

Building Regulations England Part L (BREL) Compliance Report

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

Date: Tue 05 Mar 2024 12:03:57

Project Information			
Assessed By	Kenny Lampard	Building Type	House, Detached
OCDEA Registration	EES/022411	Assessment Date	2024-03-05

Dwelling Details			
Assessment Type	As designed	Total Floor Area	212 m ²
Site Reference	Plot 01 - 24-03829	Plot Reference	00001
Address	68 Maze Green Road, Bishops Stortford, CM23 2PL		

Client Details	
Name	AC Architects
Company	AC Architects
Address	Unit 213, Lewis House, East Way, Hillend, Dunfermline , KY11 9JF

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	9.23 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	0.47 kgCO ₂ /m ²	OK	
1b Target primary energy rate and dwelling primary energy			
Target primary energy	48.8 kWh _{PE} /m ²		
Dwelling primary energy	14.74 kWh _{PE} /m ²	OK	
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	44.9 kWh/m ²		
Dwelling fabric energy efficiency	43.8 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	0.11	Walls (1) (0.11)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	0.16	0.12	Roof (1) (0.12)	OK
Windows, doors, and roof windows	1.6	1	Front (1)	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)	162.4432	0.11 (!)
Exposed wall: Walls (2)	16.259	0.1 (!)
Ground floor: Heatloss Floor 1, Heatloss Floor 1	110.58	0.12
Exposed roof: Roof (1)	120.6194	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]
Front , FGD	1.995	North	0.7	1 (!)
Front , Window	1.6254	North	0.7	1 (!)
Front , Window	1.6254	North	0.7	1 (!)
Front , Window	1.8	North	0.7	1 (!)
Front , Window	2.064	North	0.7	1 (!)
Front , Window	2.34	North	0.7	1 (!)
Fixed Hemisphere, Window	2	North	0.7	1 (!)
Front, Window	1.02	North	0.7	1 (!)
Rear , FGD	5.166	South	0.7	1 (!)
Rear, Window	2.52	South	0.7	1 (!)
Rear, FGD	7.455	South	0.7	1 (!)
Rear, Window	2.34	South	0.7	1 (!)
Rear, Window	1.98	South	0.7	1 (!)

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Rear, Window	5.94	South	0.7	1 (!)
Side , Window	2.34	East	0.7	1 (!)
Side , Window	0.72	East	0.7	1 (!)
Side , Window	1.364	East	0.7	1 (!)
Side , Window	0.825	East	0.7	1 (!)
Side, Window	1.89	East	0.7	1 (!)
Side , FGD	1.995	West	0.7	1 (!)
Side, Window	1.233	West	0.7	1 (!)
Opening, Skylight	0.9006	North	0.7	1 (!)

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	0.014 (!)	Econekt
External wall	E3: Sill	Calculated by person with suitable expertise	0.026 (!)	Econekt
External wall	E4: Jamb	Calculated by person with suitable expertise	0.01 (!)	Econekt
External wall	E5: Ground floor (normal)	SAP table default	0.32	
External wall	E6: Intermediate floor within a dwelling	SAP table default	0.14	
External wall	E16: Corner (normal)	SAP table default	0.18	
External wall	E17: Corner (inverted - internal area greater than external area)	SAP table default	0 (!)	
External wall	E14: Flat roof	SAP table default	0.16	
External wall	E24: Eaves (insulation at ceiling level - inverted)	SAP table default	0.15	
External wall	E13: Gable (insulation at rafter level)	SAP table default	0.25	
Roof	R4: Ridge (vaulted ceiling)	SAP table default	0.12	
External wall	E11: Eaves (insulation at rafter level)	SAP table default	0.15	

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	3 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	322.1%
Emitter type	Both radiators and underfloor
Flow temperature	45°C
System type	Heat Pump
Manufacturer	Mitsubishi Electric Europe B.V.
Model	Ecodan 11.2 kW
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	300 litres
Declared heat loss	2.09 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls

Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting

<i>Minimum permitted light source efficacy</i>	75 lm/W	
Lowest light source efficacy	100 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation

System type: Balanced whole-house mechanical ventilation with heat recovery		
<i>Maximum permitted specific fan power</i>	1.5 W/(l/s)	
Specific fan power	1.07 W/(l/s)	OK
<i>Minimum permitted heat recovery efficiency</i>	73%	
Heat recovery efficiency	86%	OK
Manufacturer/Model	ComfoAir 350	
Commissioning		

9 Local generation

Technology type: Photovoltaic system (1)	
Peak power	4.06 kWp
Orientation	East
Pitch	30°
Overshading	None or very little
Manufacturer	
MCS certificate	
Technology type: Photovoltaic system (2)	
Peak power	1.92 kWp
Orientation	South
Pitch	30°
Overshading	None or very little
Manufacturer	
MCS certificate	

10 Heat networks

N/A

11 Supporting documentary evidence

N/A

12 Declarations

a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed:	Assessor ID:
Name:	Date:

b. Client Declaration

N/A

Full SAP Calculation Printout



Property Reference	Plot 01 - 24-03829		Issued on Date	05/03/2024	
Assessment Reference	00001	Prop Type Ref	24-03829		
Property	68 Maze Green Road , Bishops Stortford, CM23 2PL				
SAP Rating	93 A	DER	0.47	TER	9.23
Environmental	100 A	% DER < TER			94.91
CO ₂ Emissions (t/year)	0.04	DFEE	43.76	TFEE	44.88
Compliance Check	See BREL	% DFEE < TFEE			2.50
% DPER < TPER	69.79	DPER	14.74	TPER	48.80
Assessor Details	Mr. Kenny Lampard			Assessor ID	T058-0001
Client	AC Architects , AC Architects				

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	110.5800 (1b)	2.3300 (2b)	257.6514 (1b) - (3b)
First floor	101.4400 (1c)	3.6400 (2c)	369.2416 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	626.8930 (5)

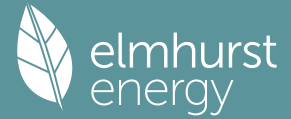
2. Ventilation rate

	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	3.0000											(17)
Infiltration rate	0.1500											(18)
Number of sides sheltered	1											(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.1388 (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
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
Balanced mechanical ventilation with heat recovery	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630
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) =												77.4000 (23c)
Effective ac	0.2899	0.2864	0.2830	0.2656	0.2622	0.2448	0.2448	0.2413	0.2518	0.2622	0.2691	0.2760

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
FGD (Uw = 1.00)			16.6300	0.9615	15.9904		(27)
Window (Uw = 1.00)			33.6200	0.9615	32.3269		(27)
Opening			0.9000	0.9615	0.8654		(27a)
Heatloss Floor 1			110.5800	0.1200	13.2696	110.0000	12163.8000 (28a)
Brickslip	198.0900	35.6500	162.4400	0.1100	17.8684	9.0000	1461.9600 (29a)
Render	30.8500	14.6000	16.2500	0.1000	1.6250	9.0000	146.2500 (29a)
External Roof 1	121.5200	0.9000	120.6200	0.1200	14.4744	9.0000	1085.5800 (30)
Total net area of external elements Aum (A, m ²)			461.0400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	96.4201			(33)
Internal Wall 1			432.1700			75.0000	32412.7500 (32c)
Internal Floor 1			101.4400			18.0000	1825.9200 (32d)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				49096.2600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							231.5643 (35)

Full SAP Calculation Printout



List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	31.0900	0.0140	0.4353
E3 Sill	26.1850	0.0260	0.6808
E4 Jamb	59.9800	0.0100	0.5998
E5 Ground floor (normal)	46.0700	0.3200	14.7424
E6 Intermediate floor within a dwelling	42.5600	0.1400	5.9584
E16 Corner (normal)	32.6340	0.1800	5.8741
E17 Corner (inverted - internal area greater than external area)	12.4340	0.0000	0.0000
E14 Flat roof	8.7170	0.1600	1.3947
E24 Eaves (insulation at ceiling level - inverted)	5.2070	0.1500	0.7810
E13 Gable (insulation at rafter level)	9.0080	0.2500	2.2520
R4 Ridge (vaulted ceiling)	16.4790	0.1200	1.9775
E11 Eaves (insulation at rafter level)	36.7330	0.1500	5.5099
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			40.2060 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 136.6261 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	59.9743	59.2567	58.5391	54.9511	54.2335	50.6455	50.6455	49.9279	52.0807	54.2335	55.6687	57.1039 (38)
Heat transfer coeff	196.6003	195.8828	195.1652	191.5772	190.8596	187.2716	187.2716	186.5540	188.7068	190.8596	192.2948	193.7300 (39)
Average = Sum(39)m / 12 =												191.3978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9273	0.9239	0.9205	0.9036	0.9002	0.8833	0.8833	0.8799	0.8900	0.9002	0.9070	0.9137 (40)
HLP (average)												0.9027
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0176 (42)
Hot water usage for mixer showers													102.4756 (42a)
Hot water usage for baths													32.1866 (42b)
Hot water usage for other uses													45.5328 (42c)
Average daily hot water use (litres/day)													166.1792 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	180.6983	177.0170	172.4331	165.2218	159.4527	153.2158	150.6410	155.2031	160.0399	166.6107	173.9402	180.1950 (44)	
Energy conte	286.1819	252.0698	265.0233	226.1804	214.6540	188.3967	182.1873	192.1739	197.3452	226.0891	247.8097	282.1418 (45)	
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	42.9273	37.8105	39.7535	33.9271	32.1981	28.2595	27.3281	28.8261	29.6018	33.9134	37.1715	42.3213 (46)	
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0900 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1286 (55)
Total storage loss	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (56)	
If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908 (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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908 (64)	
12Total per year (kWh/year)													3446.0880 (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	141.7547	125.9028	134.7194	120.3010	117.9717	107.7379	107.1765	110.4970	110.7133	121.7738	127.4927	140.4113 (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	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	193.2572	213.9633	193.2572	199.6991	193.2572	199.6991	193.2572	193.2572	199.6991	193.2572	199.6991	193.2572 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	382.3305	386.2979	376.3002	355.0162	328.1491	302.8978	286.0283	282.0609	292.0586	313.3426	340.2097	365.4610 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878 (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)	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022 (71)
Water heating gains (Table 5)	190.5305	187.3554	181.0745	167.0847	158.5641	149.6360	144.0544	148.5175	153.7684	163.6745	177.0732	188.7249 (72)
Total internal gains	834.3815	855.8799	818.8952	790.0633	748.2337	720.4961	691.6032	692.0990	713.7895	738.5376	785.2453	815.7065 (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	2.0000	10.6334	0.5700	0.7000	0.7700	5.8804 (74)

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South	12.6300	46.7521	0.5700	0.7000	0.7700	163.2715 (78)
West	2.0000	19.6403	0.5700	0.7000	0.7700	10.8613 (80)
North	12.4700	10.6334	0.5700	0.7000	0.7700	36.6644 (74)
East	7.1400	19.6403	0.5700	0.7000	0.7700	38.7750 (76)
South	12.7800	46.7521	0.5700	0.7000	0.7700	165.2106 (78)
West	1.2300	19.6403	0.5700	0.7000	0.7700	6.6797 (80)
North	0.9000	26.0000	0.5700	0.7000	1.0000	8.4029 (82)

Solar gains	435.7458	746.8926	1035.8887	1309.5085	1492.3629	1493.3353	1434.8018	1296.2536	1130.1379	829.0852	522.7325	372.4047 (83)
Total gains	1270.1273	1602.7725	1854.7839	2099.5719	2240.5966	2213.8314	2126.4050	1988.3526	1843.9274	1567.6228	1307.9778	1188.1112 (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	69.3684	69.6225	69.8785	71.1872	71.4549	72.8239	72.8239	73.1040	72.2701	71.4549	70.9216	70.3962
alpha	5.6246	5.6415	5.6586	5.7458	5.7637	5.8549	5.8549	5.8736	5.8180	5.7637	5.7281	5.6931
util living area	0.9971	0.9891	0.9664	0.8905	0.7380	0.5344	0.3866	0.4298	0.6759	0.9324	0.9914	0.9980 (86)
Living	20.0962	20.2846	20.5080	20.7564	20.8948	20.9405	20.9462	20.9457	20.9230	20.7247	20.3644	20.0725
Non living	19.0748	19.3167	19.5991	19.9076	20.0565	20.1100	20.1134	20.1163	20.0921	19.8803	19.4312	19.0538
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	20.5376	20.2846	20.5080	20.7564	20.8948	20.9405	20.9462	20.9457	20.9230	20.7247	20.3644	20.2022 (87)
Th 2	20.1444	20.1472	20.1501	20.1645	20.1673	20.1817	20.1817	20.1846	20.1760	20.1673	20.1616	20.1558 (88)
util rest of house	0.9962	0.9859	0.9570	0.8632	0.6869	0.4691	0.3152	0.3546	0.6064	0.9088	0.9884	0.9973 (89)
MIT 2	19.7180	19.3167	19.5991	19.9076	20.0565	20.1100	20.1134	20.1163	20.0921	19.8803	19.4312	19.2524 (90)
Living area fraction												FLA = Living area / (4) =
MIT	20.0114	19.6632	19.9245	20.2115	20.3566	20.4073	20.4116	20.4132	20.3896	20.1826	19.7653	19.5925 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0114	19.6632	19.9245	20.2115	20.3566	20.4073	20.4116	20.4132	20.3896	20.1826	19.7653	19.5925 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9960	0.9837	0.9540	0.8649	0.6991	0.4873	0.3353	0.3758	0.6251	0.9093	0.9866	0.9968 (94)
Useful gains	1265.0666	1576.6669	1769.5061	1815.8858	1566.2933	1078.8599	713.0043	747.1737	1152.5947	1425.3805	1290.5069	1184.3107 (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	3088.8749	2891.8652	2619.9956	2167.0235	1652.1966	1087.5474	713.7996	748.6806	1186.8842	1828.9370	2435.4769	2981.9820 (97)
Space heating kWh	1356.9134	883.8133	632.7642	252.8191	63.9121	0.0000	0.0000	0.0000	0.0000	300.2461	824.3784	1337.4674 (98a)
Space heating requirement - total per year (kWh/year)												5652.3140
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	1356.9134	883.8133	632.7642	252.8191	63.9121	0.0000	0.0000	0.0000	0.0000	300.2461	824.3784	1337.4674 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5652.3140
Space heating per m2												(98c) / (4) = 26.6593 (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 %)												322.0593 (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	1356.9134	883.8133	632.7642	252.8191	63.9121	0.0000	0.0000	0.0000	0.0000	300.2461	824.3784	1337.4674 (98)
Space heating efficiency (main heating system 1)	322.0593	322.0593	322.0593	322.0593	322.0593	0.0000	0.0000	0.0000	0.0000	322.0593	322.0593	322.0593 (210)
Space heating fuel (main heating system)	421.3241	274.4257	196.4745	78.5008	19.8448	0.0000	0.0000	0.0000	0.0000	93.2270	255.9710	415.2861 (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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908 (64)
Efficiency of water heater (217)m	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546 (216)
Fuel for water heating, kWh/month	123.9163	109.6157	116.3040	101.6534	98.1826	88.0600	86.5020	90.0949	91.2794	102.2966	109.4350	122.4628 (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	118.1557	106.7213	118.1557	114.3443	118.1557	114.3443	118.1557	118.1557	114.3443	118.1557	114.3443	118.1557 (231)
Lighting	37.3645	29.9752	26.9893	19.7735	15.2736	12.4787	13.9331	18.1108	23.5242	30.8650	34.8619	38.4030 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-82.1120	-123.9311	-189.3046	-216.2227	-231.9315	-215.8689	-213.2874	-198.5685	-170.5262	-140.5300	-91.5963	-69.4826 (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	-30.2678	-73.7153	-171.9535	-300.0246	-431.0212	-445.5775	-435.3848	-351.9003	-237.7059	-119.0484	-43.7514	-23.1479 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												

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(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1755.0540	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												277.9546	
Water heating fuel used												1239.8027	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.8190) mechanical ventilation fans (SFP = 1.8190)												1391.1884	(230a)
Total electricity for the above, kWh/year												1391.1884	(231)
Electricity for lighting (calculated in Appendix L)												301.5528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4606.8604	(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												80.7375	(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	1755.0540	0.1570	275.5118	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1239.8027	0.1410	174.8220	(264)
Space and water heating			450.3338	(265)
Pumps, fans and electric keep-hot	1391.1884	0.1387	192.9750	(267)
Energy for lighting	301.5528	0.1443	43.5234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1943.3617	0.1341	-260.6034	
PV Unit electricity exported	-2663.4987	0.1224	-326.0796	
Total			-586.6830	(269)
Total CO2, kg/year			100.1492	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.4700	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1755.0540	1.5811	2774.9440	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1239.8027	1.5214	1886.2380	(278)
Space and water heating			4661.1819	(279)
Pumps, fans and electric keep-hot	1391.1884	1.5128	2104.5898	(281)
Energy for lighting	301.5528	1.5338	462.5317	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1943.3617	1.4956	-2906.4843	
PV Unit electricity exported	-2663.4987	0.4492	-1196.5383	
Total			-4103.0226	(283)
Total Primary energy kWh/year			3125.2808	(286)
Dwelling Primary energy Rate (DPER)			14.7400	(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	110.5800 (1b)	x 2.3300 (2b)	= 257.6514 (1b) - (3b)	
First floor	101.4400 (1c)	x 3.6400 (2c)	= 369.2416 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.0200		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	626.8930 (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

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0638 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 5.0000 (17)
 Infiltration rate 0.3138 (18)
 Number of sides sheltered 1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2903 (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	0.3701	0.3628	0.3556	0.3193	0.3120	0.2758	0.2758	0.2685	0.2903	0.3120	0.3266	0.3411 (22b)
Effective ac	0.5685	0.5658	0.5632	0.5510	0.5487	0.5380	0.5380	0.5360	0.5421	0.5487	0.5533	0.5582 (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)			50.2500	1.1450	57.5382		(27)
Opening			0.9000	1.5918	1.4326		(27a)
Heatloss Floor 1			110.5800	0.1300	14.3754		(28a)
Brickslip	198.0900	35.6500	162.4400	0.1800	29.2392		(29a)
Render	30.8500	14.6000	16.2500	0.1800	2.9250		(29a)
External Roof 1	121.5200	0.9000	120.6200	0.1100	13.2682		(30)
Total net area of external elements Aum(A, m2)			461.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 118.7786		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 231.5643 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	31.0900	0.0500	1.5545
E3 Sill	26.1850	0.0500	1.3093
E4 Jamb	59.9800	0.0500	2.9990
E5 Ground floor (normal)	46.0700	0.1600	7.3712
E6 Intermediate floor within a dwelling	42.5600	0.0000	0.0000
E16 Corner (normal)	32.6340	0.0900	2.9371
E17 Corner (inverted - internal area greater than external area)	12.4340	-0.0900	-1.1191
E14 Flat roof	8.7170	0.0800	0.6974
E24 Eaves (insulation at ceiling level - inverted)	5.2070	0.2400	1.2497
E13 Gable (insulation at rafter level)	9.0080	0.0800	0.7206
R4 Ridge (vaulted ceiling)	16.4790	0.0800	1.3183
E11 Eaves (insulation at rafter level)	36.7330	0.0400	1.4693

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 20.5073 (36)

Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 139.2858 (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	117.6053	117.0551	116.5158	113.9829	113.5090	111.3030	111.3030	110.8944	112.1527	113.5090	114.4677	115.4700 (38)
Heat transfer coeff	256.8911	256.3409	255.8017	253.2688	252.7949	250.5888	250.5888	250.1802	251.4385	252.7949	253.7535	254.7558 (39)
Average = Sum(39)m / 12 =												253.2665

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2116	1.2090	1.2065	1.1946	1.1923	1.1819	1.1819	1.1800	1.1859	1.1923	1.1968	1.2016 (40)
HLP (average)												1.1945
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0176 (42)

Hot water usage for mixer showers 74.8143 73.6900 72.0517 68.9170 66.6037 64.0239 62.5575 64.1835 65.9658 68.7357 71.9377 74.5277 (42a)

Hot water usage for baths 32.2958 31.8162 31.1408 29.8954 28.9629 27.9288 27.3703 28.0410 28.7713 29.8777 31.1488 32.1866 (42b)

Hot water usage for other uses 45.5328 43.8770 42.2213 40.5656 38.9098 37.2541 37.2541 38.9098 40.5656 42.2213 43.8770 45.5328 (42c)

Average daily hot water use (litres/day) 140.3131 (43)

Daily hot water use

Jan 152.6429 Feb 149.3832 Mar 145.4137 Apr 139.3779 May 134.4764 Jun 129.2068 Jul 127.1819 Aug 131.1343 Sep 135.3027 Oct 140.8348 Nov 146.9635 Dec 152.2471 (44)

Energy conte 241.7491 212.7197 223.4955 190.8014 181.0310 158.8749 153.8155 162.3717 166.8417 191.1114 209.3765 238.3822 (45)

Energy content (annual) Total = Sum(45)m = 2330.5707

Distribution loss (46)m = 0.15 x (45)m 36.2624 31.9080 33.5243 28.6202 27.1547 23.8312 23.0723 24.3558 25.0263 28.6667 31.4065 35.7573 (46)

Water storage loss: Store volume 300.0000 (47)

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

Temperature factor from Table 2b 0.5400 (49)

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

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

If cylinder contains dedicated solar storage 35.3664 31.9439 35.3664 34.2256 35.3664 34.2256 35.3664 35.3664 34.2256 35.3664 34.2256 35.3664 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 300.3779 265.6748 282.1243 247.5390 239.6598 215.6124 212.4444 221.0005 223.5793 249.7403 266.1141 297.0110 (62)

WWHRS -34.2020 -30.2485 -31.6745 -26.2277 -24.4433 -20.9163 -19.6057 -20.8487 -21.6408 -25.5121 -28.9022 -33.5686 (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 266.1759 235.4263 250.4498 221.3112 215.2165 194.6961 192.8386 200.1518 201.9385 224.2281 237.2119 263.4424 (64)

Total per year (kWh/year) = Sum(64)m = 2703.0871 (64)

12Total per year (kWh/year) 2703 (64)

Electric shower(s) 0.0000 (64a)

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

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

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Heat gains from water heating, kWh/month
 127.2846 113.0934 121.2153 108.8315 107.0959 98.2159 98.0467 100.8916 100.8649 110.4476 115.0077 126.1651 (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
	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	192.8418	213.5034	192.8418	199.2699	192.8418	199.2699	192.8418	192.8418	199.2699	192.8418	199.2699	192.8418 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	382.3305	386.2979	376.3002	355.0162	328.1491	302.8978	286.0283	282.0609	292.0586	313.3426	340.2097	365.4610 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022 (71)
Water heating gains (Table 5)	171.0815	168.2937	162.9238	151.1549	143.9461	136.4110	131.7832	135.6070	140.0902	148.4511	159.7330	169.5768 (72)
Total internal gains	817.5171	839.3583	803.3291	776.7043	736.2003	706.8420	678.9167	678.7731	699.6820	725.8988	770.4759	799.1429 (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	14.4700	10.6334	0.6300	0.7000	0.7700	47.0232 (74)
East	7.1400	19.6403	0.6300	0.7000	0.7700	42.8566 (76)
South	25.4100	46.7521	0.6300	0.7000	0.7700	363.0591 (78)
West	3.2300	19.6403	0.6300	0.7000	0.7700	19.3875 (80)
North	0.9000	26.0000	0.6300	0.7000	1.0000	9.2875 (82)
Solar gains	481.6138	825.5129	1144.9296	1447.3515	1649.4537	1650.5285
Total gains	1299.1308	1664.8712	1948.2587	2224.0558	2385.6540	2357.3704
						1585.8335
						1432.7014
						1249.0998
						916.3573
						577.7569
						411.6052
						83
						1429.7818
						1642.2561
						1348.2328
						1210.7481
						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	53.0881	53.2020	53.3142	53.8473	53.9483	54.4232	54.4232	54.5121	54.2393	53.9483	53.7445	53.5330
alpha	4.5392	4.5468	4.5543	4.5898	4.5966	4.6282	4.6282	4.6341	4.6160	4.5966	4.5830	4.5689
util living area	0.9969	0.9903	0.9740	0.9244	0.8153	0.6390	0.4778	0.5296	0.7711	0.9535	0.9924	0.9978 (86)
MIT	19.4110	19.6844	20.0379	20.4631	20.7837	20.9480	20.9890	20.9826	20.8762	20.4338	19.8352	19.3670 (87)
Th 2	19.9107	19.9128	19.9148	19.9244	19.9262	19.9345	19.9345	19.9360	19.9313	19.9262	19.9225	19.9187 (88)
util rest of house	0.9959	0.9873	0.9657	0.9005	0.7607	0.5485	0.3666	0.4146	0.6896	0.9337	0.9896	0.9970 (89)
MIT 2	18.0613	18.4111	18.8584	19.3851	19.7453	19.9046	19.9309	19.9298	19.8475	19.3629	18.6119	18.0106 (90)
Living area fraction										FLA = Living area / (4) =		0.3580 (91)
MIT	18.5445	18.8670	19.2807	19.7711	20.1171	20.2782	20.3097	20.3067	20.2158	19.7463	19.0499	18.4963 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5445	18.8670	19.2807	19.7711	20.1171	20.2782	20.3097	20.3067	20.2158	19.7463	19.0499	18.4963 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9941	0.9833	0.9595	0.8964	0.7714	0.5790	0.4065	0.4558	0.7133	0.9295	0.9863	0.9956 (94)
Useful gains	1291.4904	1637.0743	1869.2866	1993.7284	1840.2682	1364.9908	920.6689	962.4010	1390.0209	1526.4428	1329.7899	1205.4608 (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	3659.2928	3580.3025	3269.3284	2753.3085	2127.7998	1422.8870	929.6208	977.3845	1537.7536	2312.1377	3032.3322	3642.0538 (97)
Space heating kWh	1761.6450	1305.8494	1041.6310	546.8976	213.9235	0.0000	0.0000	0.0000	0.0000	584.5570	1225.8304	1812.8252 (98a)
Space heating requirement - total per year (kWh/year)												8493.1591
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	1761.6450	1305.8494	1041.6310	546.8976	213.9235	0.0000	0.0000	0.0000	0.0000	584.5570	1225.8304	1812.8252 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8493.1591
Space heating per m ²										(98c) / (4) =		40.0583 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Efficiency of main space heating system 1 (in %)												0.0000 (201)
Efficiency of main space heating system 2 (in %)												1.0000 (202)
Efficiency of secondary/supplementary heating system, %												92.3000 (206)
												0.0000 (207)
												0.0000 (208)
Space heating requirement	1761.6450	1305.8494	1041.6310	546.8976	213.9235	0.0000	0.0000	0.0000	0.0000	584.5570	1225.8304	1812.8252 (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)	1908.6078	1414.7880	1128.5277	592.5218	231.7698	0.0000	0.0000	0.0000	0.0000	633.3228	1328.0936	1964.0576 (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)												

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	266.1759	235.4263	250.4498	221.3112	215.2165	194.6961	192.8386	200.1518	201.9385	224.2281	237.2119	263.4424	(64)
Efficiency of water heater (217)m	87.5046	87.2961	86.9003	86.0056	84.0463	79.8000	79.8000	79.8000	79.8000	86.1076	87.2054	79.8000	(216)
Fuel for water heating, kWh/month	304.1851	269.6869	288.2037	257.3219	256.0691	243.9801	241.6524	250.8168	253.0557	260.4045	272.0153	300.9147	(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	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	40.0687	32.1446	28.9427	21.2046	16.3791	13.3818	14.9415	19.4216	25.2267	33.0988	37.3850	41.1824	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-90.3996	-121.3302	-166.0526	-177.3479	-183.5146	-168.3440	-165.9433	-160.1227	-149.1759	-133.7938	-97.0377	-78.8638	(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	-71.5113	-147.4947	-288.0321	-425.5375	-556.1932	-556.7658	-550.4921	-469.2744	-348.0564	-208.8578	-94.7475	-56.8046	(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												9201.6892	(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												3198.3063	(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)												323.3775	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-5465.6936	(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												7343.6794	(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	9201.6892	0.2100	1932.3547 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3198.3063	0.2100	671.6443 (264)
Space and water heating			2603.9991 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	323.3775	0.1443	46.6734 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1691.9261	0.1357	-229.5963
PV Unit electricity exported	-3773.7675	0.1264	-476.9184
Total			-706.5147 (269)
Total CO2, kg/year			1956.0870 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.2300 (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	9201.6892	1.1300	10397.9088 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3198.3063	1.1300	3614.0861 (278)
Space and water heating			14011.9949 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	323.3775	1.5338	496.0072 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1691.9261	1.5016	-2540.5792
PV Unit electricity exported	-3773.7675	0.4639	-1750.6960
Total			-4291.2752 (283)
Total Primary energy kWh/year			10346.8277 (286)
Target Primary Energy Rate (TPER)			48.8000 (287)

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

1. Overall dwelling characteristics

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	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	110.5800 (1b)	x 2.3300 (2b)	= 257.6514 (1b) - (3b)	
First floor	101.4400 (1c)	x 3.6400 (2c)	= 369.2416 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.0200			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	626.8930 (5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0638	(8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.2138 (18)
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1978	(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	0.2522	0.2472	0.2423	0.2175	0.2126	0.1879	0.1879	0.1829	0.1978	0.2126	0.2225	0.2324 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5318	0.5306	0.5293	0.5237	0.5226	0.5176	0.5176	0.5167	0.5196	0.5226	0.5248	0.5270 (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
FGD (Uw = 1.00)			16.6300	0.9615	15.9904		(27)
Window (Uw = 1.00)			33.6200	0.9615	32.3269		(27)
Opening			0.9000	0.9615	0.8654		(27a)
Heatloss Floor 1			110.5800	0.1200	13.2696	110.0000	12163.8000 (28a)
Brickslip	198.0900	35.6500	162.4400	0.1100	17.8684	9.0000	1461.9600 (29a)
Render	30.8500	14.6000	16.2500	0.1000	1.6250	9.0000	146.2500 (29a)
External Roof 1	121.5200	0.9000	120.6200	0.1200	14.4744	9.0000	1085.5800 (30)
Total net area of external elements Aum(A, m ²)			461.0400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	96.4201			(33)
Internal Wall 1			432.1700			75.0000	32412.7500 (32c)
Internal Floor 1			101.4400			18.0000	1825.9200 (32d)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				49096.2600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							231.5643 (35)
List of Thermal Bridges				Length	Psi-value	Total	
K1 Element							
E2 Other lintels (including other steel lintels)				31.0900	0.0140	0.4353	
E3 Sill				26.1850	0.0260	0.6808	
E4 Jamb				59.9800	0.0100	0.5998	
E5 Ground floor (normal)				46.0700	0.3200	14.7424	
E6 Intermediate floor within a dwelling				42.5600	0.1400	5.9584	
E16 Corner (normal)				32.6340	0.1800	5.8741	
E17 Corner (inverted - internal area greater than external area)				12.4340	0.0000	0.0000	
E14 Flat roof				8.7170	0.1600	1.3947	
E24 Eaves (insulation at ceiling level - inverted)				5.2070	0.1500	0.7810	
E13 Gable (insulation at rafter level)				9.0080	0.2500	2.2520	
R4 Ridge (vaulted ceiling)				16.4790	0.1200	1.9775	
E11 Eaves (insulation at rafter level)				36.7330	0.1500	5.5099	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							40.2060 (36)
Point Thermal bridges							0.0000
Total fabric heat loss						(33a) =	0.0000
						(33) + (36) + (36a) =	136.6261 (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
	110.0143	109.7589	109.5086	108.3328	108.1128	107.0887	107.0887	106.8990	107.4831	108.1128	108.5578	109.0231 (38)
Heat transfer coeff	246.6404	246.3850	246.1346	244.9588	244.7388	243.7148	243.7148	243.5251	244.1092	244.7388	245.1839	245.6491 (39)
Average = Sum(39)m / 12 =												244.9578
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1633	1.1621	1.1609	1.1554	1.1543	1.1495	1.1495	1.1486	1.1513	1.1543	1.1564	1.1586 (40)
HLP (average)												1.1554
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0176 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hot water usage for other uses	32.2958	31.8162	31.1408	29.8954	28.9629	27.9288	27.3703	28.0410	28.7713	29.8777	31.1488	32.1866 (42b)
Average daily hot water use (litres/day)	45.5328	43.8770	42.2213	40.5656	38.9098	37.2541	37.2541	38.9098	40.5656	42.2213	43.8770	45.5328 (42c)
												71.3368 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	77.8286	75.6932	73.3621	70.4609	67.8727	65.1829	64.6244	66.9508	69.3369	72.0990	75.0258	77.7194	(44)
Energy content (annual)	123.2615	107.7861	112.7547	96.4575	91.3697	80.1500	78.1576	82.8991	85.4993	97.8377	106.8880	121.6898	(45)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	104.7723	91.6182	95.8415	81.9889	77.6642	68.1275	66.4340	70.4643	72.6744	83.1621	90.8548	103.4364	(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	104.7723	91.6182	95.8415	81.9889	77.6642	68.1275	66.4340	70.4643	72.6744	83.1621	90.8548	103.4364	(64)
12Total per year (kWh/year)													(64)
Electric shower(s)	59.9138	53.3837	58.2930	55.6282	56.6721	54.0597	55.8617	56.6721	55.6282	58.2930	57.1968	59.9138	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													(64a)
Heat gains from water heating, kWh/month	41.1715	36.2505	38.5336	34.4043	33.5841	30.5468	30.5739	31.7841	32.0757	35.3638	37.0129	40.8375	(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	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	193.2572	213.9633	193.2572	199.6991	193.2572	199.6991	193.2572	193.2572	199.6991	193.2572	199.6991	193.2572	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	382.3305	386.2979	376.3002	355.0162	328.1491	302.8978	286.0283	282.0609	292.0586	313.3426	340.2097	365.4610	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	(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)	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	(71)
Water heating gains (Table 5)	55.3381	53.9442	51.7925	47.7837	45.1399	42.4261	41.0940	42.7206	44.5495	47.5319	51.4068	54.8892	(72)
Total internal gains	699.1890	722.4687	689.6132	670.7624	634.8095	613.2863	588.6428	586.3020	604.5706	622.3950	659.5789	681.8707	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W							
North	2.0000	10.6334	0.5700	0.7000	0.7700	5.8804 (74)							
South	12.6300	46.7521	0.5700	0.7000	0.7700	163.2715 (78)							
West	2.0000	19.6403	0.5700	0.7000	0.7700	10.8613 (80)							
North	12.4700	10.6334	0.5700	0.7000	0.7700	36.6644 (74)							
East	7.1400	19.6403	0.5700	0.7000	0.7700	38.7750 (76)							
South	12.7800	46.7521	0.5700	0.7000	0.7700	165.2106 (78)							
West	1.2300	19.6403	0.5700	0.7000	0.7700	6.6797 (80)							
North	0.9000	26.0000	0.5700	0.7000	1.0000	8.4029 (82)							
Solar gains	435.7458	746.8926	1035.8887	1309.5085	1492.3629	1493.3353	1434.8018	1296.2536	1130.1379	829.0852	522.7325	372.4047	(83)
Total gains	1134.9348	1469.3613	1725.5019	1980.2709	2127.1724	2106.6216	2023.4446	1882.5556	1734.7085	1451.4802	1182.3114	1054.2754	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	55.2945	55.3518	55.4081	55.6740	55.7241	55.9582	55.9582	56.0018	55.8678	55.7241	55.6229	55.5176	
alpha	4.6863	4.6901	4.6939	4.7116	4.7149	4.7305	4.7305	4.7335	4.7245	4.7149	4.7082	4.7012	
util living area	0.9983	0.9940	0.9827	0.9449	0.8517	0.6840	0.5173	0.5733	0.8129	0.9683	0.9955	0.9988	(86)
MIT	19.4010	19.6575	19.9963	20.4138	20.7509	20.9361	20.9862	20.9780	20.8529	20.3885	19.8036	19.3524	(87)
Th 2	19.9495	19.9505	19.9514	19.9559	19.9567	19.9606	19.9606	19.9613	19.9591	19.9567	19.9550	19.9533	(88)
util rest of house	0.9977	0.9921	0.9770	0.9262	0.8032	0.5939	0.4014	0.4543	0.7375	0.9539	0.9938	0.9984	(89)
MIT 2	18.4889	18.7450	19.0807	19.4870	19.7892	19.9309	19.9570	19.9549	19.8782	19.4711	18.8950	18.4432	(90)
Living area fraction									flA = Living area / (4) =				(91)
MIT	18.8154	19.0717	19.4085	19.8188	20.1335	20.2908	20.3255	20.3212	20.2271	19.7995	19.2203	18.7687	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8154	19.0717	19.4085	19.8188	20.1335	20.2908	20.3255	20.3212	20.2271	19.7995	19.2203	18.7687	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1131.3710	1454.5683	1679.1688	1828.2245	1728.0291	1314.7591	896.5372	935.5774	1316.8551	1380.6291	1172.9762	1051.8958	(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	3580.0925	3491.6999	3177.2385	2674.6659	2064.0167	1386.9323	907.9527	954.9055	1495.6884	2251.4863	2971.7023	3578.7945	(97)
Space heating kWh													

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Space heating requirement - total per year (kWh/year)	1821.8488	1368.9525	1114.5638	609.4378	249.9747	0.0000	0.0000	0.0000	0.0000	647.9178	1295.0828	1880.0127 (98a)	8987.7909
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)	0.0000
Solar heating contribution - total per year (kWh/year)												0.0000	0.0000
Space heating kWh	1821.8488	1368.9525	1114.5638	609.4378	249.9747	0.0000	0.0000	0.0000	0.0000	647.9178	1295.0828	1880.0127 (98c)	8987.7909
Space heating requirement after solar contribution - total per year (kWh/year)													8987.7909
Space heating per m2												(98c) / (4) =	42.3912 (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													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	2290.9187	1803.4892	1850.7908	0.0000	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8379	0.9054	0.8750	0.0000	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1919.6484	1632.9423	1619.5345	0.0000	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	2362.4394	2269.4753	2110.4654	0.0000	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	318.8096	473.5805	365.2526	0.0000	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	79.7024	118.3951	91.3131	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement													289.4107 (107)
Energy for space heating													42.3912 (99)
Energy for space cooling													1.3650 (108)
Total													43.7563 (109)
Fabric Energy Efficiency (DFEE)													43.8 (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	110.5800 (1b)	x 2.3300 (2b)	= 257.6514 (1b) - (3b)	
First floor	101.4400 (1c)	x 3.6400 (2c)	= 369.2416 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.0200			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	626.8930 (5)

2. Ventilation rate

	Value	Reference
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) =	0.0638 (8)
Pressure Test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3138	(18)
Number of sides sheltered	1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2903 (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	0.3701	0.3628	0.3556	0.3193	0.3120	0.2758	0.2758	0.2685	0.2903	0.3120	0.3266	0.3411	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5685	0.5658	0.5632	0.5510	0.5487	0.5380	0.5380	0.5360	0.5421	0.5487	0.5533	0.5582	(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)			50.2500	1.1450	57.5382		(27)
Opening			0.9000	1.5918	1.4326		(27a)
Heatloss Floor 1			110.5800	0.1300	14.3754		(28a)
Brickslip	198.0900	35.6500	162.4400	0.1800	29.2392		(29a)
Render	30.8500	14.6000	16.2500	0.1800	2.9250		(29a)

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External Roof 1	121.5200	0.9000	120.6200	0.1100	13.2682	(30)
Total net area of external elements Aum(A, m2)			461.0400			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		118.7786	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 231.5643 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	31.0900	0.0500	1.5545
E2 Other lintels (including other steel lintels)	26.1850	0.0500	1.3093
E3 Sill	59.9800	0.0500	2.9990
E4 Jamb	46.0700	0.1600	7.3712
E5 Ground floor (normal)	42.5600	0.0000	0.0000
E6 Intermediate floor within a dwelling	32.6340	0.0900	2.9371
E16 Corner (normal)	12.4340	-0.0900	-1.1191
E17 Corner (inverted - internal area greater than external area)	8.7170	0.0800	0.6974
E14 Flat roof	5.2070	0.2400	1.2497
E24 Eaves (insulation at ceiling level - inverted)	9.0080	0.0800	0.7206
E13 Gable (insulation at rafter level)	16.4790	0.0800	1.3183
R4 Ridge (vaulted ceiling)	36.7330	0.0400	1.4693
E11 Eaves (insulation at rafter level)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)			20.5073 (36)
Point Thermal bridges			0.0000
Total fabric heat loss	(33) + (36) + (36a) =		139.2858 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	117.6053	117.0551	116.5158	113.9829	113.5090	111.3030	111.3030	110.8944	112.1527	113.5090	114.4677	115.4700	(38)
Heat transfer coeff	256.8911	256.3409	255.8017	253.2688	252.7949	250.5888	250.5888	250.1802	251.4385	252.7949	253.7535	254.7558	(39)
Average = Sum(39)m / 12 =												253.2665	
HLP	1.2116	1.2090	1.2065	1.1946	1.1923	1.1819	1.1819	1.1800	1.1859	1.1923	1.1968	1.2016	(40)
HLP (average)												1.1945	
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0176 (42)
Hot water usage for baths	32.2958	31.8162	31.1408	29.8954	28.9629	27.9288	27.3703	28.0410	28.7713	29.8777	31.1488	32.1866	(42b)
Hot water usage for other uses	45.5328	43.8770	42.2213	40.5656	38.9098	37.2541	37.2541	38.9098	40.5656	42.2213	43.8770	45.5328	(42c)
Average daily hot water use (litres/day)												71.3368	(43)
Daily hot water use	77.8286	75.6932	73.3621	70.4609	67.8727	65.1829	64.6244	66.9508	69.3369	72.0990	75.0258	77.7194	(44)
Energy conte	123.2615	107.7861	112.7547	96.4575	91.3697	80.1500	78.1576	82.8991	85.4993	97.8377	106.8880	121.6898	(45)
Energy content (annual)										Total = Sum(45)m =		1184.7512	
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	104.7723	91.6182	95.8415	81.9889	77.6642	68.1275	66.4340	70.4643	72.6744	83.1621	90.8548	103.4364	(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	104.7723	91.6182	95.8415	81.9889	77.6642	68.1275	66.4340	70.4643	72.6744	83.1621	90.8548	103.4364	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1007.0385	(64)
Electric shower(s)	59.9138	53.3837	58.2930	55.6282	56.6721	54.0597	55.8617	56.6721	55.6282	58.2930	57.1968	59.9138	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												681.5161	(64a)
Heat gains from water heating, kWh/month	41.1715	36.2505	38.5336	34.4043	33.5841	30.5468	30.5739	31.7841	32.0757	35.3638	37.0129	40.8375	(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	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	150.8777	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	192.8418	213.5034	192.8418	199.2699	192.8418	199.2699	192.8418	192.8418	199.2699	192.8418	199.2699	192.8418	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	382.3305	386.2979	376.3002	355.0162	328.1491	302.8978	286.0283	282.0609	292.0586	313.3426	340.2097	365.4610	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	38.0878	(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)	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	(71)
Water heating gains (Table 5)	55.3381	53.9442	51.7925	47.7837	45.1399	42.4261	41.0940	42.7206	44.5495	47.5319	51.4068	54.8892	(72)
Total internal gains	698.7736	722.0088	689.1978	670.3331	634.3941	612.8571	588.2274	585.8866	604.1414	621.9796	659.1497	681.4553	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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North	14.4700	10.6334	0.6300	0.7000	0.7700	47.0232 (74)
East	7.1400	19.6403	0.6300	0.7700	0.7700	42.8566 (76)
South	25.4100	46.7521	0.6300	0.7000	0.7700	363.0591 (78)
West	3.2300	19.6403	0.6300	0.7000	0.7700	19.3875 (80)
North	0.9000	26.0000	0.6300	0.7000	1.0000	9.2875 (82)

Solar gains	481.6138	825.5129	1144.9296	1447.3515	1649.4537	1650.5285	1585.8335	1432.7014	1249.0998	916.3573	577.7569	411.6052 (83)
Total gains	1180.3874	1547.5216	1834.1274	2117.6847	2283.8478	2263.3855	2174.0610	2018.5880	1853.2411	1538.3370	1236.9066	1093.6065 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	53.0881	53.2020	53.3142	53.8473	53.9483	54.4232	54.4232	54.5121	54.2393	53.9483	53.7445	53.5330
alpha	4.5392	4.5468	4.5543	4.5898	4.5966	4.6282	4.6282	4.6341	4.6160	4.5966	4.5830	4.5689
util living area	0.9979	0.9927	0.9791	0.9351	0.8330	0.6596	0.4961	0.5512	0.7938	0.9628	0.9947	0.9985 (86)
MIT	19.3488	19.6247	19.9839	20.4228	20.7611	20.9409	20.9872	20.9796	20.8593	20.3887	19.7779	19.3050 (87)
Th 2	19.9107	19.9128	19.9148	19.9244	19.9262	19.9345	19.9345	19.9360	19.9313	19.9262	19.9225	19.9187 (88)
util rest of house	0.9973	0.9904	0.9723	0.9137	0.7808	0.5683	0.3815	0.4328	0.7146	0.9462	0.9926	0.9981 (89)
MIT 2	18.4075	18.6835	19.0395	19.4681	19.7684	19.9076	19.9312	19.9302	19.8556	19.4458	18.8445	18.3699 (90)
Living area fraction	FLA = Living area / (4) = 0.3580 (91)											
MIT	18.7445	19.0205	19.3776	19.8099	20.1238	20.2775	20.3093	20.3059	20.2150	19.7834	19.1787	18.7047 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.7445	19.0205	19.3776	19.8099	20.1238	20.2775	20.3093	20.3059	20.2150	19.7834	19.1787	18.7047 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9962	0.9879	0.9680	0.9110	0.7914	0.5992	0.4227	0.4753	0.7378	0.9435	0.9906	0.9973 (94)
Useful gains	1175.9352	1528.7548	1775.3810	1929.1985	1807.5177	1356.2250	918.9906	959.4075	1367.2768	1451.3654	1225.3048	1090.1097 (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	3710.6715	3619.6637	3294.1066	2763.1375	2129.4976	1422.7257	929.5039	977.1826	1537.5387	2321.5159	3065.0139	3695.1671 (97)
Space heating kWh	1885.8438	1405.0908	1129.9319	600.4360	239.5531	0.0000	0.0000	0.0000	0.0000	647.3920	1324.5906	1938.1627 (98a)
Space heating requirement - total per year (kWh/year)	9171.0009											
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	1885.8438	1405.0908	1129.9319	600.4360	239.5531	0.0000	0.0000	0.0000	0.0000	647.3920	1324.5906	1938.1627 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	9171.0009											
Space heating per m2	(98c) / (4) = 43.2554 (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	2355.5345	1854.3570	1901.3699	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8526	0.9148	0.8867	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2008.2724	1696.4490	1686.0286	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2544.9867	2444.8811	2268.9970	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	386.4343	556.8335	433.7284	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	96.6086	139.2084	108.4321	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	344.2491 (107)											
Energy for space heating	43.2554 (99)											
Energy for space cooling	1.6237 (108)											
Total	44.8790 (109)											
Fabric Energy Efficiency (TFEE)	44.9 (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	110.5800 (1b)	x 2.3300 (2b)	= 257.6514 (1b) - (3b)
First floor	101.4400 (1c)	x 3.6400 (2c)	= 369.2416 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 626.8930 (5)

2. Ventilation rate

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	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			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			1 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1388 (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 infiltr rate	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630 (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) =												77.4000 (23c)
Effective ac	0.2899	0.2864	0.2830	0.2656	0.2622	0.2448	0.2448	0.2413	0.2518	0.2622	0.2691	0.2760 (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
FGD (Uw = 1.00)			16.6300	0.9615	15.9904		(27)
Window (Uw = 1.00)			33.6200	0.9615	32.3269		(27)
Opening			0.9000	0.9615	0.8654		(27a)
Heatloss Floor 1			110.5800	0.1200	13.2696	110.0000	(28a)
Brickslip	198.0900	35.6500	162.4400	0.1100	17.8684	9.0000	1461.9600 (29a)
Render	30.8500	14.6000	16.2500	0.1000	1.6250	9.0000	146.2500 (29a)
External Roof 1	121.5200	0.9000	120.6200	0.1200	14.4744	9.0000	1085.5800 (30)
Total net area of external elements Aum(A, m2)			461.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	96.4201		(33)
Internal Wall 1			432.1700			75.0000	32412.7500 (32c)
Internal Floor 1			101.4400			18.0000	1825.9200 (32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	49096.2600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		231.5643 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	31.0900	0.0140	0.4353
E3 Sill	26.1850	0.0260	0.6808
E4 Jamb	59.9800	0.0100	0.5998
E5 Ground floor (normal)	46.0700	0.3200	14.7424
E6 Intermediate floor within a dwelling	42.5600	0.1400	5.9584
E16 Corner (normal)	32.6340	0.1800	5.8741
E17 Corner (inverted - internal area greater than external area)	12.4340	0.0000	0.0000
E14 Flat roof	8.7170	0.1600	1.3947
E24 Eaves (insulation at ceiling level - inverted)	5.2070	0.1500	0.7810
E13 Gable (insulation at rafter level)	9.0080	0.2500	2.2520
R4 Ridge (vaulted ceiling)	16.4790	0.1200	1.9775
E11 Eaves (insulation at rafter level)	36.7330	0.1500	5.5099

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		40.2060 (36)
Point Thermal bridges		(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) =	136.6261 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(39)m	Jan 59.9743	Feb 59.2567	Mar 58.5391	Apr 54.9511	May 54.2335	Jun 50.6455	Jul 50.6455	Aug 49.9279	Sep 52.0807	Oct 54.2335	Nov 55.6687	Dec 57.1039 (38)
Heat transfer coeff	196.6003	195.8828	195.1652	191.5772	190.8596	187.2716	187.2716	186.5540	188.7068	190.8596	192.2948	193.7300 (39)
Average = Sum(39)m / 12 =												191.3978

HLP	Jan 0.9273	Feb 0.9239	Mar 0.9205	Apr 0.9036	May 0.9002	Jun 0.8833	Jul 0.8833	Aug 0.8799	Sep 0.8900	Oct 0.9002	Nov 0.9070	Dec 0.9137 (40)
HLP (average)												0.9027
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0176 (42)	
Hot water usage for mixer showers													
Hot water usage for baths	102.8697	101.3238	99.0710	94.7609	91.5801	88.0328	86.0166	88.2523	90.7030	94.5116	98.9144	102.4756 (42a)	
Hot water usage for other uses	32.2958	31.8162	31.1408	29.8954	28.9629	27.9288	27.3703	28.0410	28.7713	29.8777	31.1488	32.1866 (42b)	
Average daily hot water use (litres/day)	45.5328	43.8770	42.2213	40.5656	38.9098	37.2541	37.2541	38.9098	40.5656	42.2213	43.8770	45.5328 (42c)	
Daily hot water use	180.6983	177.0170	172.4331	165.2218	159.4527	153.2158	150.6410	155.2031	160.0399	166.6107	173.9402	180.1950 (44)	
Energy conte	286.1819	252.0698	265.0233	226.1804	214.6540	188.3967	182.1873	192.1739	197.3452	226.0891	247.8097	282.1418 (45)	
Energy content (annual)												Total = Sum(45)m = 2760.2530	
Distribution loss (46)m = 0.15 x (45)m	42.9273	37.8105	39.7535	33.9271	32.1981	28.2595	27.3281	28.8261	29.6018	33.9134	37.1715	42.3213 (46)	
Water storage loss:													
Store volume												300.0000 (47)	

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a) If manufacturer declared loss factor is known (kWh/day):												2.0900 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1286 (55)
Total storage loss	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (56)
If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908 (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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	141.7547	125.9028	134.7194	120.3010	117.9717	107.7379	107.1765	110.4970	110.7133	121.7738	127.4927	140.4113 (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	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.6879	37.9150	30.8346	23.3438	17.4497	14.7318	15.9182	20.6911	27.7716	35.2624	41.1564	43.8743 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	570.6425	576.5640	561.6420	529.8750	489.7748	452.0862	426.9080	420.9865	435.9084	467.6755	507.7757	545.4642 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229 (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)	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022 (71)
Water heating gains (Table 5)	190.5305	187.3554	181.0745	167.0847	158.5641	149.6360	144.0544	148.5175	153.7684	163.6745	177.0732	188.7249 (72)
Total internal gains	920.3349	918.3083	890.0251	836.7774	782.2625	732.9279	703.3545	706.6691	733.9224	783.0863	842.4793	894.5375 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
North	2.0000	10.6334	0.5700	0.7000	0.7700	5.8804 (74)						
South	12.6300	46.7521	0.5700	0.7000	0.7700	163.2715 (78)						
West	2.0000	19.6403	0.5700	0.7000	0.7700	10.8613 (80)						
North	12.4700	10.6334	0.5700	0.7000	0.7700	36.6644 (74)						
East	7.1400	19.6403	0.5700	0.7000	0.7700	38.7750 (76)						
South	12.7800	46.7521	0.5700	0.7000	0.7700	165.2106 (78)						
West	1.2300	19.6403	0.5700	0.7000	0.7700	6.6797 (80)						
North	0.9000	26.0000	0.5700	0.7000	1.0000	8.4029 (82)						
Solar gains	435.7458	746.8926	1035.8887	1309.5085	1492.3629	1493.3353	1434.8018	1296.2536	1130.1379	829.0852	522.7325	372.4047 (83)
Total gains	1356.0807	1665.2009	1925.9137	2146.2859	2274.6254	2226.2632	2138.1563	2002.9227	1864.0603	1612.1715	1365.2117	1266.9422 (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	69.3684	69.6225	69.8785	71.1872	71.4549	72.8239	72.8239	73.1040	72.2701	71.4549	70.9216	70.3962
alpha	5.6246	5.6415	5.6586	5.7458	5.7637	5.8549	5.8549	5.8736	5.8180	5.7637	5.7281	5.6931
util living area	0.9959	0.9870	0.9608	0.8825	0.7299	0.5316	0.3845	0.4268	0.6699	0.9250	0.9895	0.9972 (86)
Living	20.1316	20.3091	20.5324	20.7667	20.8976	20.9406	20.9462	20.9457	20.9241	20.7373	20.3872	20.1053
Non living	19.1200	19.3476	19.6286	19.9189	20.0589	20.1101	20.1134	20.1163	20.0928	19.8943	19.4600	19.0957
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	20.5557	20.3091	20.5324	20.7667	20.8976	20.9406	20.9462	20.9457	20.9241	20.7373	20.3872	20.2304 (87)
Th 2	20.1444	20.1472	20.1501	20.1645	20.1673	20.1817	20.1817	20.1846	20.1760	20.1673	20.1616	20.1558 (88)
util rest of house	0.9947	0.9833	0.9501	0.8541	0.6786	0.4665	0.3135	0.3520	0.6006	0.8997	0.9859	0.9963 (89)
MIT 2	19.7360	19.3476	19.6286	19.9189	20.0589	20.1101	20.1134	20.1163	20.0928	19.8943	19.4600	19.2867 (90)
Living area fraction												fLA = Living area / (4) = 0.3580 (91)
MIT	20.0295	19.6918	19.9522	20.2224	20.3592	20.4075	20.4116	20.4132	20.3904	20.1961	19.7920	19.6246 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0295	19.6918	19.9522	20.2224	20.3592	20.4075	20.4116	20.4132	20.3904	20.1961	19.7920	19.6246 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9945	0.9808	0.9471	0.8562	0.6909	0.4847	0.3335	0.3731	0.6193	0.9007	0.9839	0.9956 (94)
Ext temp.	1348.6709	1633.2715	1824.0953	1837.7109	1571.6515	1079.1201	713.0300	747.2369	1154.3230	1452.0364	1343.1880	1261.4081 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	3092.4231	2897.4639	2625.4063	2169.1169	1652.6910	1087.5714	713.8022	748.6869	1187.0429	1831.5132	2440.6016	2988.2058 (97)
Space heating requirement - total per year (kWh/year)	1297.3516	849.5373	596.1754	238.6123	60.2933	0.0000	0.0000	0.0000	0.0000	282.3307	790.1378	1284.7375 (98a)
												5399.1759

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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	1297.3516	849.5373	596.1754	238.6123	60.2933	0.0000	0.0000	0.0000	0.0000	282.3307	790.1378	1284.7375	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													5399.1759
Space heating per m2													(98c) / (4) = 25.4654 (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 %)													322.0593 (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	1297.3516	849.5373	596.1754	238.6123	60.2933	0.0000	0.0000	0.0000	0.0000	282.3307	790.1378	1284.7375	(98)
Space heating efficiency (main heating system 1)	322.0593	322.0593	322.0593	322.0593	322.0593	0.0000	0.0000	0.0000	0.0000	322.0593	322.0593	322.0593	(210)
Space heating fuel (main heating system)	402.8301	263.7829	185.1136	74.0896	18.7212	0.0000	0.0000	0.0000	0.0000	87.6642	245.3392	398.9134	(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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908	(64)
Efficiency of water heater (217)m	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	(216)
Fuel for water heating, kWh/month	123.9163	109.6157	116.3040	101.6534	98.1826	88.0600	86.5020	90.0949	91.2794	102.2966	109.4350	122.4628	(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	118.1557	106.7213	118.1557	114.3443	118.1557	114.3443	118.1557	118.1557	114.3443	118.1557	114.3443	118.1557	(231)
Lighting	37.3645	29.9752	26.9893	19.7735	15.2736	12.4787	13.9331	18.1108	23.5242	30.8650	34.8619	38.4030	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-81.8968	-123.5886	-188.5048	-215.6267	-231.7109	-215.8689	-213.2874	-198.5685	-170.5262	-140.1838	-91.3783	-69.3317	(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	-30.4829	-74.0578	-172.7533	-300.6206	-431.2418	-445.5775	-435.3848	-351.9003	-237.7059	-119.3946	-43.9694	-23.2988	(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													1676.4542 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													277.9546
Water heating fuel used													1239.8027 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.8190)													
mechanical ventilation fans (SFP = 1.8190)													1391.1884 (230a)
Total electricity for the above, kWh/year													1391.1884 (231)
Electricity for lighting (calculated in Appendix L)													301.5528 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-4606.8604 (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													2.1377 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1676.4542	16.4900	276.4473 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1239.8027	16.4900	204.4435 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	1391.1884	16.4900	229.4070 (249)
Energy for lighting	301.5528	16.4900	49.7261 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1940.4727	16.4900	-319.9839
PV Unit electricity exported	-2666.3877	5.5900	-149.0511
Total			-469.0350 (252)
Total energy cost			290.9888 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
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Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.4076 (257)
 SAP value 93.3931
 SAP rating (Section 12) 93 (258)
 SAP band A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1676.4542	0.1570	263.2464 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1239.8027	0.1410	174.8220 (264)
Space and water heating			438.0684 (265)
Pumps, fans and electric keep-hot	1391.1884	0.1387	192.9750 (267)
Energy for lighting	301.5528	0.1443	43.5234 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1940.4727	0.1341	-260.1723
PV Unit electricity exported	-2666.3877	0.1225	-326.5607
Total			-586.7330 (269)
Total CO2, kg/year			87.8338 (272)
CO2 emissions per m2			0.4100 (273)
EI value			99.5421
EI rating			100 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	110.5800 (1b)	x 2.3300 (2b)	= 257.6514 (1b) - (3b)
First floor	101.4400 (1c)	x 3.6400 (2c)	= 369.2416 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 626.8930 (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)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1388 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.8000	4.8000	4.2000	4.1000	3.7000	3.7000	3.8000	3.9000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2250	1.2000	1.2000	1.0500	1.0250	0.9250	0.9250	0.9500	0.9750	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.1700	0.1665	0.1665	0.1457	0.1422	0.1283	0.1283	0.1318	0.1353	0.1457	0.1492	0.1561 (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) =												77.4000 (23c)
Effective ac	0.2830	0.2795	0.2795	0.2587	0.2552	0.2413	0.2413	0.2448	0.2483	0.2587	0.2622	0.2691 (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
FGD (Uw = 1.00)			16.6300	0.9615	15.9904		(27)
Window (Uw = 1.00)			33.6200	0.9615	32.3269		(27)
Opening			0.9000	0.9615	0.8654		(27a)
Heatloss Floor 1			110.5800	0.1200	13.2696	110.0000	12163.8000 (28a)
Brickslip	198.0900	35.6500	162.4400	0.1100	17.8684	9.0000	1461.9600 (29a)
Render	30.8500	14.6000	16.2500	0.1000	1.6250	9.0000	146.2500 (29a)
External Roof 1	121.5200	0.9000	120.6200	0.1200	14.4744	9.0000	1085.5800 (30)
Total net area of external elements Aum(A, m2)			461.0400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		96.4201		(33)

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Internal Wall 1	432.1700	75.0000	32412.7500 (32c)
Internal Floor 1	101.4400	18.0000	1825.9200 (32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 49096.2600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 231.5643 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	31.0900	0.0140	0.4353
E2 Other lintels (including other steel lintels)	26.1850	0.0260	0.6808
E3 Sill	59.9800	0.0100	0.5998
E4 Jamb	46.0700	0.3200	14.7424
E5 Ground floor (normal)	42.5600	0.1400	5.9584
E6 Intermediate floor within a dwelling	32.6340	0.1800	5.8741
E16 Corner (normal)	12.4340	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	8.7170	0.1600	1.3947
E14 Flat roof	5.2070	0.1500	0.7810
E24 Eaves (insulation at ceiling level - inverted)	9.0080	0.2500	2.2520
E13 Gable (insulation at rafter level)	16.4790	0.1200	1.9775
R4 Ridge (vaulted ceiling)	36.7330	0.1500	5.5099
E11 Eaves (insulation at rafter level)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 40.2060 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 136.6261 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.5391	57.8215	57.8215	53.5159	52.7983	49.9279	49.9279	50.6455	51.3631	53.5159	54.2335	55.6687 (38)
Heat transfer coeff	195.1652	194.4476	194.4476	190.1420	189.4244	186.5540	186.5540	187.2716	187.9892	190.1420	190.8596	192.2948 (39)
Average = Sum(39)m / 12 =												190.4410

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9205	0.9171	0.9171	0.8968	0.8934	0.8799	0.8799	0.8833	0.8867	0.8968	0.9002	0.9070 (40)
HLP (average)												0.8982
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0176 (42)

Hot water usage for mixer showers 102.8697 101.3238 99.0710 94.7609 91.5801 88.0328 86.0166 88.2523 90.7030 94.5116 98.9144 102.4756 (42a)

Hot water usage for baths 32.2958 31.8162 31.1408 29.8954 28.9629 27.9288 27.3703 28.0410 28.7713 29.8777 31.1488 32.1866 (42b)

Hot water usage for other uses 45.5328 43.8770 42.2213 40.5656 38.9098 37.2541 37.2541 38.9098 40.5656 42.2213 43.8770 45.5328 (42c)

Average daily hot water use (litres/day) 166.1792 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	180.6983	177.0170	172.4331	165.2218	159.4527	153.2158	150.6410	155.2031	160.0399	166.6107	173.9402	180.1950 (44)
Energy conte	286.1819	252.0698	265.0233	226.1804	214.6540	188.3967	182.1873	192.1739	197.3452	226.0891	247.8097	282.1418 (45)
Energy content (annual)												Total = Sum(45)m = 2760.2530
Distribution loss (46)m = 0.15 x (45)m	42.9273	37.8105	39.7535	33.9271	32.1981	28.2595	27.3281	28.8261	29.6018	33.9134	37.1715	42.3213 (46)
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1286 (55)
Total storage loss	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (56)
If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908 (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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908 (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	141.7547	125.9028	134.7194	120.3010	117.9717	107.7379	107.1765	110.4970	110.7133	121.7738	127.4927	140.4113 (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	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.6879	37.9150	30.8346	23.3438	17.4497	14.7318	15.9182	20.6911	27.7716	35.2624	41.1564	43.8743 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	570.6425	576.5640	561.6420	529.8750	489.7748	452.0862	426.9080	420.9865	435.9084	467.6755	507.7757	545.4642 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229 (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)	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022 (71)
Water heating gains (Table 5)	190.5305	187.3554	181.0745	167.0847	158.5641	149.6360	144.0544	148.5175	153.7684	163.6745	177.0732	188.7249 (72)
Total internal gains	920.3349	918.3083	890.0251	836.7774	782.2625	732.9279	703.3545	706.6691	733.9224	783.0863	842.4793	894.5375 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
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	m2	Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	W
North	2.0000	12.0246	0.5700	0.7000	0.7700	6.6498 (74)
South	12.6300	51.4430	0.5700	0.7000	0.7700	179.6536 (78)
West	2.0000	22.3829	0.5700	0.7000	0.7700	12.3781 (80)
North	12.4700	12.0246	0.5700	0.7000	0.7700	41.4615 (74)
East	7.1400	22.3829	0.5700	0.7000	0.7700	44.1897 (76)
South	12.7800	51.4430	0.5700	0.7000	0.7700	181.7873 (78)
West	1.2300	22.3829	0.5700	0.7000	0.7700	7.6125 (80)
North	0.9000	30.0000	0.5700	0.7000	1.0000	9.6957 (82)

Solar gains	483.4282	759.0144	1033.7111	1346.7836	1499.1877	1592.6114	1512.0433	1383.2389	1202.1507	884.1240	594.1034	409.2023 (83)
Total gains	1403.7631	1677.3227	1923.7362	2183.5609	2281.4502	2325.5393	2215.3978	2089.9079	1936.0731	1667.2103	1436.5827	1303.7398 (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	69.8785	70.1364	70.1364	71.7246	71.9963	73.1040	73.1040	72.8239	72.5459	71.7246	71.4549	70.9216
alpha	5.6586	5.6758	5.6758	5.7816	5.7998	5.8736	5.8736	5.8549	5.8364	5.7816	5.7637	5.7281
util living area	0.9953	0.9871	0.9595	0.8673	0.7007	0.4702	0.3197	0.3401	0.6062	0.9024	0.9860	0.9967 (86)
Living	20.1523	20.3070	20.5430	20.7901	20.9095	20.9441	20.9469	20.9466	20.9343	20.7782	20.4310	20.1299
Non living	19.1510	19.3496	19.6441	19.9501	20.0756	20.1152	20.1168	20.1136	20.1032	19.9429	19.5199	19.1318
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	20.5663	20.3070	20.5430	20.7901	20.9095	20.9441	20.9469	20.9466	20.9343	20.7782	20.4310	20.2516 (87)
Th 2	20.1501	20.1530	20.1530	20.1702	20.1731	20.1846	20.1846	20.1846	20.1789	20.1702	20.1673	20.1616 (88)
util rest of house	0.9939	0.9835	0.9484	0.8365	0.6470	0.4066	0.2513	0.2671	0.5347	0.8710	0.9813	0.9957 (89)
MIT 2	19.7518	19.3496	19.6441	19.9501	20.0756	20.1152	20.1168	20.1136	20.1032	19.9429	19.5199	19.3173 (90)
Living area fraction										fLA = Living area / (4) =		
MIT	20.0434	19.6924	19.9660	20.2508	20.3742	20.4120	20.4140	20.4119	20.4008	20.2420	19.8461	19.6518 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0434	19.6924	19.9660	20.2508	20.3742	20.4120	20.4140	20.4119	20.4008	20.2420	19.8461	19.6518 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9937	0.9811	0.9456	0.8397	0.6606	0.4245	0.2706	0.2877	0.5544	0.8740	0.9790	0.9950 (94)
Useful gains	1394.9299	1645.6190	1819.0695	1833.5581	1507.0355	987.1711	599.3773	601.1997	1073.4406	1457.1519	1406.4539	1297.1819 (95)
Ext temp.	4.2000	4.7000	6.6000	9.1000	12.1000	15.1000	17.2000	17.2000	14.6000	11.0000	7.2000	4.2000 (96)
Heat loss rate W	3092.0854	2915.2341	2598.9781	2120.2398	1567.3287	990.9746	599.5800	601.4914	1090.4813	1757.2899	2413.6306	2971.3055 (97)
Space heating kWh	1262.6837	853.1813	580.2520	206.4108	44.8581	0.0000	0.0000	0.0000	0.0000	223.3026	725.1672	1245.5479 (98a)
Space heating requirement - total per year (kWh/year)												5141.4038
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	1262.6837	853.1813	580.2520	206.4108	44.8581	0.0000	0.0000	0.0000	0.0000	223.3026	725.1672	1245.5479 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5141.4038
Space heating per m2												24.2496 (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 %)												321.9265 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	1262.6837	853.1813	580.2520	206.4108	44.8581	0.0000	0.0000	0.0000	0.0000	223.3026	725.1672	1245.5479 (98)
Space heating efficiency (main heating system 1)	321.9265	321.9265	321.9265	321.9265	321.9265	0.0000	0.0000	0.0000	0.0000	321.9265	321.9265	321.9265 (210)
Space heating fuel (main heating system)	392.2274	265.0237	180.2437	64.1174	13.9343	0.0000	0.0000	0.0000	0.0000	69.3645	225.2587	386.9045 (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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908 (64)
Efficiency of water heater (217)m	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526 (216)
Fuel for water heating, kWh/month	123.9172	109.6165	116.3048	101.6542	98.1833	88.0606	86.5026	90.0956	91.2800	102.2973	109.4358	122.4636 (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	118.1557	106.7213	118.1557	114.3443	118.1557	114.3443	118.1557	118.1557	114.3443	118.1557	114.3443	118.1557 (231)
Lighting	37.3645	29.9752	26.9893	19.7735	15.2736	12.4787	13.9331	18.1108	23.5242	30.8650	34.8619	38.4030 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-91.0631	-127.6356	-190.8874	-219.6901	-232.5218	-222.6025	-219.0292	-206.1683	-178.4538	-147.6956	-102.6868	-76.5768 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233b)m	-36.8354	-78.5090	-178.2809	-320.7795	-441.4748	-489.4173	-471.7477	-390.2835	-265.3238	-136.2912	-55.1617	-27.7945	(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												1597.0740	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												277.9526	
Water heating fuel used												1239.8115	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.8190)														
mechanical ventilation fans (SFP = 1.8190)														
Total electricity for the above, kWh/year													1391.1884	(230a)
Electricity for lighting (calculated in Appendix L)													301.5528	(232)

Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-4906.9104	(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													-377.2836	(238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1597.0740	25.1600	401.8238	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1239.8115	25.1600	311.9366	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	1391.1884	25.1600	350.0230	(249)
Energy for lighting	301.5528	25.1600	75.8707	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2015.0108	25.1600	-506.9767	
PV Unit electricity exported	-2891.8996	5.8100	-168.0194	
Total			-674.9961	(252)
Total energy cost			464.6580	(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	1597.0740	0.1574	251.4353	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1239.8115	0.1410	174.8233	(264)
Space and water heating			426.2586	(265)
Pumps, fans and electric keep-hot	1391.1884	0.1387	192.9750	(267)
Energy for lighting	301.5528	0.1443	43.5234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2015.0108	0.1343	-270.5404	
PV Unit electricity exported	-2891.8996	0.1223	-353.7322	
Total			-624.2726	(269)
Total CO2, kg/year			38.4844	(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	1597.0740	1.5828	2527.8449	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1239.8115	1.5214	1886.2514	(278)
Space and water heating			4414.0964	(279)
Pumps, fans and electric keep-hot	1391.1884	1.5128	2104.5898	(281)
Energy for lighting	301.5528	1.5338	462.5317	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2015.0108	1.4962	-3014.8497	
PV Unit electricity exported	-2891.8996	0.4488	-1297.8474	
Total			-4312.6971	(283)
Total Primary energy kWh/year			2668.5208	(286)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating: A 93
 Current environmental impact rating: A 100

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

Recommended measures: SAP change Cost change CO2 change

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(none)

Measures omitted - SAP change or cost saving too small:

N Solar water heating + 0.6 -£ 42 -24 kg (61.3%)

Recommended measures (none)	Total Savings	£0	0.00 kg/m ²	Energy efficiency	Environmental impact
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Potential energy efficiency rating: A 93
 Potential environmental impact rating: A 100

Fuel prices for cost data on this page from database revision number 538 TEST (29 Feb 2024)
 Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, East Anglia):

	Current £1140	Potential £1140	Saving £0
Electricity			
Space heating	£752	£752	£0
Water heating	£312	£312	£0
Lighting	£76	£76	£0
Generated (PV)	-£675	-£675	£0
Total cost of fuels	£465	£465	£0
Total cost of uses	£465	£465	£0
Delivered energy	-2 kWh/m ²	-2 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.0 tonnes	0.0 tonnes	0.0 tonnes
CO2 emissions per m ²	0 kg/m ²	0 kg/m ²	0 kg/m ²
Primary energy	13 kWh/m ²	13 kWh/m ²	0 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	110.5800 (1b)	x 2.3300 (2b)	= 257.6514 (1b) - (3b)
First floor	101.4400 (1c)	x 3.6400 (2c)	= 369.2416 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	626.8930 (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 APF50												3.0000 (17)
Infiltration rate												0.1500 (18)
Number of sides sheltered												1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.1388 (21)
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												77.4000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2899	0.2864	0.2830	0.2656	0.2622	0.2448	0.2448	0.2413	0.2518	0.2622	0.2691	0.2760 (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
FGD (Uw = 1.00)			16.6300	0.9615	15.9904		(27)
Window (Uw = 1.00)			33.6200	0.9615	32.3269		(27a)
Opening			0.9000	0.9615	0.8654		(27a)

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Heatloss Floor 1				110.5800	0.1200	13.2696	110.0000	12163.8000 (28a)
Bricks/Slip	198.0900	35.6500		162.4400	0.1100	17.8684	9.0000	1461.9600 (29a)
Render	30.8500	14.6000		16.2500	0.1000	1.6250	9.0000	146.2500 (29a)
External Roof 1	121.5200	0.9000		120.6200	0.1200	14.4744	9.0000	1085.5800 (30)
Total net area of external elements Aum(A, m ²)				461.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =		96.4201		(33)
Internal Wall 1				432.1700			75.0000	32412.7500 (32c)
Internal Floor 1				101.4400			18.0000	1825.9200 (32d)

Heat capacity Cm = Sum(A x k) (28) ... (30) + (32) + (32a) ... (32e) = 49096.2600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 231.5643 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	31.0900	0.0140	0.4353
E3 Sill	26.1850	0.0260	0.6808
E4 Jamb	59.9800	0.0100	0.5998
E5 Ground floor (normal)	46.0700	0.3200	14.7424
E6 Intermediate floor within a dwelling	42.5600	0.1400	5.9584
E16 Corner (normal)	32.6340	0.1800	5.8741
E17 Corner (inverted - internal area greater than external area)	12.4340	0.0000	0.0000
E14 Flat roof	8.7170	0.1600	1.3947
E24 Eaves (insulation at ceiling level - inverted)	5.2070	0.1500	0.7810
E13 Gable (insulation at rafter level)	9.0080	0.2500	2.2520
R4 Ridge (vaulted ceiling)	16.4790	0.1200	1.9775
E11 Eaves (insulation at rafter level)	36.7330	0.1500	5.5099

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 40.2060 (36)
 Point Thermal bridges 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 136.6261 (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	59.9743	59.2567	58.5391	54.9511	54.2335	50.6455	50.6455	49.9279	52.0807	54.2335	55.6687	57.1039 (38)
Average = Sum(39)m / 12 =	196.6003	195.8828	195.1652	191.5772	190.8596	187.2716	187.2716	186.5540	188.7068	190.8596	192.2948	193.7300 (39)
HLP	0.9273	0.9239	0.9205	0.9036	0.9002	0.8833	0.8833	0.8799	0.8900	0.9002	0.9070	0.9137 (40)
HLP (average)												0.9027
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0176 (42)	
Hot water usage for mixer showers														
Hot water usage for baths														
Hot water usage for other uses														
Average daily hot water use (litres/day)														166.1792 (43)
Daily hot water use	180.6983	177.0170	172.4331	165.2218	159.4527	153.2158	150.6410	155.2031	160.0399	166.6107	173.9402	180.1950 (44)		
Energy content (annual)	286.1819	252.0698	265.0233	226.1804	214.6540	188.3967	182.1873	192.1739	197.3452	226.0891	247.8097	282.1418 (45)		
Distribution loss (46)m = 0.15 x (45)m	42.9273	37.8105	39.7535	33.9271	32.1981	28.2595	27.3281	28.8261	29.6018	33.9134	37.1715	42.3213 (46)		
Water storage loss:													300.0000 (47)	
Store volume													2.0900 (48)	
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)	
Temperature factor from Table 2b													1.1286 (55)	
Enter (49) or (54) in (55)														
Total storage loss	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (56)		
If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908 (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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908 (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	141.7547	125.9028	134.7194	120.3010	117.9717	107.7379	107.1765	110.4970	110.7133	121.7738	127.4927	140.4113 (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	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.6879	37.9150	30.8346	23.3438	17.4497	14.7318	15.9182	20.6911	27.7716	35.2624	41.1564	43.8743 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	570.6425	576.5640	561.6420	529.8750	489.7748	452.0862	426.9080	420.9865	435.9084	467.6755	507.7757	545.4642 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229 (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)	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022 (71)
Water heating gains (Table 5)	190.5305	187.3554	181.0745	167.0847	158.5641	149.6360	144.0544	148.5175	153.7684	163.6745	177.0732	188.7249 (72)
Total internal gains	920.3349	918.3083	890.0251	836.7774	782.2625	732.9279	703.3545	706.6691	733.9224	783.0863	842.4793	894.5375 (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		2.0000	10.6334	0.5700	0.7000	0.7700	5.8804 (74)						
South		12.6300	46.7521	0.5700	0.7000	0.7700	163.2715 (78)						
West		2.0000	19.6403	0.5700	0.7000	0.7700	10.8613 (80)						
North		12.4700	10.6334	0.5700	0.7000	0.7700	36.6644 (74)						
East		7.1400	19.6403	0.5700	0.7000	0.7700	38.7750 (76)						
South		12.7800	46.7521	0.5700	0.7000	0.7700	165.2106 (78)						
West		1.2300	19.6403	0.5700	0.7000	0.7700	6.6797 (80)						
North		0.9000	26.0000	0.5700	0.7000	1.0000	8.4029 (82)						
Solar gains	435.7458	746.8926	1035.8887	1309.5085	1492.3629	1493.3353	1434.8018	1296.2536	1130.1379	829.0852	522.7325	372.4047	(83)
Total gains	1356.0807	1665.2009	1925.9137	2146.2859	2274.6254	2226.2632	2138.1563	2002.9227	1864.0603	1612.1715	1365.2117	1266.9422	(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	69.3684	69.6225	69.8785	71.1872	71.4549	72.8239	72.8239	73.1040	72.2701	71.4549	70.9216	70.3962	
alpha	5.6246	5.6415	5.6586	5.7458	5.7637	5.8549	5.8549	5.8736	5.8180	5.7637	5.7281	5.6931	
util living area	0.9959	0.9870	0.9608	0.8825	0.7299	0.5316	0.3845	0.4268	0.6699	0.9250	0.9895	0.9972	(86)
Living	20.1316	20.3091	20.5324	20.7667	20.8976	20.9406	20.9462	20.9457	20.9241	20.7373	20.3872	20.1053	
Non living	19.1200	19.3476	19.6286	19.9189	20.0589	20.1101	20.1134	20.1163	20.0928	19.8943	19.4600	19.0957	
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	20.5557	20.3091	20.5324	20.7667	20.8976	20.9406	20.9462	20.9457	20.9241	20.7373	20.3872	20.2304	(87)
Th 2	20.1444	20.1472	20.1501	20.1645	20.1673	20.1817	20.1817	20.1846	20.1760	20.1673	20.1616	20.1558	(88)
util rest of house	0.9947	0.9833	0.9501	0.8541	0.6786	0.4665	0.3135	0.3520	0.6006	0.8997	0.9859	0.9963	(89)
MIT 2	19.7360	19.3476	19.6286	19.9189	20.0589	20.1101	20.1134	20.1163	20.0928	19.8943	19.4600	19.2867	(90)
Living area fraction										FLA = Living area / (4) =			0.3580 (91)
MIT	20.0295	19.6918	19.9522	20.2224	20.3592	20.4075	20.4116	20.4132	20.3904	20.1961	19.7920	19.6246	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0295	19.6918	19.9522	20.2224	20.3592	20.4075	20.4116	20.4132	20.3904	20.1961	19.7920	19.6246	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9945	0.9808	0.9471	0.8562	0.6909	0.4847	0.3335	0.3731	0.6193	0.9007	0.9839	0.9956	(94)
Useful gains	1348.6709	1633.2715	1824.0953	1837.7109	1571.6515	1079.1201	713.0300	747.2369	1154.3230	1452.0364	1343.1880	1261.4081	(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	3092.4231	2897.4639	2625.4063	2169.1169	1652.6910	1087.5714	713.8022	748.6869	1187.0429	1831.5132	2440.6016	2988.2058	(97)
Space heating kWh	1297.3516	849.5373	596.1754	238.6123	60.2933	0.0000	0.0000	0.0000	0.0000	282.3307	790.1378	1284.7375	(98a)
Space heating requirement - total per year (kWh/year)												5399.1759	
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	1297.3516	849.5373	596.1754	238.6123	60.2933	0.0000	0.0000	0.0000	0.0000	282.3307	790.1378	1284.7375	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5399.1759	
Space heating per m ²										(98c) / (4) =		25.4654	(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 %)												322.0593 (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	1297.3516	849.5373	596.1754	238.6123	60.2933	0.0000	0.0000	0.0000	0.0000	282.3307	790.1378	1284.7375	(98)
Space heating efficiency (main heating system 1)	322.0593	322.0593	322.0593	322.0593	322.0593	0.0000	0.0000	0.0000	0.0000	322.0593	322.0593	322.0593	(210)
Space heating fuel (main heating system 1)	402.8301	263.7829	185.1136	74.0896	18.7212	0.0000	0.0000	0.0000	0.0000	87.6642	245.3392	398.9134	(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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908	(64)
Efficiency of water heater (217)m	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	277.9546	(216)
Fuel for water heating, kWh/month	123.9163	109.6157	116.3040	101.6534	98.1826	88.0600	86.5020	90.0949	91.2794	102.2966	109.4350	122.4628	(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	118.1557	106.7213	118.1557	114.3443	118.1557	114.3443	118.1557	118.1557	114.3443	118.1557	114.3443	118.1557	(231)
Lighting	37.3645	29.9752	26.9893	19.7735	15.2736	12.4787	13.9331	18.1108	23.5242	30.8650	34.8619	38.4030	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-81.8968	-123.5886	-188.5048	-215.6267	-231.7109	-215.8689	-213.2874	-198.5685	-170.5262	-140.1838	-91.3783	-69.3317	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

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(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-30.4829	-74.0578	-172.7533	-300.6206	-431.2418	-445.5775	-435.3848	-351.9003	-237.7059	-119.3946	-43.9694	-23.2988	(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													1676.4542 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													277.9546
Water heating fuel used													1239.8027 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.8190) mechanical ventilation fans (SFP = 1.8190)													
Total electricity for the above, kWh/year													1391.1884 (230a)
Electricity for lighting (calculated in Appendix L)													1391.1884 (231)
													301.5528 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-4606.8604 (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													2.1377 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1676.4542	16.4900	276.4473	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1239.8027	16.4900	204.4435	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	1391.1884	16.4900	229.4070	(249)
Energy for lighting	301.5528	16.4900	49.7261	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1940.4727	16.4900	-319.9839	
PV Unit electricity exported	-2666.3877	5.5900	-149.0511	
Total			-469.0350	(252)
Total energy cost			290.9888	(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] =	0.4076	(257)
SAP value		93.3931	
SAP rating (Section 12)		93	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1676.4542	0.1570	263.2464	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1239.8027	0.1410	174.8220	(264)
Space and water heating			438.0684	(265)
Pumps, fans and electric keep-hot	1391.1884	0.1387	192.9750	(267)
Energy for lighting	301.5528	0.1443	43.5234	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1940.4727	0.1341	-260.1723	
PV Unit electricity exported	-2666.3877	0.1225	-326.5607	
Total			-586.7330	(269)
Total CO2, kg/year			87.8338	(272)
CO2 emissions per m2			0.4100	(273)
EI value			99.5421	
EI rating			100	(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 Storey height Volume

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Ground floor		(m2)		(m)		(m3)
First floor	110.5800 (1b)	x	2.3300 (2b)	=	257.6514 (1b)	- (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.0200		101.4400 (1c)	x	3.6400 (2c)	= 369.2416 (1c) - (3c)
Dwelling volume					(3a) + (3b) + (3c) + (3d) + (3e) ... (3n)	= 626.8930 (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			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.1388 (21)

Wind speed	Jan 4.9000	Feb 4.8000	Mar 4.8000	Apr 4.2000	May 4.1000	Jun 3.7000	Jul 3.7000	Aug 3.8000	Sep 3.9000	Oct 4.2000	Nov 4.3000	Dec 4.5000 (22)
Wind factor	1.2250	1.2000	1.2000	1.0500	1.0250	0.9250	0.9250	0.9500	0.9750	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.1700	0.1665	0.1665	0.1457	0.1422	0.1283	0.1283	0.1318	0.1353	0.1457	0.1492	0.1561 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												77.4000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2830	0.2795	0.2795	0.2587	0.2552	0.2413	0.2413	0.2448	0.2483	0.2587	0.2622	0.2691 (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
FGD (Uw = 1.00)			16.6300	0.9615	15.9904		(27)
Window (Uw = 1.00)			33.6200	0.9615	32.3269		(27)
Opening		0.9000	0.9000	0.9615	0.8654		(27a)
Heatloss Floor 1			110.5800	0.1200	13.2696	110.0000	12163.8000 (28a)
Brickslip	198.0900	35.6500	162.4400	0.1100	17.8684	9.0000	1461.9600 (29a)
Render	30.8500	14.6000	16.2500	0.1000	1.6250	9.0000	146.2500 (29a)
External Roof 1	121.5200	0.9000	120.6200	0.1200	14.4744	9.0000	1085.5800 (30)
Total net area of external elements Aum(A, m2)			461.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	96.4201	(33)
Internal Wall 1			432.1700			75.0000	32412.7500 (32c)
Internal Floor 1			101.4400			18.0000	1825.9200 (32d)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 49096.2600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							231.5643 (35)

List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				31.0900	0.0140	0.4353	
E3 Sill				26.1850	0.0260	0.6808	
E4 Jamb				59.9800	0.0100	0.5998	
E5 Ground floor (normal)				46.0700	0.3200	14.7424	
E6 Intermediate floor within a dwelling				42.5600	0.1400	5.9584	
E16 Corner (normal)				32.6340	0.1800	5.8741	
E17 Corner (inverted - internal area greater than external area)				12.4340	0.0000	0.0000	
E14 Flat roof				8.7170	0.1600	1.3947	
E24 Eaves (insulation at ceiling level - inverted)				5.2070	0.1500	0.7810	
E13 Gable (insulation at rafter level)				9.0080	0.2500	2.2520	
R4 Ridge (vaulted ceiling)				16.4790	0.1200	1.9775	
E11 Eaves (insulation at rafter level)				36.7330	0.1500	5.5099	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							40.2060 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 136.6261 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 58.5391	Feb 57.8215	Mar 57.8215	Apr 53.5159	May 52.7983	Jun 49.9279	Jul 49.9279	Aug 50.6455	Sep 51.3631	Oct 53.5159	Nov 54.2335	Dec 55.6687 (38)
Heat transfer coeff	195.1652	194.4476	194.4476	190.1420	189.4244	186.5540	186.5540	187.2716	187.9892	190.1420	190.8596	192.2948 (39)
Average = Sum(39)m / 12 =												190.4410
HLP	Jan 0.9205	Feb 0.9171	Mar 0.9171	Apr 0.8968	May 0.8934	Jun 0.8799	Jul 0.8799	Aug 0.8833	Sep 0.8867	Oct 0.8968	Nov 0.9002	Dec 0.9070 (40)
HLP (average)												0.8982
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0176 (42)
Hot water usage for mixer showers												102.4756 (42a)
Hot water usage for baths												32.2958 (42b)
Hot water usage for other uses												31.1408 (42b)

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	45.5328	43.8770	42.2213	40.5656	38.9098	37.2541	37.2541	38.9098	40.5656	42.2213	43.8770	45.5328 (42c)
Average daily hot water use (litres/day)	166.1792 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	180.6983	177.0170	172.4331	165.2218	159.4527	153.2158	150.6410	155.2031	160.0399	166.6107	173.9402	180.1950 (44)
Energy content (annual)	286.1819	252.0698	265.0233	226.1804	214.6540	188.3967	182.1873	192.1739	197.3452	226.0891	247.8097	282.1418 (45)
Distribution loss (46)m = 0.15 x (45)m	42.9273	37.8105	39.7535	33.9271	32.1981	28.2595	27.3281	28.8261	29.6018	33.9134	37.1715	42.3213 (46)
Water storage loss:												
Store volume	300.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	2.0900 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	1.1286 (55)											
Total storage loss	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (56)
If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908 (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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908 (64)
	Total per year (kWh/year) = Sum(64)m = 3446.0880 (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	141.7547	125.9028	134.7194	120.3010	117.9717	107.7379	107.1765	110.4970	110.7133	121.7738	127.4927	140.4113 (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	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532	181.0532 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.6879	37.9150	30.8346	23.3438	17.4497	14.7318	15.9182	20.6911	27.7716	35.2624	41.1564	43.8743 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	570.6425	576.5640	561.6420	529.8750	489.7748	452.0862	426.9080	420.9865	435.9084	467.6755	507.7757	545.4642 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229	56.1229 (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)	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022	-120.7022 (71)
Water heating gains (Table 5)	190.5305	187.3554	181.0745	167.0847	158.5641	149.6360	144.0544	148.5175	153.7684	163.6745	177.0732	188.7249 (72)
Total internal gains	920.3349	918.3083	890.0251	836.7774	782.2625	732.9279	703.3545	706.6691	733.9224	783.0863	842.4793	894.5375 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North	2.0000	12.0246	0.5700	0.7000	0.7700	6.6498 (74)						
South	12.6300	51.4430	0.5700	0.7000	0.7700	179.6536 (78)						
West	2.0000	22.3829	0.5700	0.7000	0.7700	12.3781 (80)						
North	12.4700	12.0246	0.5700	0.7000	0.7700	41.4615 (74)						
East	7.1400	22.3829	0.5700	0.7000	0.7700	44.1897 (76)						
South	12.7800	51.4430	0.5700	0.7000	0.7700	181.7873 (78)						
West	1.2300	22.3829	0.5700	0.7000	0.7700	7.6125 (80)						
North	0.9000	30.0000	0.5700	0.7000	1.0000	9.6957 (82)						
Solar gains	483.4282	759.0144	1033.7111	1346.7836	1499.1877	1592.6114	1512.0433	1383.2389	1202.1507	884.1240	594.1034	409.2023 (83)
Total gains	1403.7631	1677.3227	1923.7362	2183.5609	2281.4502	2325.5393	2215.3978	2089.9079	1936.0731	1667.2103	1436.5827	1303.7398 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	69.8785	70.1364	70.1364	71.7246	71.9963	73.1040	73.1040	72.8239	72.5459	71.7246	71.4549	70.9216
tau	5.6586	5.6758	5.6758	5.7816	5.7998	5.8736	5.8736	5.8549	5.8364	5.7816	5.7637	5.7281
util living area	0.9953	0.9871	0.9595	0.8673	0.7007	0.4702	0.3197	0.3401	0.6062	0.9024	0.9860	0.9967 (86)
Living	20.1523	20.3070	20.5430	20.7901	20.9095	20.9441	20.9469	20.9466	20.9343	20.7782	20.4310	20.1299
Non living	19.1510	19.3496	19.6441	19.9501	20.0756	20.1152	20.1168	20.1136	20.1032	19.9429	19.5199	19.1318
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	20.5663	20.3070	20.5430	20.7901	20.9095	20.9441	20.9469	20.9466	20.9343	20.7782	20.4310	20.2516 (87)
Th 2	20.1501	20.1530	20.1530	20.1702	20.1731	20.1846	20.1846	20.1817	20.1789	20.1702	20.1673	20.1616 (88)
util rest of house	0.9939	0.9835	0.9484	0.8365	0.6470	0.4066	0.2513	0.2671	0.5347	0.8710	0.9813	0.9957 (89)
MIT 2	19.7518	19.3496	19.6441	19.9501	20.0756	20.1152	20.1168	20.1136	20.1032	19.9429	19.5199	19.3173 (90)
Living area fraction	20.0434	19.6924	19.9660	20.2508	20.3742	20.4120	20.4140	20.4119	20.4008	20.2420	19.8461	19.6518 (92)
Temperature adjustment	20.0434	19.6924	19.9660	20.2508	20.3742	20.4120	20.4140	20.4119	20.4008	20.2420	19.8461	0.0000
adjusted MIT	20.0434	19.6924	19.9660	20.2508	20.3742	20.4120	20.4140	20.4119	20.4008	20.2420	19.8461	19.6518 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9937	0.9811	0.9456	0.8397	0.6606	0.4245	0.2706	0.2877	0.5544	0.8740	0.9790	0.9950	(94)
Useful gains	1394.9299	1645.6190	1819.0695	1833.5581	1507.0355	987.1711	599.3773	601.1997	1073.4406	1457.1519	1406.4539	1297.1819	(95)
Ext temp.	4.2000	4.7000	6.6000	9.1000	12.1000	15.1000	17.2000	17.2000	14.6000	11.0000	7.2000	4.2000	(96)
Heat loss rate W	3092.0854	2915.2341	2598.9781	2120.2398	1567.3287	990.9746	599.5800	601.4914	1090.4813	1757.2899	2413.6306	2971.3055	(97)
Space heating kWh	1262.6837	853.1813	580.2520	206.4108	44.8581	0.0000	0.0000	0.0000	0.0000	223.3026	725.1672	1245.5479	(98a)
Space heating requirement - total per year (kWh/year)												5141.4038	
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	1262.6837	853.1813	580.2520	206.4108	44.8581	0.0000	0.0000	0.0000	0.0000	223.3026	725.1672	1245.5479	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5141.4038	
Space heating per m2													(98c) / (4) = 24.2496 (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 %)													321.9265 (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	1262.6837	853.1813	580.2520	206.4108	44.8581	0.0000	0.0000	0.0000	0.0000	223.3026	725.1672	1245.5479	(98)
Space heating efficiency (main heating system 1)	321.9265	321.9265	321.9265	321.9265	321.9265	0.0000	0.0000	0.0000	0.0000	321.9265	321.9265	321.9265	(210)
Space heating fuel (main heating system)	392.2274	265.0237	180.2437	64.1174	13.9343	0.0000	0.0000	0.0000	0.0000	69.3645	225.2587	386.9045	(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	344.4309	304.6818	323.2723	282.5504	272.9030	244.7667	240.4363	250.4229	253.7152	284.3381	304.1797	340.3908	(64)
Efficiency of water heater (217)m	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526	277.9526	(216)
Fuel for water heating, kWh/month	123.9172	109.6165	116.3048	101.6542	98.1833	88.0606	86.5026	90.0956	91.2800	102.2973	109.4358	122.4636	(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	118.1557	106.7213	118.1557	114.3443	118.1557	114.3443	118.1557	118.1557	114.3443	118.1557	114.3443	118.1557	(231)
Lighting	37.3645	29.9752	26.9893	19.7735	15.2736	12.4787	13.9331	18.1108	23.5242	30.8650	34.8619	38.4030	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-91.0631	-127.6356	-190.8874	-219.6901	-232.5218	-222.6025	-219.0292	-206.1683	-178.4538	-147.6956	-102.6868	-76.5768	(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	-36.8354	-78.5090	-178.2809	-320.7795	-441.4748	-489.4173	-471.7477	-390.2835	-265.3238	-136.2912	-55.1617	-27.7945	(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													1597.0740 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													277.9526
Water heating fuel used													1239.8115 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.8190)													
mechanical ventilation fans (SFP = 1.8190)													1391.1884 (230a)
Total electricity for the above, kWh/year													1391.1884 (231)
Electricity for lighting (calculated in Appendix L)													301.5528 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-4906.9104 (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													-377.2836 (238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1597.0740	25.1600	401.8238	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1239.8115	25.1600	311.9366	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	1391.1884	25.1600	350.0230	(249)
Energy for lighting	301.5528	25.1600	75.8707	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				

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PV Unit electricity used in dwelling	-2015.0108	25.1600	-506.9767
PV Unit electricity exported	-2891.8996	5.8100	-168.0194
Total			-674.9961 (252)
Total energy cost			464.6580 (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	1597.0740	0.1574	251.4353 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1239.8115	0.1410	174.8233 (264)
Space and water heating			426.2586 (265)
Pumps, fans and electric keep-hot	1391.1884	0.1387	192.9750 (267)
Energy for lighting	301.5528	0.1443	43.5234 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2015.0108	0.1343	-270.5404
PV Unit electricity exported	-2891.8996	0.1223	-353.7322
Total			-624.2726 (269)
Total CO2, kg/year			38.4844 (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	1597.0740	1.5828	2527.8449 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1239.8115	1.5214	1886.2514 (278)
Space and water heating			4414.0964 (279)
Pumps, fans and electric keep-hot	1391.1884	1.5128	2104.5898 (281)
Energy for lighting	301.5528	1.5338	462.5317 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2015.0108	1.4962	-3014.8497
PV Unit electricity exported	-2891.8996	0.4488	-1297.8474
Total			-4312.6971 (283)
Total Primary energy kWh/year			2668.5208 (286)

Summary for Input Data



Property Reference	Plot 01 - 24-03829		Issued on Date	05/03/2024
Assessment Reference	00001	Prop Type Ref	24-03829	
Property	68 Maze Green Road , Bishops Stortford, CM23 2PL			

SAP Rating	93 A	DER	0.47	TER	9.23
Environmental	100 A	% DER < TER			94.91
CO ₂ Emissions (t/year)	0.04	DFEE	43.76	TFEE	44.88
Compliance Check	See BREL	% DFEE < TFEE			2.50
% DPER < TPER	69.79	DPER	14.74	TPER	48.80

Assessor Details	Mr. Kenny Lampard	Assessor ID	T058-0001
Client	AC Architects , AC Architects		

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

Orientation	North
Property Tenure	ND
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	1
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:	46.07 m	110.58 m ²	2.33 m
1st Storey:	42.56 m	101.44 m ²	3.64 m

8.0 Living Area	75.91	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
	Brickslip	Solid Wall	Solid wall : plasterboard on dabs, insulation, any outside structure	0.11	9.00	198.09	162.44	0.00	None	35.65	Enter Gross Area
	Render	Solid Wall	Solid wall : plasterboard on dabs, insulation, any outside structure	0.10	9.00	30.85	16.26	0.00	None	14.59	Enter Gross Area

9.2 Internal Walls	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Internal Wall 1	Dense block, plasterboard on dabs	75.00	432.17

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	External Roof 1	External Slope Roof	Plasterboard, insulated slope	0.12	9.00	121.52	120.62	None	0.00	Enter Gross Area	0.90

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	0.12	None	0.00	110.00	110.58

11.2 Internal Floors	Description	Storey Index	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	101.44

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)
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Summary for Input Data



FGD	Manufacturer	Window	Triple Low-E Soft 0.05	0.57	0.70	1.00
Window	Manufacturer	Window	Triple Low-E Soft 0.05	0.57	0.70	1.00
Skylight	Manufacturer	Roof Window	Triple Low-E Soft 0.05	0.57	0.70	1.00

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
Front	FGD	Render	North	2.00	
Front	Window	Brickslip	North	3.25	
Front	Window	Brickslip	North	6.20	
Fixed Hemisphere	Window	Render	North	2.00	
Front	Window	Render	North	1.02	
Rear	FGD	Render	South	5.17	
Rear	Window	Render	South	2.52	
Rear	FGD	Brickslip	South	7.46	
Rear	Window	Brickslip	South	10.26	
Side	Window	Brickslip	East	5.25	
Side	Window	Render	East	1.89	
Side	FGD	Brickslip	West	2.00	
Side	Window	Brickslip	West	1.23	
Opening	Skylight	External Roof 1	North	0.90	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	31.09	0.01	0.01 Econekt	Yes
E3 Sill	Independently assessed	26.18	0.03	0.03 Econekt	No
E4 Jamb	Independently assessed	59.98	0.01	0.01 Econekt	Yes
E5 Ground floor (normal)	Table K1 - Default	46.07	0.32	0.32	Yes
E6 Intermediate floor within a dwelling	Table K1 - Default	42.56	0.14	0.14	Yes
E16 Corner (normal)	Table K1 - Default	32.63	0.18	0.18	No
E17 Corner (inverted – internal area greater than external area)	Table K1 - Default	12.43	0.00	0.00	No
E14 Flat roof	Table K1 - Default	8.72	0.16	0.16	No
E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	5.21	0.15	0.15	No
E13 Gable (insulation at rafter level)	Table K1 - Default	9.01	0.25	0.25	No
R4 Ridge (vaulted ceiling)	Table K1 - Default	16.48	0.12	0.12	No
E11 Eaves (insulation at rafter level)	Table K1 - Default	36.73	0.15	0.15	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

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

Manufacturer SFP

Duct Type

MVHR Efficiency

Wet Rooms

SFP from Installer Commissioning Certificate

MVHR System Location

Duct Installation Specification

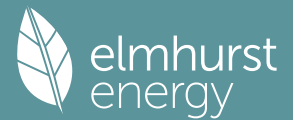
20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Summary for Input Data



	Name	Efficacy	Power	Capacity	Count
	Lighting 1	100.00	8	800	35
24.0 Main Heating 1	Database				
Percentage of Heat	100.00			%	
Database Ref. No.	104649				
Fuel Type	Electricity				
In Winter	322.06				
In Summer	277.95				
Model Name	Ecodan 11.2 kW				
Manufacturer	Mitsubishi Electric Europe B.V.				
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	45.00				

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

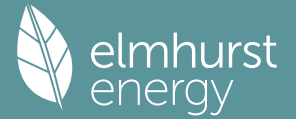
28.0 Water Heating	Main Heating 1				
Water Heating	Main Heating 1				
SAP Code	901				
Flue Gas Heat Recovery System	No				
Waste Water Heat Recovery Instantaneous System 1	No				
Waste Water Heat Recovery Instantaneous System 2	No				
Waste Water Heat Recovery Storage System	No				
Solar Panel	No	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

28.1 Showers						
Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To	

28.3 Waste Water Heat Recovery System	
--	--

29.0 Hot Water Cylinder	Hot Water Cylinder				
Cylinder Stat	Yes				
Cylinder In Heated Space	Yes				
Independent Time Control	Yes				
Insulation Type	Measured Loss				
Cylinder Volume	300.00				
Loss	2.09				

Summary for Input Data



Pipes insulation

In Airing Cupboard

31.0 Thermal Store

32.0 Photovoltaic Unit

Export Capable Meter?

Connected To Dwelling

Diverter

Battery Capacity [kWh]

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
4.06	East	30°	None Or Little		No	1.00		
1.92	South	30°	None Or Little		No	1.00		

34.0 Small-scale Hydro

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

Recommendations

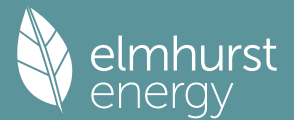
Lower cost measures

None

Further measures to achieve even higher standards

Typical Cost	Typical savings per year	Ratings after improvement	
		SAP rating	Environmental Impact
		A 94	A 100
		0	0
		0	0

Thermal Bridging



Property Reference	Plot 01 - 24-03829		Issued on Date	05/03/2024
Assessment Reference	00001	Prop Type Ref	Detached House	
Property	68 Maze Green Road , Bishops Stortford, CM23 2PL			

SAP Rating	93 A	DER	0.47	TER	9.23
Environmental	100 A	% DER < TER			94.91
CO ₂ Emissions (t/year)	0.04	DFEE	43.76	TFEE	44.88
Compliance Check	See BREL	% DFEE < TFEE			2.50
% DPER < TPER	69.79	DPER	14.74	TPER	48.80

Assessor Details	Mr. Kenny Lampard	Assessor ID	T058-0001
Client	AC Architects , AC Architects		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.014	31.09	0.44	Econekt
External wall	E3 Sill	Independently assessed	0.026	26.18	0.68	Econekt
External wall	E4 Jamb	Independently assessed	0.010	59.98	0.60	Econekt
External wall	E5 Ground floor (normal)	Table K1 - Default	0.320	46.07	14.74	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Default	0.140	42.56	5.96	
External wall	E16 Corner (normal)	Table K1 - Default	0.180	32.63	5.87	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Default	0.000	12.43	0.00	
External wall	E14 Flat roof	Table K1 - Default	0.160	8.72	1.39	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.150	5.21	0.78	
External wall	E13 Gable (insulation at rafter level)	Table K1 - Default	0.250	9.01	2.25	
External roof	R4 Ridge (vaulted ceiling)	Table K1 - Default	0.120	16.48	1.98	
External wall	E11 Eaves (insulation at rafter level)	Table K1 - Default	0.150	36.73	5.51	

Total: W/mK:
 Y-Value: W/m²K:

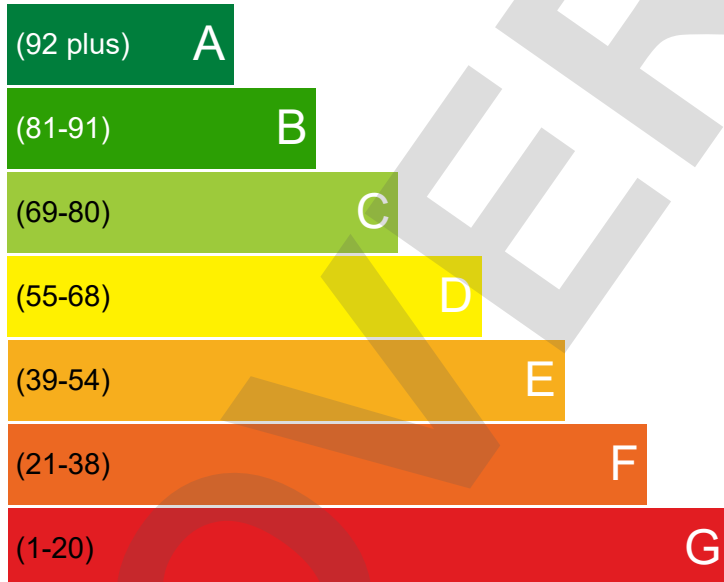
Dwelling Address	68 Maze Green Road , Bishops Stortford, CM23 2PL
Report Date	05/03/2024
Property Type	House, Detached
Floor Area [m ²]	212

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



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 0.11 W/m ² K	Very Good
Roof	Average thermal transmittance 0.12 W/m ² K	Very Good
Floor	Average thermal transmittance 0.12 W/m ² K	Very Good
Windows	High performance glazing	Very 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	Excellent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 13 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: **0.0** per year

With the recommended measures the potential CO emissions could be: **0.0** 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	£42	 A 94
Photovoltaic		 -94	£506	 G 0

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£465

Over a year you could save

£0

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. Kenny Lampard
Assessor's accreditation number	
Email Address	

Accreditation scheme contact details

Accreditation scheme	
Telephone	
Email Address	

Assessment details

Related party disclosure	
Date of assessment	05/03/2024
Date of certificate	05/03/2024
Type of assessment	SAP, new dwelling