ERGA06EVA + EHVH08SU18E6V
Manufacturer	Daikin Europe NV
System Type	Heat Pump
Controls SAP Code	2207
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

26.0 Heat Networks

28.0 Water Heating

Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From header tank
Bath Count	1
Immersion Only Heating Hot Water	Yes

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
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28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

Insulation Type	Internal Store			
Cylinder Volume	Measured Loss			
Loss	180.00			L
In Airing Cupboard	1.40			kWh/day
	No			

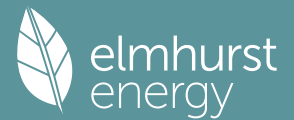
Recommendations

Lower cost measures
None

Further measures to achieve even higher standards

Typical Cost	Typical savings per year	Ratings after improvement	
		SAP rating	Environmental Impact
£3,500 - £5,500	£241	B 87	A 97
		B 91	A 98
		0	0

Thermal Bridging



Property Reference	00809	Issued on Date	05/02/2024
Assessment Reference	00001	Prop Type Ref	Detached House
Property	10, Kindersley Way, Abbots Langley, WD5 0DQ		

SAP Rating	86 B	DER	2.95	TER	10.06
Environmental	97 A	% DER < TER			70.68
CO ₂ Emissions (t/year)	0.38	DFEE	41.19	TFEE	41.50
Compliance Check	See BREL	% DFEE < TFEE			0.74
% DPER < TPER	41.72	DPER	30.65	TPER	52.59

Assessor Details	Mr. Matthew Carter	Assessor ID	7869-0001
Client	113, Mr. Wysmolinski		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.060	19.44	1.17	High Therm
External wall	E3 Sill	Independently assessed	0.022	14.44	0.32	RCD
External wall	E4 Jamb	Independently assessed	0.017	48.80	0.83	RCD
External wall	E5 Ground floor (normal)	Independently assessed	0.064	41.24	2.64	RCD
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.001	30.80	0.03	RCD
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.001	20.44	0.02	RCD
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.057	17.52	1.00	RCD
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.043	7.21	0.31	RCD
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.036	12.00	0.43	RCD
External wall	E16 Corner (normal)	Independently assessed	0.042	33.74	1.42	RCD
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.085	9.90	-0.84	RCD
External wall	E14 Flat roof	Table K1 - Default	0.160	13.70	2.19	
External roof	R1 Head of roof window	Table K1 - Default	0.240	1.78	0.43	
External roof	R2 Sill of roof window	Table K1 - Default	0.240	1.78	0.43	
External roof	R3 Jamb of roof window	Table K1 - Default	0.240	4.20	1.01	
External roof	R7 Flat ceiling (inverted)	Table K1 - Default	0.120	8.80	1.06	
External roof	R6 Flat ceiling	Table K1 - Default	0.120	5.36	0.64	
External roof	R8 Roof to wall (rafter)	Table K1 - Default	0.120	5.36	0.64	
External roof	R9 Roof to wall (flat ceiling)	Table K1 - Default	0.320	5.68	1.82	
External roof	R4 Ridge (vaulted ceiling)	Table K1 - Default	0.120	5.30	0.64	

Total: 307.49 W/mK:
 Y-Value: 0.05 W/m²K:

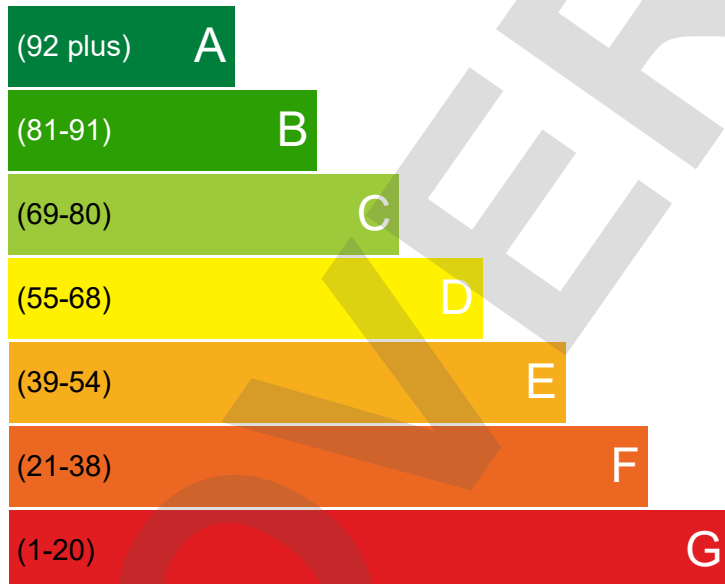
Dwelling Address	10, Kindersley Way, Abbots Langley, WD5 0DQ
Report Date	05/02/2024
Property Type	House, Detached
Floor Area [m ²]	139

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs



CURRENT

POTENTIAL

86

91

Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Floor	Average thermal transmittance 0.1 W/m ² K	Very Good
Windows	High performance glazing	Good
Main heating	Air source heat pump, radiators and underfloor, electric	Very Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Good lighting efficiency	Good
Air tightness	Air permeability [AP50] = 4.5 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 29 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling





The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **0.4** per year

With the recommended measures the potential CO emissions could be: **0.3** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
Solar water heating		 1	£38	 B 87
Photovoltaic	£241	 4	£279	 B 91

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£645

Over a year you could save

£241

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details

Assessor name	Mr. Matthew Carter
Assessor's accreditation number	
Email Address	

Accreditation scheme contact details

Accreditation scheme	
Telephone	
Email Address	

Assessment details

Related party disclosure	
Date of assessment	05/02/2024
Date of certificate	05/02/2024
Type of assessment	SAP, new dwelling