

Full SAP Calculation Printout



Property Reference	CPG-7172-23 P2		Issued on Date	13/01/2024	
Assessment Reference	SEC1 - ASHP ROI TF 0.15 improv	Prop Type Ref	DS		
Property	Plot 2, Collygree Parc, South Road, Penzance, Cornwall, TR20 9LY				
SAP Rating	98 A	DER	-0.73	TER	11.60
Environmental	101 A	% DER < TER			106.29
CO ₂ Emissions (t/year)	-0.13	DFEE	30.59	TFEE	35.30
Compliance Check	See BREL	% DFEE < TFEE			13.33
% DPER < TPER	90.32	DPER	5.87	TPER	60.60
Assessor Details	Mr. Stuart Thomas			Assessor ID	V220-0003
Client	Cornwall Planning Group, CPG				

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	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.6000 (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												1.0000 (17)	
Infiltration rate												0.0500 (18)	
Number of sides sheltered												2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.0425 (21)	
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	0.0542	0.0531	0.0521	0.0468	0.0457	0.0404	0.0404	0.0393	0.0425	0.0457	0.0478	0.0499 (22b)	
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)	
Effective ac	0.1492	0.1481	0.1471	0.1417	0.1407	0.1354	0.1354	0.1343	0.1375	0.1407	0.1428	0.1449 (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
Window (Uw = 1.20)			11.9700	1.1450	13.7061		(27)
Door			2.1200	1.0000	2.1200		(26a)
Floor 1 P/a 0.45			40.0000	0.1200	4.8000	110.0000	4400.0000 (28a)
External Wall 1 Render	89.9200	14.0900	75.8300	0.1500	11.3745	9.0000	682.4700 (29a)
External Roof 1 Horz	40.0000		40.0000	0.0900	3.6000	9.0000	360.0000 (30)
Total net area of external elements Aum(A, m ²)			169.9200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	35.6006	(33)
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000 (32)
Internal Wall 1 GF			34.1300			9.0000	307.1700 (32c)
Internal Wall 2 FF			60.2000			9.0000	541.8000 (32c)
Internal Floor 1			40.0000			18.0000	720.0000 (32d)
Internal Ceiling 1			40.0000			9.0000	360.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8169.8400 (34)

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

102.1230 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	9.9800	0.0300	0.2994
E5 Ground floor (normal)	18.0000	0.0210	0.3780
E10 Eaves (insulation at ceiling level)	10.0000	0.0440	0.4400
E12 Gable (insulation at ceiling level)	8.0000	0.0510	0.4080
E6 Intermediate floor within a dwelling	18.0000	0.0800	1.4400
P1 Party wall - Ground floor	8.0000	0.1490	1.1920
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.4800	3.8400
E18 Party wall between dwellings	9.9800	0.0395	0.3942
E2 Other lintels (including other steel lintels)	10.6100	0.0840	0.8912
E3 Sill	9.6000	0.0430	0.4128
E4 Jamb	23.1000	0.0340	0.7854

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

Point Thermal bridges	(36a) =	10.4810 (36)
Total fabric heat loss	(33) + (36) + (36a) =	46.0817 (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	9.8267	9.7567	9.6867	9.3368	9.2668	8.9169	8.9169	8.8469	9.0569	9.2668	9.4068	9.5467 (38)
Heat transfer coeff	55.9083	55.8384	55.7684	55.4184	55.3485	54.9985	54.9985	54.9286	55.1385	55.3485	55.4884	55.6284 (39)
Average = Sum(39)m / 12 =												55.4009
HLP	0.6989	0.6980	0.6971	0.6927	0.6919	0.6875	0.6875	0.6866	0.6892	0.6919	0.6936	Dec 0.6954 (40)
HLP (average)												0.6925
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.4629 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	75.5424	74.4205	72.8406	69.9276	67.7463	65.3277	64.0212	65.5901	67.2982	69.8863	72.8593	75.2870 (42b)
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522 (42c)
Average daily hot water use (litres/day)												106.2689 (43)
Daily hot water use	115.3945	112.8235	109.7944	105.4322	101.8018	97.9340	96.6275	99.6456	102.8029	106.8401	111.2623	115.1391 (44)
Energy conte	182.7567	160.6591	168.7499	144.3314	137.0448	120.4213	116.8626	123.3820	126.7662	144.9810	158.5135	180.2801 (45)
Energy content (annual)												Total = Sum(45)m = 1764.7487
Distribution loss (46)m = 0.15 x (45)m	27.4135	24.0989	25.3125	21.6497	20.5567	18.0632	17.5294	18.5073	19.0149	21.7472	23.7770	27.0420 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8640 (55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated solar storage												
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 (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 (61)
Total heat required for water heating calculated for each month	232.8031	205.8623	218.7963	192.7634	187.0912	168.8533	166.9090	173.4284	175.1982	195.0274	206.9455	230.3265 (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	232.8031	205.8623	218.7963	192.7634	187.0912	168.8533	166.9090	173.4284	175.1982	195.0274	206.9455	230.3265 (64)
Total per year (kWh/year)												2354.0047 (64)
Electric shower(s)												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	100.8037	89.5817	96.1465	86.7358	85.6045	78.7857	78.8940	81.0616	80.8954	88.2433	91.4513	99.9802 (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	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.0636	129.6061	117.0636	120.9657	117.0636	120.9657	117.0636	117.0636	120.9657	117.0636	120.9657	117.0636 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143 (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)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144 (71)
Water heating gains (Table 5)	135.4889	133.3061	129.2291	120.4664	115.0598	109.4245	106.0403	108.9538	112.3547	118.6066	127.0158	134.3821 (72)
Total internal gains	531.9359	544.5728	522.2150	505.1384	480.4092	464.1829	447.2142	447.8506	460.8919	475.4577	503.1895	521.1468 (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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Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	204.6600	
Water heating fuel used	1150.2026	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)		
mechanical ventilation fans (SFP = 0.5720)	139.2889	(230a)
Total electricity for the above, kWh/year	139.2889	(231)
Electricity for lighting (calculated in Appendix L)	182.6625	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2331.7732	(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	-636.5290	(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	223.0902	0.1570	35.0196 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1150.2026	0.1408	161.9882 (264)
Space and water heating			197.0078 (265)
Pumps, fans and electric keep-hot	139.2889	0.1387	19.3211 (267)
Energy for lighting	182.6625	0.1443	26.3638 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1014.6058	0.1344	-136.3367
PV Unit electricity exported	-1317.1674	0.1251	-164.8107
Total			-301.1474 (269)
Total CO2, kg/year			-58.4547 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.7300 (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	223.0902	1.5811	352.7233 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1150.2026	1.5208	1749.1725 (278)
Space and water heating			2101.8957 (279)
Pumps, fans and electric keep-hot	139.2889	1.5128	210.7162 (281)
Energy for lighting	182.6625	1.5338	280.1739 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1014.6058	1.4966	-1518.4731
PV Unit electricity exported	-1317.1674	0.4593	-604.9300
Total			-2123.4032 (283)
Total Primary energy kWh/year			469.3826 (286)
Dwelling Primary energy Rate (DPER)			5.8700 (287)

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

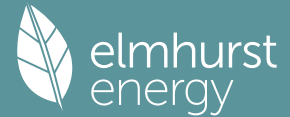
 1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.6000 (5)

 2. Ventilation rate

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	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1503 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4003 (18)

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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	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.0636	129.6061	117.0636	120.9657	117.0636	120.9657	117.0636	117.0636	120.9657	117.0636	120.9657	117.0636 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144 (71)
Water heating gains (Table 5)	140.7151	138.5323	134.4553	125.6926	120.2861	114.6508	111.2665	114.1800	117.5809	123.8328	132.2420	139.6083 (72)
Total internal gains	540.1621	552.7990	530.4412	513.3646	488.6354	469.4091	452.4404	453.0769	466.1181	483.6839	511.4157	529.3730 (73)

6. Solar gains

[Jan]	Area		Solar flux		Specific data		FF		Access		Gains	
	m2		Table 6a		g		Specific data		factor		W	
			W/m2		or Table 6b		or Table 6c		Table 6d			
North	4.4100		10.6334		0.6300		0.7000		0.7700		14.3312 (74)	
South	7.5600		46.7521		0.6300		0.7000		0.7700		108.0176 (78)	
Solar gains	122.3488	204.2926	271.8838	329.4418	366.1004	363.2140	350.2000	322.2014	291.3541	223.4100	145.7170	105.2843 (83)
Total gains	662.5109	757.0916	802.3251	842.8064	854.7358	832.6231	802.6404	775.2782	757.4722	707.0939	657.1327	634.6573 (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	25.9567	26.0283	26.0989	26.4358	26.4998	26.8019	26.8019	26.8586	26.6847	26.4998	26.3707	26.2370
alpha	2.7304	2.7352	2.7399	2.7624	2.7667	2.7868	2.7868	2.7906	2.7790	2.7667	2.7580	2.7491
util living area	0.9334	0.9055	0.8708	0.8055	0.7081	0.5654	0.4332	0.4621	0.6360	0.8126	0.9035	0.9395 (86)
MIT	18.8392	19.1543	19.5538	20.0699	20.5052	20.8151	20.9354	20.9208	20.7274	20.1823	19.4440	18.7914 (87)
Th 2	20.0067	20.0091	20.0115	20.0229	20.0250	20.0349	20.0349	20.0368	20.0311	20.0250	20.0207	20.0162 (88)
util rest of house	0.9243	0.8930	0.8532	0.7782	0.6649	0.4997	0.3484	0.3777	0.5743	0.7810	0.8887	0.9312 (89)
MIT 2	17.5003	17.8945	18.3931	19.0312	19.5448	19.8879	19.9976	19.9886	19.8002	19.1788	18.2712	17.4462 (90)
Living area fraction	fLA = Living area / (4) =											0.4205 (91)
MIT	18.0633	18.4243	18.8812	19.4680	19.9487	20.2778	20.3919	20.3806	20.1901	19.6008	18.7644	18.0119 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0633	18.4243	18.8812	19.4680	19.9487	20.2778	20.3919	20.3806	20.1901	19.6008	18.7644	18.0119 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9012	0.8683	0.8294	0.7606	0.6612	0.5171	0.3807	0.4089	0.5851	0.7653	0.8652	0.9092 (94)
Useful gains	597.0853	657.3844	665.4138	641.0624	565.1630	430.5085	305.6025	317.0013	443.2202	541.1691	568.5692	577.0030 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.0000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1203.3303	1179.1781	1076.5900	907.2144	706.4013	480.7551	321.0754	336.3366	517.9327	770.8119	1003.8107	1194.6744 (97)
Space heating kWh	451.0463	350.6454	305.9150	191.6294	105.0813	0.0000	0.0000	0.0000	0.0000	170.8542	313.3738	459.5476 (98a)
Space heating requirement - total per year (kWh/year)												2348.0930
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	451.0463	350.6454	305.9150	191.6294	105.0813	0.0000	0.0000	0.0000	0.0000	170.8542	313.3738	459.5476 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2348.0930
Space heating per m2												(98c) / (4) = 29.3512 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												
Efficiency of main space heating system 1 (in %)												
Efficiency of main space heating system 2 (in %)												
Efficiency of secondary/supplementary heating system, %												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	451.0463	350.6454	305.9150	191.6294	105.0813	0.0000	0.0000	0.0000	0.0000	170.8542	313.3738	459.5476 (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)	488.6742	379.8975	331.4356	207.6158	113.8476	0.0000	0.0000	0.0000	0.0000	185.1075	339.5166	497.8847 (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	237.6635	210.2523	223.6567	197.4670	191.9516	173.5569	171.7694	178.2888	179.9019	199.8878	211.6491	235.1869 (64)
Efficiency of water heater												79.8000 (216)

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(217)m	85.4734	85.1981	84.7626	83.9925	82.7676	79.8000	79.8000	79.8000	79.8000	83.7098	84.9383	85.5343	(217)
Fuel for water heating, kWh/month													
(233a)m	278.0554	246.7804	263.8624	235.1007	231.9162	217.4898	215.2499	223.4195	225.4409	238.7865	249.1799	274.9620	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	24.3235	19.5132	17.5695	12.8722	9.9428	8.1234	9.0702	11.7898	15.3137	20.0924	22.6944	24.9995	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.2969	-52.5119	-75.3791	-84.6330	-91.1561	-85.0432	-83.9913	-79.3464	-71.1273	-59.9927	-40.9790	-32.2535	(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	-21.2710	-44.7299	-88.8765	-133.4482	-176.4177	-177.2501	-175.1642	-148.3248	-108.7361	-63.9544	-28.3952	-16.8217	(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												2543.9795	(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												2900.2438	(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)												196.3046	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1977.1002	(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												3749.4276	(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	2543.9795	0.2100	534.2357 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2900.2438	0.2100	609.0512 (264)
Space and water heating			1143.2869 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	196.3046	0.1443	28.3328 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-793.7104	0.1346	-106.8461
PV Unit electricity exported	-1183.3898	0.1259	-148.9938
Total			-255.8399 (269)
Total CO2, kg/year			927.7090 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6000 (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	2543.9795	1.1300	2874.6968 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2900.2438	1.1300	3277.2755 (278)
Space and water heating			6151.9723 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	196.3046	1.5338	301.0985 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-793.7104	1.4975	-1188.5970
PV Unit electricity exported	-1183.3898	0.4622	-546.9101
Total			-1735.5071 (283)
Total Primary energy kWh/year			4847.6645 (286)
Target Primary Energy Rate (TPER)			60.6000 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.6000 (5)

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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												3 * 10 = 30.0000 (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) =												30.0000 / (5) = 0.1503 (8)	
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												1.0000 (17)	
Infiltration rate												0.2003 (18)	
Number of sides sheltered												2 (19)	
												Shelter factor	
Infiltration rate adjusted to include shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)	
												(21) = (18) x (20) = 0.1703 (21)	
												Wind speed	
	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	0.2171	0.2128	0.2086	0.1873	0.1830	0.1617	0.1617	0.1575	0.1703	0.1830	0.1915	0.2001	(22b)
												If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23b)	
Effective ac	0.5236	0.5226	0.5217	0.5175	0.5167	0.5131	0.5131	0.5124	0.5145	0.5167	0.5183	0.5200	(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						
Window (Uw = 1.20)			11.9700	1.1450	13.7061			(27)					
Door			2.1200	1.0000	2.1200			(26a)					
Floor 1 P/a 0.45			40.0000	0.1200	4.8000	110.0000	4400.0000	(28a)					
External Wall 1 Render	89.9200	14.0900	75.8300	0.1500	11.3745	9.0000	682.4700	(29a)					
External Roof 1 Horz	40.0000		40.0000	0.0900	3.6000	9.0000	360.0000	(30)					
Total net area of external elements Aum(A, m2)			169.9200					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	35.6006		(33)					
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000	(32)					
Internal Wall 1 GF			34.1300			9.0000	307.1700	(32c)					
Internal Wall 2 FF			60.2000			9.0000	541.8000	(32c)					
Internal Floor 1			40.0000			18.0000	720.0000	(32d)					
Internal Ceiling 1			40.0000			9.0000	360.0000	(32e)					
								Heat capacity Cm = Sum(A x k)					
								Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					
								(28)...(30) + (32) + (32a)...(32e) = 8169.8400 (34)					
								102.1230 (35)					
								List of Thermal Bridges					
K1 Element				Length	Psi-value		Total						
E16 Corner (normal)				9.9800	0.0300		0.2994						
E5 Ground floor (normal)				18.0000	0.0210		0.3780						
E10 Eaves (insulation at ceiling level)				10.0000	0.0440		0.4400						
E12 Gable (insulation at ceiling level)				8.0000	0.0510		0.4080						
E6 Intermediate floor within a dwelling				18.0000	0.0800		1.4400						
P1 Party wall - Ground floor				8.0000	0.1490		1.1920						
P2 Party wall - Intermediate floor within a dwelling				8.0000	0.0000		0.0000						
P4 Party wall - Roof (insulation at ceiling level)				8.0000	0.4800		3.8400						
E18 Party wall between dwellings				9.9800	0.0395		0.3942						
E2 Other lintels (including other steel lintels)				10.6100	0.0840		0.8912						
E3 Sill				9.6000	0.0430		0.4128						
E4 Jamb				23.1000	0.0340		0.7854						
								Thermal bridges (Sum(L x Psi) calculated using Appendix K)					
								Point Thermal bridges					
								(36a) = 0.0000					
								Total fabric heat loss (33) + (36) + (36a) = 46.0817 (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	34.4859	34.4256	34.3666	34.0891	34.0372	33.7956	33.7956	33.7508	33.8887	34.0372	34.1422	34.2520	(38)
Average = Sum(39)m / 12 =	80.5676	80.5073	80.4482	80.1708	80.1189	79.8772	79.8772	79.8325	79.9703	80.1189	80.2239	80.3337	(39)
	80.1705												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0071	1.0063	1.0056	1.0021	1.0015	0.9985	0.9985	0.9979	0.9996	1.0015	1.0028	1.0042	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4629 (42)	
Hot water usage for mixer showers												0.0000 (42a)	
Hot water usage for baths	28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	(42b)
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)
Average daily hot water use (litres/day)												62.4644 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	68.1485	66.2791	64.2381	61.6978	59.4316	57.0764	56.5871	58.6239	60.7129	63.1315	65.6943	68.0528	(44)
Energy content (annual)	107.9305	94.3805	98.7316	84.4612	80.0063	70.1821	68.4372	72.5886	74.8651	85.6688	93.5935	106.5542	(45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1037.3997	

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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	750.8460	591.0915	606.7269	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8134	0.8703	0.8523	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	610.7130	514.4395	517.0842	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	920.5062	887.3635	849.2288	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	223.0511	277.4554	247.1156	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 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	55.7628	69.3639	61.7789	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												186.9055 (107)
Energy for space heating												28.2525 (99)
Energy for space cooling												2.3363 (108)
Total												30.5888 (109)
Fabric Energy Efficiency (DFEE)												30.6 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 199.6000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1503 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4003 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3403 (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	0.4338	0.4253	0.4168	0.3743	0.3658	0.3232	0.3232	0.3147	0.3403	0.3658	0.3828	0.3998 (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	0.5941	0.5904	0.5869	0.5700	0.5669	0.5522	0.5522	0.5495	0.5579	0.5669	0.5733	0.5799 (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
TER Semi-glazed door			2.1200	1.0000	2.1200		(26a)
TER Opening Type (Uw = 1.20)			11.9700	1.1450	13.7061		(27)
Floor 1 P/a 0.45			40.0000	0.1300	5.2000		(28a)
External Wall 1 Render	89.9200	14.0900	75.8300	0.1800	13.6494		(29a)
External Roof 1 Horz	40.0000		40.0000	0.1100	4.4000		(30)
Total net area of external elements Aum(A, m ²)			169.9200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 39.0755		(33)
Party Wall 1			39.9200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							102.1230 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				9.9800	0.0900	0.8982	
E5 Ground floor (normal)				18.0000	0.1600	2.8800	
E10 Eaves (insulation at ceiling level)				10.0000	0.0600	0.6000	
E12 Gable (insulation at ceiling level)				8.0000	0.0600	0.4800	
E6 Intermediate floor within a dwelling				18.0000	0.0000	0.0000	
P1 Party wall - Ground floor				8.0000	0.0800	0.6400	

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P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.1200	0.9600
E18 Party wall between dwellings	9.9800	0.0600	0.5988
E2 Other lintels (including other steel lintels)	10.6100	0.0500	0.5305
E3 Sill	9.6000	0.0500	0.4800
E4 Jamb	23.1000	0.0500	1.1550

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 9.2225 (36)
 Total fabric heat loss (33) + (36) + (36a) = 48.2980 (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	39.1323	38.8916	38.6557	37.5476	37.3403	36.3751	36.3751	36.1964	36.7469	37.3403	37.7597	38.1982 (38)
Average = Sum(39)m / 12 =	87.4303	87.1897	86.9537	85.8456	85.6383	84.6731	84.6731	84.4944	85.0449	85.6383	86.0577	86.4962 (39)
												85.8446

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0929	1.0899	1.0869	1.0731	1.0705	1.0584	1.0584	1.0562	1.0631	1.0705	1.0757	1.0812 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4629 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	28.2006 (42b)
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	39.8522 (42c)
Average daily hot water use (litres/day)													62.4644 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	68.1485	66.2791	64.2381	61.6978	59.4316	57.0764	56.5871	58.6239	60.7129	63.1315	65.6943	68.0528 (44)	
Energy content (annual)	107.9305	94.3805	98.7316	84.4612	80.0063	70.1821	68.4372	72.5886	74.8651	85.6688	93.5935	106.5542 (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	91.7409	80.2234	83.9218	71.7920	68.0054	59.6548	58.1716	61.7003	63.6353	72.8185	79.5545	90.5711 (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	91.7409	80.2234	83.9218	71.7920	68.0054	59.6548	58.1716	61.7003	63.6353	72.8185	79.5545	90.5711 (64)	
12Total per year (kWh/year)													881.7897 (64)
Electric shower(s)	52.4656	46.7473	51.0463	48.7128	49.6269	47.3393	48.9172	49.6269	48.7128	51.0463	50.0864	52.4656	52.4656 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													596.7935 (64a)
Heat gains from water heating, kWh/month	36.0516	31.7427	33.7420	30.1262	29.4081	26.7485	26.7722	27.8318	28.0870	30.9662	32.4102	35.7592 (65)	

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

Metabolic gains (Table 5), Watts													
(66)m	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.0636	129.6061	117.0636	120.9657	117.0636	120.9657	117.0636	117.0636	120.9657	117.0636	120.9657	117.0636	117.0636 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582	209.7582 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143 (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	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144 (71)
Water heating gains (Table 5)	48.4565	47.2361	45.3522	41.8420	39.5270	37.1507	35.9841	37.4083	39.0098	41.6212	45.0142	48.0634	48.0634 (72)
Total internal gains	444.9035	458.5028	438.3381	426.5140	404.8763	391.9091	377.1581	376.3052	387.5470	398.4723	421.1879	434.8282	434.8282 (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	4.4100	10.6334	0.6300	0.7000	0.7700	14.3312 (74)						
South	7.5600	46.7521	0.6300	0.7000	0.7700	108.0176 (78)						
Solar gains	122.3488	204.2926	271.8838	329.4418	366.1004	363.2140	350.2000	322.2014	291.3541	223.4100	145.7170	105.2843 (83)
Total gains	567.2523	662.7954	710.2219	755.9558	770.9768	755.1230	727.3581	698.5065	678.9011	621.8823	566.9050	540.1125 (84)

7. Mean internal temperature (heating season)

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

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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	25.9567	26.0283	26.0989	26.4358	26.4998	26.8019	26.8019	26.8586	26.6847	26.4998	26.3707	26.2370
alpha	2.7304	2.7352	2.7399	2.7624	2.7667	2.7868	2.7868	2.7906	2.7790	2.7667	2.7580	2.7491
util living area	0.9523	0.9279	0.8974	0.8378	0.7463	0.6053	0.4701	0.5025	0.6797	0.8494	0.9286	0.9576 (86)
MIT	18.6386	18.9730	19.3961	19.9520	20.4281	20.7795	20.9205	20.9021	20.6749	20.0623	19.2703	18.5876 (87)
Th 2	20.0067	20.0091	20.0115	20.0229	20.0250	20.0349	20.0349	20.0368	20.0311	20.0250	20.0207	20.0162 (88)
util rest of house	0.9455	0.9178	0.8825	0.8131	0.7052	0.5387	0.3806	0.4138	0.6190	0.8216	0.9169	0.9515 (89)
MIT 2	17.8583	18.1870	18.6016	19.1436	19.5870	19.8962	19.9986	19.9894	19.8128	19.2587	18.4916	17.8146 (90)
Living area fraction									FLA = Living area / (4) =			0.4205 (91)
MIT	18.1864	18.5175	18.9357	19.4835	19.9407	20.2676	20.3862	20.3732	20.1753	19.5966	18.8190	18.1397 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1864	18.5175	18.9357	19.4835	19.9407	20.2676	20.3862	20.3732	20.1753	19.5966	18.8190	18.1397 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9291	0.8989	0.8631	0.7976	0.7012	0.5557	0.4144	0.4462	0.6288	0.8075	0.8990	0.9362 (94)
Useful gains	527.0587	595.7621	612.9975	602.9433	540.6456	419.6128	301.4501	311.6474	426.8662	502.1641	509.6480	505.6306 (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	1214.0937	1187.3083	1081.3333	908.5501	705.7201	479.8964	320.5923	335.7120	516.6725	770.4542	1008.5127	1205.7293 (97)
Space heating kWh	511.1541	397.5190	348.4418	220.0370	122.8154	0.0000	0.0000	0.0000	0.0000	199.6079	359.1826	520.8734 (98a)
Space heating requirement - total per year (kWh/year)												2679.6312
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	511.1541	397.5190	348.4418	220.0370	122.8154	0.0000	0.0000	0.0000	0.0000	199.6079	359.1826	520.8734 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2679.6312
Space heating per m2												(98c) / (4) = 33.4954 (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	795.9276	626.5813	642.1576	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7524	0.8193	0.7996	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	598.8555	513.3585	513.4473	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	832.9036	802.8996	771.5179	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	168.5146	215.4186	192.0046	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	42.1287	53.8547	48.0011	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												143.9845 (107)
Energy for space heating												33.4954 (99)
Energy for space cooling												1.7998 (108)
Total												35.2952 (109)
Fabric Energy Efficiency (TFEE)												35.3 (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	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.6000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door

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Measured/design AP50												1.0000 (17)
Infiltration rate												0.0500 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.0425 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Balanced mechanical ventilation with heat recovery	0.0542	0.0531	0.0521	0.0468	0.0457	0.0404	0.0404	0.0393	0.0425	0.0457	0.0478	0.0499 (22b)
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.1492	0.1481	0.1471	0.1417	0.1407	0.1354	0.1354	0.1343	0.1375	0.1407	0.1428	0.1449 (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
Window (Uw = 1.20)			11.9700	1.1450	13.7061		(27)
Door			2.1200	1.0000	2.1200		(26a)
Floor 1 P/a 0.45			40.0000	0.1200	4.8000	110.0000	4400.0000 (28a)
External Wall 1 Render	89.9200	14.0900	75.8300	0.1500	11.3745	9.0000	682.4700 (29a)
External Roof 1 Horz	40.0000		40.0000	0.0900	3.6000	9.0000	360.0000 (30)
Total net area of external elements Aum (A, m2)			169.9200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 35.6006		(33)
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000 (32)
Internal Wall 1 GF			34.1300			9.0000	307.1700 (32c)
Internal Wall 2 FF			60.2000			9.0000	541.8000 (32c)
Internal Floor 1			40.0000			18.0000	720.0000 (32d)
Internal Ceiling 1			40.0000			9.0000	360.0000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8169.8400 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 102.1230 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	9.9800	0.0300	0.2994
E5 Ground floor (normal)	18.0000	0.0210	0.3780
E10 Eaves (insulation at ceiling level)	10.0000	0.0440	0.4400
E12 Gable (insulation at ceiling level)	8.0000	0.0510	0.4080
E6 Intermediate floor within a dwelling	18.0000	0.0800	1.4400
P1 Party wall - Ground floor	8.0000	0.1490	1.1920
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.4800	3.8400
E18 Party wall between dwellings	9.9800	0.0395	0.3942
E2 Other lintels (including other steel lintels)	10.6100	0.0840	0.8912
E3 Sill	9.6000	0.0430	0.4128
E4 Jamb	23.1000	0.0340	0.7854

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.4810 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 46.0817 (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	9.8267	9.7567	9.6867	9.3368	9.2668	8.9169	8.9169	8.8469	9.0569	9.2668	9.4068	9.5467 (38)
Average = Sum(39)m / 12 =	55.9083	55.8384	55.7684	55.4184	55.3485	54.9985	54.9985	54.9286	55.1385	55.3485	55.4884	55.6284 (39)
												55.4009

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6989	0.6980	0.6971	0.6927	0.6919	0.6875	0.6875	0.6866	0.6892	0.6919	0.6936	0.6954 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4629 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	75.5424	74.4205	72.8406	69.9276	67.7463	65.3277	64.0212	65.5901	67.2982	69.8863	72.8593	75.2870 (42b)
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522 (42c)
Average daily hot water use (litres/day)												106.2689 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.3945	112.8235	109.7944	105.4322	101.8018	97.9340	96.6275	99.6456	102.8029	106.8401	111.2623	115.1391 (44)
Energy content (annual)	182.7567	160.6591	168.7499	144.3314	137.0448	120.4213	116.8626	123.3820	126.7662	144.9810	158.5135	180.2801 (45)
Distribution loss (46)m = 0.15 x (45)m	27.4135	24.0989	25.3125	21.6497	20.5567	18.0632	17.5294	18.5073	19.0149	21.7472	23.7770	27.0420 (46)

Water storage loss:
Store volume 250.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):
Temperature factor from Table 2b 1.6000 (48)

Enter (49) or (54) in (55)												0.5400 (49)
Total storage loss												0.8640 (55)
Primary loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
Combi loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (57)
Total heat required for water heating calculated for each month	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)
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)

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Space heating efficiency (main heating system 1)	194.3506	122.3480	86.7944	41.0717	15.0308	0.0000	0.0000	0.0000	0.0000	0.0000	38.3959	109.6702	197.9013	(98)
Space heating fuel (main heating system)	400.0453	400.0453	400.0453	400.0453	400.0453	0.0000	0.0000	0.0000	0.0000	0.0000	400.0453	400.0453	400.0453	(210)
Space heating efficiency (main heating system 2)	48.5822	30.5835	21.6961	10.2668	3.7573	0.0000	0.0000	0.0000	0.0000	0.0000	9.5979	27.4145	49.4697	(211)
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	0.0000	(212)
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	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	0.0000	(215)
Water heating requirement	232.8031	205.8623	218.7963	192.7634	187.0912	168.8533	166.9090	173.4284	175.1982	195.0274	206.9455	230.3265	204.6600	(64)
Efficiency of water heater (217)m	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	(216)
Fuel for water heating, kWh/month	113.7512	100.5875	106.9072	94.1871	91.4156	82.5043	81.5543	84.7398	85.6045	95.2934	101.1167	112.5410	204.6600	(217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.8300	10.6852	11.8300	11.4484	11.8300	11.4484	11.8300	11.8300	11.4484	11.8300	11.4484	11.8300	11.8300	(231)
Lighting	22.6332	18.1572	16.3485	11.9776	9.2519	7.5588	8.4399	10.9704	14.2495	18.6961	21.1172	23.2622	23.2622	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-45.9438	-65.8056	-96.0235	-108.8837	-118.3996	-110.5714	-109.1852	-102.7718	-90.5987	-75.2665	-50.6808	-39.5958	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	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	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-21.6730	-47.0274	-96.1439	-148.6586	-199.7721	-202.2422	-199.4943	-166.9231	-120.6265	-68.9754	-29.5225	-16.9879	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	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	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													201.3679	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													204.6600	(217)
Water heating fuel used													1150.2026	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)														
mechanical ventilation fans (SFP = 0.5720)													139.2889	(230a)
Total electricity for the above, kWh/year													139.2889	(231)
Electricity for lighting (calculated in Appendix L)													182.6625	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-2331.7732	(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													-658.2513	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	201.3679	16.4900	33.2056	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1150.2026	16.4900	189.6684	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	139.2889	16.4900	22.9687	(249)
Energy for lighting	182.6625	16.4900	30.1210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1013.7263	16.4900	-167.1635	
PV Unit electricity exported	-1318.0469	5.5900	-73.6788	
Total			-240.8423	(252)
Total energy cost			35.1215	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.1011	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	98.3604	
SAP rating (Section 12)		98	(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	201.3679	0.1569	31.6043	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1150.2026	0.1408	161.9882	(264)
Space and water heating			193.5926	(265)
Pumps, fans and electric keep-hot	139.2889	0.1387	19.3211	(267)
Energy for lighting	182.6625	0.1443	26.3638	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1013.7263	0.1344	-136.2032	

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PV Unit electricity exported	-1318.0469	0.1252	-164.9621
Total			-301.1653 (269)
Total CO2, kg/year			-61.8878 (272)
CO2 emissions per m2			-0.7700 (273)
EI value			100.6634
EI rating			101 (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	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.6000 (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												1.0000 (17)	
Infiltration rate												0.0500 (18)	
Number of sides sheltered												2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.0425 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(22)
	6.6000	6.2000	6.1000	5.6000	5.5000	4.7000	4.6000	4.5000	5.0000	5.8000	6.0000	6.5000	
Wind factor	1.6500	1.5500	1.5250	1.4000	1.3750	1.1750	1.1500	1.1250	1.2500	1.4500	1.5000	1.6250	(22a)
Adj infilt rate	0.0701	0.0659	0.0648	0.0595	0.0584	0.0499	0.0489	0.0478	0.0531	0.0616	0.0638	0.0691	(22b)
Balanced mechanical ventilation with heat recovery													0.5000 (23a)
If mechanical ventilation													0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													81.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													
Effective ac	0.1651	0.1609	0.1598	0.1545	0.1534	0.1449	0.1439	0.1428	0.1481	0.1566	0.1587	0.1641	(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
Window (Uw = 1.20)			11.9700	1.1450	13.7061		(27)
Door			2.1200	1.0000	2.1200		(26a)
Floor 1 P/a 0.45			40.0000	0.1200	4.8000	110.0000	4400.0000 (28a)
External Wall 1 Render	89.9200	14.0900	75.8300	0.1500	11.3745	9.0000	682.4700 (29a)
External Roof 1 Horz	40.0000		40.0000	0.0900	3.6000	9.0000	360.0000 (30)
Total net area of external elements Aum(A, m2)			169.9200				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	35.6006			
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000 (32)
Internal Wall 1 GF			34.1300			9.0000	307.1700 (32c)
Internal Wall 2 FF			60.2000			9.0000	541.8000 (32c)
Internal Floor 1			40.0000			18.0000	720.0000 (32d)
Internal Ceiling 1			40.0000			9.0000	360.0000 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =			8169.8400 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					102.1230 (35)		
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				9.9800	0.0300	0.2994	
E5 Ground floor (normal)				18.0000	0.0210	0.3780	
E10 Eaves (insulation at ceiling level)				10.0000	0.0440	0.4400	
E12 Gable (insulation at ceiling level)				8.0000	0.0510	0.4080	
E6 Intermediate floor within a dwelling				18.0000	0.0800	1.4400	
P1 Party wall - Ground floor				8.0000	0.1490	1.1920	
P2 Party wall - Intermediate floor within a dwelling				8.0000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)				8.0000	0.4800	3.8400	
E18 Party wall between dwellings				9.9800	0.0395	0.3942	
E2 Other lintels (including other steel lintels)				10.6100	0.0840	0.8912	
E3 Sill				9.6000	0.0430	0.4128	
E4 Jamb				23.1000	0.0340	0.7854	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4810 (36)

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Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	-1161.4689 (238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	118.7728	25.1600	29.8832 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1150.2026	25.1600	289.3910 (247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000 (247a)
Pumps, fans and electric keep-hot	139.2889	25.1600	35.0451 (249)
Energy for lighting	182.6625	25.1600	45.9579 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1119.2035	25.1600	-281.5916
PV Unit electricity exported	-1633.1922	5.8100	-94.8885
Total			-376.4801 (252)
Total energy cost			23.7971 (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	118.7728	0.1568	18.6192 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1150.2026	0.1408	161.9882 (264)
Space and water heating			180.6074 (265)
Pumps, fans and electric keep-hot	139.2889	0.1387	19.3211 (267)
Energy for lighting	182.6625	0.1443	26.3638 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1119.2035	0.1349	-150.9777
PV Unit electricity exported	-1633.1922	0.1260	-205.8050
Total			-356.7828 (269)
Total CO2, kg/year			-130.4904 (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	118.7728	1.5803	187.6996 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1150.2026	1.5208	1749.1725 (278)
Space and water heating			1936.8721 (279)
Pumps, fans and electric keep-hot	139.2889	1.5128	210.7162 (281)
Energy for lighting	182.6625	1.5338	280.1739 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1119.2035	1.4986	-1677.1900
PV Unit electricity exported	-1633.1922	0.4626	-755.4721
Total			-2432.6621 (283)
Total Primary energy kWh/year			-4.9000 (286)

SAP 10 EPC IMPROVEMENTS

SEC1 - ASHP ROI TF 0.15 improv

Current energy efficiency rating:	A 98
Current environmental impact rating:	A 101

N Solar water heating			Recommended
U Solar photovoltaic panels			Already installed
V2 Wind turbine			Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.7	-£ 69	-40 kg (30.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£69	0.50 kg/m²	A 100 A 101
Total Savings	£69	0.50 kg/m²	

Potential energy efficiency rating:	A 100
Potential environmental impact rating:	A 101

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South West England):

	Current £400	Potential £319	Saving £81
Electricity			
Space heating	£65	£85	-£20
Water heating	£289	£188	£102
Lighting	£46	£46	£0
Generated (PV)	-£376	-£364	-£12
Total cost of fuels	£24	-£45	£69
Total cost of uses	£24	-£45	£70

Full SAP Calculation Printout



Delivered energy	-15 kWh/m ²	-19 kWh/m ²	4 kWh/m ²
Carbon dioxide emissions	-0.1 tonnes	-0.2 tonnes	0.0 tonnes
CO2 emissions per m ²	-2 kg/m ²	-2 kg/m ²	1 kg/m ²
Primary energy	-0 kWh/m ²	-5 kWh/m ²	5 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	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.6000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			1.0000 (17)
Infiltration rate			0.0500 (18)
Number of sides sheltered			2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.0542	0.0531	0.0521	0.0468	0.0457	0.0404	0.0404	0.0393	0.0425	0.0457	0.0478	0.0499 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.1492	0.1481	0.1471	0.1417	0.1407	0.1354	0.1354	0.1343	0.1375	0.1407	0.1428	0.1449 (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
Window (Uw = 1.20)			11.9700	1.1450	13.7061		(27)
Door			2.1200	1.0000	2.1200		(26a)
Floor 1 P/a 0.45			40.0000	0.1200	4.8000	110.0000	4400.0000 (28a)
External Wall 1 Render	89.9200	14.0900	75.8300	0.1500	11.3745	9.0000	682.4700 (29a)
External Roof 1 Horz	40.0000		40.0000	0.0900	3.6000	9.0000	360.0000 (30)
Total net area of external elements Aum(A, m ²)			169.9200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	35.6006	(33)
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000 (32)
Internal Wall 1 GF			34.1300			9.0000	307.1700 (32c)
Internal Wall 2 FF			60.2000			9.0000	541.8000 (32c)
Internal Floor 1			40.0000			18.0000	720.0000 (32d)
Internal Ceiling 1			40.0000			9.0000	360.0000 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8169.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		102.1230 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	9.9800	0.0300	0.2994
E5 Ground floor (normal)	18.0000	0.0210	0.3780
E10 Eaves (insulation at ceiling level)	10.0000	0.0440	0.4400
E12 Gable (insulation at ceiling level)	8.0000	0.0510	0.4080
E6 Intermediate floor within a dwelling	18.0000	0.0800	1.4400
P1 Party wall - Ground floor	8.0000	0.1490	1.1920
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.4800	3.8400
E18 Party wall between dwellings	9.9800	0.0395	0.3942
E2 Other lintels (including other steel lintels)	10.6100	0.0840	0.8912
E3 Sill	9.6000	0.0430	0.4128
E4 Jamb	23.1000	0.0340	0.7854

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.4810 (36)
Point Thermal bridges		(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.0817 (37)

Full SAP Calculation Printout



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
	9.8267	7.7567	9.6867	9.3368	9.2668	8.9169	8.9169	8.8469	9.0569	9.2668	9.4068	9.5467 (38)
Heat transfer coeff	55.9083	55.8384	55.7684	55.4184	55.3485	54.9985	54.9985	54.9286	55.1385	55.3485	55.4884	55.6284 (39)
Average = Sum(39)m / 12 =												55.4009
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6989	0.6980	0.6971	0.6927	0.6919	0.6875	0.6875	0.6866	0.6892	0.6919	0.6936	0.6954 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4629 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												75.5424 (42b)
Hot water usage for other uses												39.8522 (42c)
Average daily hot water use (litres/day)												106.2689 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	115.3945	112.8235	109.7944	105.4322	101.8018	97.9340	96.6275	99.6456	102.8029	106.8401	111.2623	115.1391 (44)
Energy conte	182.7567	160.6591	168.7499	144.3314	137.0448	120.4213	116.8626	123.3820	126.7662	144.9810	158.5135	180.2801 (45)
Energy content (annual)												Total = Sum(45)m = 1764.7487
Distribution loss (46)m = 0.15 x (45)m												27.4135 (46)
Water storage loss:												250.0000 (47)
Store volume												1.6000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8640 (55)
Enter (49) or (54) in (55)												
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	232.8031	205.8623	217.4006	186.0098	174.2969	156.2465	153.8821	161.3320	169.7954	193.6317	206.9455	230.3265 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												599.3060 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												599.3060
Solar input	-0.0000	-16.2478	-57.1859	-77.6199	-99.9149	-91.8832	-91.1420	-80.4420	-56.3516	-28.5186	-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	232.8031	189.6145	160.2146	108.3899	74.3819	64.3633	62.7401	80.8900	113.4438	165.1131	206.9455	230.3265 (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	100.8037	89.5817	95.0299	81.3329	75.3691	68.7003	68.4724	71.3845	76.5731	87.1267	91.4513	99.9802 (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	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8578	22.9666	18.6777	14.1402	10.5700	8.9236	9.6423	12.5334	16.8223	21.3598	24.9301	26.5764 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.5232	330.9219	322.3573	304.1245	281.1088	259.4772	245.0260	241.6274	250.1919	268.4248	291.4405	313.0720 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400 (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)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144 (71)
Water heating gains (Table 5)	135.4889	133.3061	127.7283	112.9624	101.3025	95.4171	92.0328	95.9469	106.3515	117.1058	127.0158	134.3821 (72)
Total internal gains	590.3671	588.6919	570.2606	532.7243	494.4785	465.3152	448.1984	451.6049	474.8630	508.3876	544.8836	575.5277 (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	4.4100	10.6334	0.7600	0.7000	0.7700	17.2884 (74)
South	7.5600	46.7521	0.7600	0.7000	0.7700	130.3069 (78)

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Water heating fuel used	825.3817 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)	
mechanical ventilation fans (SFP = 0.5720)	139.2889 (230a)
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	219.2889 (231)
Electricity for lighting (calculated in Appendix L)	182.6625 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2331.7732 (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	-902.5998 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	201.8403	16.4900	33.2835 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	825.3817	16.4900	136.1054 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	139.2889	16.4900	22.9687 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	182.6625	16.4900	30.1210 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-969.5457	16.4900	-159.8781
PV Unit electricity exported	-1362.2275	5.5900	-76.1485
Total			-236.0266 (252)
Total energy cost			-0.3559 (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] = -0.0010 (257)
SAP value	100.0166
SAP rating (Section 12)	100 (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	201.8403	0.1569	31.6706 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	825.3817	0.1462	120.6641 (264)
Space and water heating			152.3347 (265)
Pumps, fans and electric keep-hot	219.2889	0.1387	30.4181 (267)
Energy for lighting	182.6625	0.1443	26.3638 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-969.5457	0.1349	-130.7572
PV Unit electricity exported	-1362.2275	0.1248	-169.9912
Total			-300.7484 (269)
Total CO2, kg/year			-91.6318 (272)
CO2 emissions per m2			-1.1500 (273)
EI value			100.9823
EI rating			101 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	199.6000 (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)

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 1.0000 (17)
 Infiltration rate 0.0500 (18)
 Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.0425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.6000	6.2000	6.1000	5.6000	5.5000	4.7000	4.6000	4.5000	5.0000	5.8000	6.0000	6.5000 (22)
Wind factor	1.6500	1.5500	1.5250	1.4000	1.3750	1.1750	1.1500	1.1250	1.2500	1.4500	1.5000	1.6250 (22a)
Adj infilt rate	0.0701	0.0659	0.0648	0.0595	0.0584	0.0499	0.0489	0.0478	0.0531	0.0616	0.0638	0.0691 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.1651	0.1609	0.1598	0.1545	0.1534	0.1449	0.1439	0.1428	0.1481	0.1566	0.1587	0.1641 (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
Window (Uw = 1.20)			11.9700	1.1450	13.7061		(27)
Door			2.1200	1.0000	2.1200		(26a)
Floor 1 P/a 0.45			40.0000	0.1200	4.8000	110.0000	4400.0000 (28a)
External Wall 1 Render	89.9200	14.0900	75.8300	0.1500	11.3745	9.0000	682.4700 (29a)
External Roof 1 Horz	40.0000		40.0000	0.0900	3.6000	9.0000	360.0000 (30)
Total net area of external elements Aum(A, m2)			169.9200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.6006		(33)
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000 (32)
Internal Wall 1 GF			34.1300			9.0000	307.1700 (32c)
Internal Wall 2 FF			60.2000			9.0000	541.8000 (32c)
Internal Floor 1			40.0000			18.0000	720.0000 (32d)
Internal Ceiling 1			40.0000			9.0000	360.0000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8169.8400 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 102.1230 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	9.9800	0.0300	0.2994
E5 Ground floor (normal)	18.0000	0.0210	0.3780
E10 Eaves (insulation at ceiling level)	10.0000	0.0440	0.4400
E12 Gable (insulation at ceiling level)	8.0000	0.0510	0.4080
E6 Intermediate floor within a dwelling	18.0000	0.0800	1.4400
P1 Party wall - Ground floor	8.0000	0.1490	1.1920
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.4800	3.8400
E18 Party wall between dwellings	9.9800	0.0395	0.3942
E2 Other lintels (including other steel lintels)	10.6100	0.0840	0.8912
E3 Sill	9.6000	0.0430	0.4128
E4 Jamb	23.1000	0.0340	0.7854

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.4810 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 46.0817 (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	10.8765	10.5965	10.5265	10.1766	10.1066	9.5467	9.4768	9.4068	9.7567	10.3166	10.4565	10.8065 (38)
Heat transfer coeff	56.9581	56.6782	56.6082	56.2583	56.1883	55.6284	55.5584	55.4884	55.8384	56.3982	56.5382	56.8881 (39)
Average = Sum(39)m / 12 =												56.2524

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.7120	0.7085	0.7076	0.7032	0.7024	0.6954	0.6945	0.6936	0.6980	0.7050	0.7067	0.7111 (40)
HLP (average)												0.7032
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4629 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	75.5424	74.4205	72.8406	69.9276	67.7463	65.3277	64.0212	65.5901	67.2982	69.8863	72.8593	75.2870 (42b)	
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522 (42c)	
Average daily hot water use (litres/day)													106.2689 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.3945	112.8235	109.7944	105.4322	101.8018	97.9340	96.6275	99.6456	102.8029	106.8401	111.2623	115.1391 (44)
Energy conte	182.7567	160.6591	168.7499	144.3314	137.0448	120.4213	116.8626	123.3820	126.7662	144.9810	158.5135	180.2801 (45)
Energy content (annual)												Total = Sum(45)m = 1764.7487
Distribution loss (46)m = 0.15 x (45)m	27.4135	24.0989	25.3125	21.6497	20.5567	18.0632	17.5294	18.5073	19.0149	21.7472	23.7770	27.0420 (46)
Water storage loss:												250.0000 (47)
Store volume												1.6000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8640 (55)
Enter (49) or (54) in (55)												

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Total energy cost

-45.1927 (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	119.1233	0.1567	18.6683 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	746.7240	0.1474	110.0354 (264)
Space and water heating			128.7037 (265)
Pumps, fans and electric keep-hot	219.2889	0.1387	30.4181 (267)
Energy for lighting	182.6625	0.1443	26.3638 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1055.5901	0.1355	-143.0780
PV Unit electricity exported	-1696.8056	0.1256	-213.1602
Total			-356.2382 (269)
Total CO2, kg/year			-170.7525 (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	119.1233	1.5801	188.2318 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	746.7240	1.5452	1153.8083 (278)
Space and water heating			1342.0401 (279)
Pumps, fans and electric keep-hot	219.2889	1.5128	331.7402 (281)
Energy for lighting	182.6625	1.5338	280.1739 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1055.5901	1.5010	-1584.4255
PV Unit electricity exported	-1696.8056	0.4611	-782.4457
Total			-2366.8712 (283)
Total Primary energy kWh/year			-412.9170 (286)