

Building Regulations England Part L (BREL) Compliance Report

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

Date: Thu 01 Feb 2024 11:49:39

Project Information			
Assessed By	Daniel Watt	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/027301	Assessment Date	2024-02-01

Dwelling Details			
Assessment Type	As designed	Total Floor Area	34 m ²
Site Reference	1D1P - Ground floor_Copy	Plot Reference	00001_Copy
Address	42-43 Drake Street		

Client Details	
Name	Paul Butler Associates
Company	Paul Butler Associates
Address	31 Blackfriars Road, Manchester, M3 7AQ

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	Mains gas		
Target carbon dioxide emission rate	16.92 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	12.12 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	91.88 kWh _{PE} /m ²		
Dwelling primary energy	84.3 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	27.0 kWh/m ²		
Dwelling fabric energy efficiency	18.7 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	0.15	Walls (1) (0.15)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.11	GF (0.11)	OK
Roofs	0.16	N/A	N/A	N/A
Windows, doors, and roof windows	1.6	0.8	NE (0.8)	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)	21.68	0.15
Ground floor: GF, GF	34.25	0.11

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]
NE, Windows	2	North East	0.7	0.8 (!)
S, Windows	2	South	0.7	0.8 (!)

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	0.03 (!)	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	

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	1 m ³ /hm ² , Design value (!)	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Boiler with radiators or underfloor heating - Mains gas

Efficiency	90.0%
Emitter type	Underfloor
Flow temperature	
System type	
Manufacturer	V
Model	V
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	120 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation

System type: Balanced whole-house mechanical ventilation with heat recovery

Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	0.47 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	89%	OK
Manufacturer/Model	Sentinel Kinetic FH, 408167A	
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: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Summary for Input Data

Property Reference	1D1P - Ground floor_Copy			Issued on Date	01/02/2024
Assessment Reference	00001_Copy	Prop Type Ref	1D1P - Mid Floor		
Property	42-43 Drake Street				

SAP Rating	79 C	DER	12.12	TER	16.92
Environmental	93 A	% DER < TER			28.37
CO ₂ Emissions (t/year)	0.41	DFEE	18.70	TFEE	27.03
Compliance Check	See BREL	% DFEE < TFEE			30.81
% DPER < TPER	8.25	DPER	84.30	TPER	91.88

Assessor Details	Mr. Daniel Watt	Assessor ID	AV75-0001
Client			

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

Orientation	Southeast
Property Tenture	ND
Transaction Type	6
Terrain Type	Urban
1.0 Property Type	Flat, Mid-Terrace
Position of Flat	Ground-floor flat
Which Floor	1
2.0 Number of Storeys	1
3.0 Date Built	2024
3.0 Property Age Band	L
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
Thermal Mass	N/A
7.0 Electricity Tariff	Standard
Smart electricity meter fitted	Yes
Smart gas meter fitted	Yes

7.0 Measurements			
	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	10.70 m	34.25 m ²	2.40 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

8.0 Living Area	15.00	m ²
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9.0 External Walls											
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type	
External Wall 1	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	25.68	21.68	0.00	None	4.00	Enter Gross Area	

10.1 Party Ceilings				Kappa	Area (m ²)
Description	Construction			(kJ/m ² K)	
Party Ceiling 1	Precast concrete planks floor, screed, carpeted			30.00	34.25

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)	
GF	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.11	None	0.00	110.00	34.25	

12.0 Opening Types									
Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m ² K)

Summary for Input Data



Windows Manufacturer Window Triple Low-E Soft 0.05 Air Filled 0.72 Wood 0.70 0.80

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
NE	Windows	External Wall 1	North East	2.00	0
S	Windows	External Wall 1	South	2.00	0

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	3.00	0.03	0.03	No
E3 Sill	Independently assessed	3.00	0.04	0.04	No
E4 Jamb	Independently assessed	6.00	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	10.70	0.07	0.07	No
E16 Corner (normal)	Independently assessed	4.80	0.09	0.09	No
E18 Party wall between dwellings	Independently assessed	4.80	0.06	0.06	No
E5 Ground floor (normal)	Independently assessed	10.70	0.16	0.16	No

Y-value 0.06 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 1.00 m³/(h.m²) @ 50 Pa

Property Tested? Yes

Test Method Blower Door

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present Yes

Approved Installation Yes

Mechanical Ventilation data Type Database

Type Balanced mechanical ventilation with heat recovery

MV Reference Number 500811

Configuration 1

Manufacturer SFP 0.47

Duct Type Rigid

MVHR Efficiency 89.00

Wet Rooms 1

SFP from Installer Commissioning Certificate No

MVHR System Location Inside heated envelope (installed exclusively)

Duct Installation Specification Level 1

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

No

22.0 Lighting

No Fixed Lighting No

Name	Efficacy	Power	Capacity	Count
LED	120.00	2	240	10

24.0 Main Heating 1

Manufacturer

Percentage of Heat 100.00 %

Database Ref. No. 0

Fuel Type Mains gas

SAP Code 104

In Winter 90.00

In Summer 90.00

Model Name V

Summary for Input Data

Manufacturer	V
Controls SAP Code	2110
Delayed Start Stat	Yes
Burner Control	On/Off
HETAS approved System	No
Oil Pump Inside	No
Flue Type	Open
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heating Pump Age	2013 or later
Heat Emitter	Underfloor
Underfloor Heating	Yes - Pipes in thin screed
Flow Temperature	Unknown
Boiler Interlock	Yes
Combi boiler type	Standard Combi
Combi keep hot type	Electric, time clock

25.0 Main Heating 2

26.0 Heat Networks

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None									
Heat source 2	None									
Heat source 3	None									
Heat source 4	None									
Heat source 5	None									

28.0 Water Heating

Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Summer Immersion	No
Cold Water Source	From mains
Bath Count	0
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

	None	
Cylinder Stat	No	
Cylinder In Heated Space	No	
Independent Time Control	No	
Insulation Type	Measured Loss	
Cylinder Volume	173.00	L
Loss	1.92	kWh/day
In Airing Cupboard	No	

31.0 Thermal Store

Summary for Input Data



34.0 Small-scale Hydro

Electricity Generated

None

Apportioned

0.00

Connected to dwelling's electricity meter

0.00

kWh/Year

Electricity Generation

Yes

Annual

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Recommendations

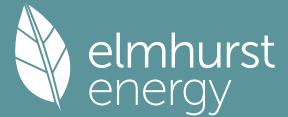
Lower cost measures

None

Further measures to achieve even higher standards

None

Full SAP Calculation Printout



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Compliance Check	See BREL	% DFEE < TFEE				30.81
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Assessor Details	Mr. Daniel Watt				Assessor ID	AV75-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.2500 (1b)	2.4000 (2b)	82.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	34.2500		82.2000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	82.2000 (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	1.0000 (17)
Infiltration rate	0.0500 (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) = 0.0425 (21)

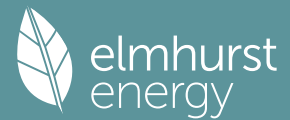
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.0542	0.0531	0.0521	0.0468	0.0457	0.0404	0.0404	0.0393	0.0425	0.0457	0.0478	0.0499 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												80.1000 (23c)
Effective ac	0.1537	0.1526	0.1516	0.1462	0.1452	0.1399	0.1399	0.1388	0.1420	0.1452	0.1473	0.1494 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 0.80)			4.0000	0.7752	3.1008		(27)
GF			34.2500	0.1100	3.7675	110.0000	3767.5000 (28a)
External Wall 1	25.6800	4.0000	21.6800	0.1500	3.2520	70.0000	1517.6000 (29a)
Total net area of external elements Aum(A, m ²)			59.9300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.1203		(33)
Party Ceiling 1			34.2500			30.0000	1027.5000 (32b)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	6312.6000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							184.3095 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				3.0000	0.0300	0.0900	
E3 Sill				3.0000	0.0400	0.1200	
E4 Jamb				6.0000	0.0500	0.3000	
E7 Party floor between dwellings (in blocks of flats)				10.7000	0.0700	0.7490	

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	97.5239	97.6805	97.8376	98.6306	98.7908	99.5994	99.5994	99.7627	99.2744	98.7908	98.4710	98.1533

Full SAP Calculation Printout



alpha	7.5016	7.5120	7.5225	7.5754	7.5861	7.6400	7.6400	7.6508	7.6183	7.5861	7.5647	7.5436
util living area	0.8387	0.7603	0.6722	0.5398	0.4094	0.2873	0.2055	0.2229	0.3458	0.5492	0.7430	0.8568 (86)
MIT	20.8736	20.9162	20.9415	20.9556	20.9586	20.9593	20.9593	20.9593	20.9591	20.9558	20.9282	20.8611 (87)
Th 2	20.4980	20.4988	20.4995	20.5034	20.5041	20.5080	20.5080	20.5088	20.5065	20.5041	20.5026	20.5011 (88)
util rest of house	0.8225	0.7415	0.6513	0.5182	0.3877	0.2652	0.1826	0.1991	0.3211	0.5237	0.7211	0.8416 (89)
MIT 2	20.3523	20.4008	20.4291	20.4476	20.4512	20.4557	20.4557	20.4566	20.4540	20.4487	20.4186	20.3410 (90)
Living area fraction	20.5806	20.6266	20.6535	20.6701	20.6734	20.6762	20.6763	20.6768	20.6752	20.6708	20.6418	20.5688 (92)
Temperature adjustment	20.4306	20.4766	20.5035	20.5201	20.5234	20.5262	20.5263	20.5268	20.5252	20.5208	20.4918	-0.1500
adjusted MIT												20.4188 (93)

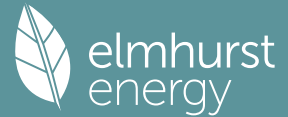
8. Space heating requirement												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8203	0.7407	0.6515	0.5190	0.3885	0.2660	0.1834	0.2000	0.3221	0.5246	0.7206	0.8390 (94)
Useful gains	269.6760	269.6252	247.0581	205.8776	156.5385	104.3315	69.1236	72.5345	113.4754	175.4456	231.4734	266.2813 (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	290.0320	279.6206	250.9782	206.5866	156.6123	104.3346	69.1238	72.5347	113.4892	176.0902	238.4706	289.7477 (97)
Space heating kWh	15.1448	6.7170	2.9166	0.5105	0.0549	0.0000	0.0000	0.0000	0.0000	0.4796	5.0380	17.4590 (98a)
Space heating requirement - total per year (kWh/year)												48.3203
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	15.1448	6.7170	2.9166	0.5105	0.0549	0.0000	0.0000	0.0000	0.0000	0.4796	5.0380	17.4590 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												48.3203
Space heating per m2										(98c) / (4) =		1.4108 (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 %)												90.0000 (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	15.1448	6.7170	2.9166	0.5105	0.0549	0.0000	0.0000	0.0000	0.0000	0.4796	5.0380	17.4590 (98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000 (210)
Space heating fuel (main heating system)	16.8276	7.4633	3.2407	0.5672	0.0610	0.0000	0.0000	0.0000	0.0000	0.5328	5.5977	19.3989 (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	177.3795	157.1621	167.6904	149.1553	145.7586	132.6156	131.7978	136.3075	137.0047	151.2484	158.9656	175.6663 (64)
Efficiency of water heater (217)m	90.0000	90.0000	90.0000	90.0000	90.0000	90.0000	90.0000	90.0000	90.0000	90.0000	90.0000	90.0000 (216)
Fuel for water heating, kWh/month	140.4673	123.4830	129.7017	110.9335	105.3330	92.5561	89.8210	94.8318	97.4329	111.4328	121.8339	138.5638 (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	63.2669	57.1443	63.2669	61.2260	63.2669	61.2260	63.2669	63.2669	61.2260	63.2669	61.2260	63.2669 (231)
Lighting	13.4810	10.8149	9.7377	7.1342	5.5107	4.5023	5.0270	6.5343	8.4874	11.1360	12.5781	13.8557 (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												53.6893 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												90.0000
Water heating fuel used												1356.3909 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5875)												
mechanical ventilation fans (SFP = 0.5875)												58.9168 (230a)
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
maintaining electric keep-hot facility for gas combi boiler												600.0000 (230f)
Total electricity for the above, kWh/year												744.9168 (231)
Electricity for lighting (calculated in Appendix L)												108.7992 (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												

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Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2263.7962 (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	53.6893	0.2100	11.2747	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1356.3909	0.2100	284.8421	(264)
Space and water heating			296.1168	(265)
Pumps, fans and electric keep-hot	744.9168	0.1387	103.3292	(267)
Energy for lighting	108.7992	0.1443	15.7031	(268)
Total CO2, kg/year			415.1491	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.1200	(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	53.6893	1.1300	60.6689	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1356.3909	1.1300	1532.7217	(278)
Space and water heating			1593.3906	(279)
Pumps, fans and electric keep-hot	744.9168	1.5128	1126.9102	(281)
Energy for lighting	108.7992	1.5338	166.8799	(282)
Total Primary energy kWh/year			2887.1807	(286)
Dwelling Primary energy Rate (DPER)			84.3000	(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	34.2500 (1b)	x 2.4000 (2b)	= 82.2000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	34.2500		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 82.2000 (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	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) =	0.2433 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4933	(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) =	0.4193 (21)

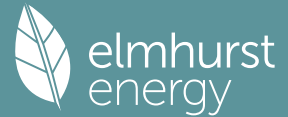
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5346	0.5241	0.5137	0.4612	0.4508	0.3983	0.3983	0.3879	0.4193	0.4508	0.4717	0.4927	(22b)
Effective ac	0.6429	0.6374	0.6319	0.6064	0.6016	0.5793	0.5793	0.5752	0.5879	0.6016	0.6113	0.6214	(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 Opening Type (Uw = 1.20)			4.0000	1.1450	4.5802			(27)
GF			34.2500	0.1300	4.4525			(28a)
External Wall 1	25.6800	4.0000	21.6800	0.1800	3.9024			(29a)
Total net area of external elements Aum(A, m2)			59.9300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		12.9351			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							194.3095	(35)
List of Thermal Bridges								

7. Mean internal temperature (heating season)

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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	54.1239	54.3635	54.6004	55.7415	55.9602	57.0018	57.0018	57.1990	56.5961	55.9602	55.5194	55.0659
alpha	4.6083	4.6242	4.6400	4.7161	4.7307	4.8001	4.8001	4.8133	4.7731	4.7307	4.7013	4.6711
util living area	0.9687	0.9506	0.9227	0.8521	0.7306	0.5494	0.4022	0.4325	0.6400	0.8552	0.9445	0.9723 (86)
MIT	19.9703	20.1533	20.3789	20.6754	20.8771	20.9758	20.9956	20.9937	20.9495	20.7182	20.3253	19.9550 (87)
Th 2	20.0856	20.0893	20.0929	20.1098	20.1130	20.1278	20.1278	20.1306	20.1221	20.1130	20.1066	20.0999 (88)
util rest of house	0.9618	0.9402	0.9062	0.8218	0.6803	0.4807	0.3240	0.3529	0.5712	0.8199	0.9311	0.9662 (89)
MIT 2	18.9109	19.1408	19.4210	19.7856	20.0077	20.1125	20.1260	20.1279	20.0869	19.8431	19.3708	18.9025 (90)
Living area fraction									fLA = Living area / (4) =			0.4380 (91)
MIT	19.3749	19.5842	19.8405	20.1753	20.3885	20.4906	20.5068	20.5071	20.4647	20.2264	19.7888	19.3635 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3749	19.5842	19.8405	20.1753	20.3885	20.4906	20.5068	20.5071	20.4647	20.2264	19.7888	19.3635 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9553	0.9333	0.9009	0.8242	0.6966	0.5098	0.3582	0.3877	0.5989	0.8248	0.9255	0.9600 (94)
Useful gains	304.2268	326.3050	325.4173	308.8240	263.3727	186.9445	126.1014	131.8613	198.9989	262.7402	286.3375	295.4692 (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	514.8916	499.3393	451.6784	373.9386	287.0223	191.0389	126.7037	132.7386	207.8938	318.0055	422.5017	509.0588 (97)
Space heating kWh	156.7346	116.2790	93.9382	46.8825	17.5954	0.0000	0.0000	0.0000	0.0000	41.1174	98.0382	158.9107 (98a)
Space heating requirement - total per year (kWh/year)												729.4960
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	156.7346	116.2790	93.9382	46.8825	17.5954	0.0000	0.0000	0.0000	0.0000	41.1174	98.0382	158.9107 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												729.4960
Space heating per m2										(98c) / (4) =		21.2992 (99)

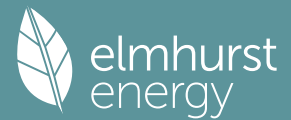
9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)												92.4000 (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	156.7346	116.2790	93.9382	46.8825	17.5954	0.0000	0.0000	0.0000	0.0000	41.1174	98.0382	158.9107 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	169.6262	125.8431	101.6648	50.7386	19.0426	0.0000	0.0000	0.0000	0.0000	44.4993	106.1020	171.9812 (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	167.0977	147.0567	155.4345	135.8066	130.6853	116.7091	114.9005	120.4741	122.7591	137.9511	147.6058	165.2945 (64)
Efficiency of water heater (217)m	84.2444	83.8831	83.3369	82.3442	81.2325	80.3000	80.3000	80.3000	80.3000	82.1242	83.5248	80.3000 (216)
Fuel for water heating, kWh/month	198.3487	175.3114	186.5135	164.9255	160.8781	145.3413	143.0891	150.0300	152.8756	167.9787	176.7210	84.2971 (217)
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	12.5673	10.0820	9.0777	6.6507	5.1372	4.1971	4.6863	6.0915	7.9122	10.3813	11.7256	12.9166 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-6.6284	-10.1106	-15.7138	-19.1606	-22.0243	-21.0860	-20.8541	-19.0128	-16.0048	-12.2122	-7.5612	-5.6464 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.7297	-3.7666	-7.7268	-11.9614	-16.1607	-16.3454	-16.1296	-13.4778	-9.6632	-5.4760	-2.3391	-1.3570 (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												789.4979 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												80.3000
Water heating fuel used												2018.0984 (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)												101.4257 (232)

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

PV generation	-282.1487 (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	

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Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2712.8733 (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	789.4979	0.2100	165.7945 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2018.0984	0.2100	423.8007 (264)
Space and water heating			589.5952 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	101.4257	0.1443	14.6389 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-176.0153	0.1329	-23.3996
PV Unit electricity exported	-106.1334	0.1251	-13.2729
Total			-36.6726 (269)
Total CO2, kg/year			579.4908 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.9200 (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	789.4979	1.1300	892.1326 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2018.0984	1.1300	2280.4512 (278)
Space and water heating			3172.5838 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	101.4257	1.5338	155.5701 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-176.0153	1.4912	-262.4797
PV Unit electricity exported	-106.1334	0.4590	-48.7169
Total			-311.1966 (283)
Total Primary energy kWh/year			3147.0582 (286)
Target Primary Energy Rate (TPER)			91.8800 (287)