

Full SAP Calculation Printout



Property Reference	DE-15 P				Issued on Date	05/06/2025		
Assessment Reference	DE-15 P		Prop Type Ref		DE-15 P			
Property								
SAP Rating	92 A		DER	1.37		TER	7.51	
Environmental	99 A		% DER < TER				81.76	
CO ₂ Emissions (t/year)	0.08		DFEE	33.88		TFEE	34.99	
Compliance Check	See BREL		% DFEE < TFEE				3.17	
% DPER < TPER	44.60		DPER	21.78		TPER	39.31	
Assessor Details	Mr. Dominic Bibby					Assessor ID	U683-0001	
Client	client, .							

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		92.0000	(1b)	x	2.4000	(2b)	= 220.8000 (1b) - (3b)
First floor		82.0000	(1c)	x	2.6600	(2c)	= 218.1200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.0000						(4)
Dwelling volume					(3a) + (3b) + (3c) + (3d) + (3e) ... (3n)	=	438.9200 (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) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	4.0000 (17)
Number of sides sheltered	0.2000 (18)
	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Adj infilt rate	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174
Mechanical extract ventilation - decentralised												
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
fd			1.8900	1.4000	2.6460		(26)
w			39.4800	1.1450	45.2061		(27)
gf			92.0000	0.1200	11.0400		(28a)
External Wall 1	147.0000	41.3700	105.6300	0.2100	22.1823		(29a)
gf flat roof	10.0000		10.0000	0.1200	1.2000		(30)
sloped roof	8.0000		8.0000	0.1400	1.1200		(30)
flat c	75.8000		75.8000	0.1100	8.3380		(30)
Total net area of external elements Aum(A, m2)			332.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7324		(33)
Main dwelling							
Party Wall 1			50.0000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E2 Other lintels (including other steel lintels)	0.0000	0.0190	0.0000
E3 Sill	0.0000	0.0160	0.0000
E4 Jamb	0.0000	0.0170	0.0000
E5 Ground floor (normal)	44.0000	0.0540	2.3760
E6 Intermediate floor within a dwelling	39.0000	0.0080	0.3120
E10 Eaves (insulation at ceiling level)	0.0000	0.0480	0.0000
E11 Eaves (insulation at rafter level)	0.0000	0.0410	0.0000
E12 Gable (insulation at ceiling level)	0.0000	0.0560	0.0000
E13 Gable (insulation at rafter level)	0.0000	0.0580	0.0000
E16 Corner (normal)	0.0000	0.0400	0.0000
E17 Corner (inverted - internal area greater than external area)	0.0000	-0.0680	-0.0000
R1 Head of roof window	0.0000	0.1200	0.0000
R2 Sill of roof window	0.0000	0.1200	0.0000
R3 Jamb of roof window	0.0000	0.1200	0.0000
E14 Flat roof	0.0000	0.0460	0.0000
E18 Party wall between dwellings	0.0000	0.0360	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			2.6880 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =		94.4204 (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	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218 (38)
Heat transfer coeff												
	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422 (39)
Average = Sum(39)m / 12 =												166.8422
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589 (40)
HLP (average)												0.9589
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9679 (42)
Hot water usage for mixer showers													
	81.1267	79.8847	78.0543	75.2384	72.7155	69.1860	66.3943	69.6579	71.2994	74.7952	78.4358	81.0536 (42a)	
Hot water usage for baths													
	31.2258	30.7545	30.0839	29.0797	28.1746	26.9287	25.9835	27.1393	27.7459	28.9804	30.2639	31.2011 (42b)	
Hot water usage for other uses													
	45.0243	43.3870	41.7498	40.1125	38.4753	36.8380	36.8380	38.4753	40.1125	41.7498	43.3870	45.0243 (42c)	
Average daily hot water use (litres/day)												144.6775 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	157.3768	154.0262	149.8879	144.4306	139.3654	132.9527	129.2159	135.2725	139.1578	145.5254	152.0868	157.2789 (44)	
Energy conte	231.6859	203.8078	214.1868	188.6625	179.5864	153.7554	142.7873	159.2183	161.4161	187.5242	205.5503	230.9756 (45)	
Energy content (annual)										Total = Sum(45)m =		2259.1566	
Distribution loss (46)m = 0.15 x (45)m													
	34.7529	30.5712	32.1280	28.2994	26.9380	23.0633	21.4181	23.8827	24.2124	28.1286	30.8326	34.6463 (46)	
Water storage loss:													
Store volume												250.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												2.2200 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												1.1988 (55)	
Total storage loss													
	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (56)	
If cylinder contains dedicated solar storage													
	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (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													
	292.1111	258.3854	274.6120	247.1385	240.0116	212.2314	203.2125	219.6435	219.8921	247.9494	264.0263	291.4008 (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													
	292.1111	258.3854	274.6120	247.1385	240.0116	212.2314	203.2125	219.6435	219.8921	247.9494	264.0263	291.4008 (64)	
										Total per year (kWh/year) = Sum(64)m =		2970.6146 (64)	
12Total per year (kWh/year)												2971 (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													
	125.3757	111.4282	119.5573	109.5111	108.0526	97.9045	95.8170	101.2802	100.4517	110.6920	115.1263	125.1396 (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	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	174.2842	192.9575	174.2842	180.0937	174.2842	180.0937	174.2842	174.2842	180.0937	174.2842	180.0937	174.2842 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	345.6074	349.1937	340.1563	320.9167	296.6302	273.8042	258.5551	254.9688	264.0062	283.2458	307.5324	330.3583 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395 (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)												
	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160 (71)
Water heating gains (Table 5)												
	168.5158	165.8157	160.6952	152.0987	145.2321	135.9784	128.7862	136.1293	139.5162	148.7795	159.8976	168.1983 (72)
Total internal gains												
	758.9259	778.4855	745.6543	723.6276	686.6650	657.3949	629.1441	632.9009	651.1346	676.8281	718.0422	743.3593 (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	16.4500	10.6334	0.6300	0.7000	0.7700	53.4576 (74)
South	15.2600	46.7521	0.6300	0.7000	0.7700	218.0355 (78)
West	7.7700	19.6403	0.6300	0.7000	0.7700	46.6380 (80)

Solar gains	318.1311	550.4800	778.7085	1012.0631	1179.8913	1192.5801	1140.8800	1011.8615	858.6230	615.0158	382.5454	271.3205 (83)
Total gains	1077.0570	1328.9655	1524.3628	1735.6907	1866.5562	1849.9750	1770.0241	1644.7624	1509.7576	1291.8438	1100.5876	1014.6798 (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	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237
alpha	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282
util living area	0.9976	0.9916	0.9738	0.9097	0.7646	0.5670	0.4133	0.4637	0.7183	0.9472	0.9931	0.9983 (86)
MIT	20.1273	20.2917	20.4993	20.7362	20.8872	20.9378	20.9455	20.9444	20.9148	20.7019	20.3598	20.0898 (87)
Th 2	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178 (88)
util rest of house	0.9968	0.9889	0.9656	0.8837	0.7110	0.4933	0.3312	0.3763	0.6430	0.9259	0.9905	0.9977 (89)
MIT 2	19.0878	19.2971	19.5579	19.8419	20.0019	20.0445	20.0490	20.0486	20.0290	19.8087	19.3849	19.0399 (90)
Living area fraction	fLA = Living area / (4) =											0.0977 (91)
MIT	19.1893	19.3943	19.6499	19.9293	20.0884	20.1318	20.1366	20.1361	20.1155	19.8960	19.4802	19.1425 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1893	19.3943	19.6499	19.9293	20.0884	20.1318	20.1366	20.1361	20.1155	19.8960	19.4802	19.1425 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9956	0.9860	0.9601	0.8773	0.7091	0.4945	0.3330	0.3782	0.6428	0.9193	0.9879	0.9968 (94)
Useful gains	1072.3633	1310.3778	1463.5881	1522.6899	1323.5231	914.8310	589.4067	621.9894	970.4568	1187.5368	1087.2969	1011.4811 (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	2484.1711	2418.2543	2193.9598	1840.1536	1399.5413	922.9367	590.0591	623.3462	1003.6464	1550.9605	2065.5341	2493.0391 (97)
Space heating kWh	1050.3849	744.4930	543.3965	228.5739	56.5575	0.0000	0.0000	0.0000	0.0000	270.3873	704.3308	1102.2792 (98a)
Space heating requirement - total per year (kWh/year)												4700.4032
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	1050.3849	744.4930	543.3965	228.5739	56.5575	0.0000	0.0000	0.0000	0.0000	270.3873	704.3308	1102.2792 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4700.4032
Space heating per m2	(98c) / (4) =											27.0138 (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 %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1050.3849	744.4930	543.3965	228.5739	56.5575	0.0000	0.0000	0.0000	0.0000	270.3873	704.3308	1102.2792 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	478.9717	339.4861	247.7868	104.2289	25.7900	0.0000	0.0000	0.0000	0.0000	123.2956	321.1723	502.6353 (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	292.1111	258.3854	274.6120	247.1385	240.0116	212.2314	203.2125	219.6435	219.8921	247.9494	264.0263	291.4008 (64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	153.4197	135.7066	144.2290	129.7996	126.0565	111.4661	106.7293	115.3590	115.4896	130.2255	138.6693	153.0467 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	29.5616	26.7008	29.5616	28.6080	29.5616	28.6080	29.5616	29.5616	28.6080	29.5616	28.6080	29.5616 (231)
Lighting	40.4591	32.4578	29.2247	21.4112	16.5387	13.5122	15.0871	19.6108	25.4725	33.4213	37.7493	41.5836 (232)

Electricity generated by PVs (Appendix M) (negative quantity)	-55.3285	-88.8127	-143.7268	-170.7562	-184.2678	-170.2511	-166.7720	-154.2685	-129.0652	-103.0551	-63.3194	-46.2695 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-15.9363	-41.3212	-105.2204	-198.4501	-299.7563	-316.3266	-308.9053	-243.2896	-156.9260	-70.9667	-23.4821	-11.8017 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												2143.3667 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000

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Water heating fuel used	1560.1968	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (MEVDecentralised, DataSheet: total watage = 29.2500, total flow = 45.0000, SFP = 0.6500)		
mechanical ventilation fans (SFP = 0.6500)	348.0636	(230a)
Total electricity for the above, kWh/year	348.0636	(231)
Electricity for lighting (calculated in Appendix L)	326.5283	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3268.2753	(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	1109.8801	(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	2143.3667	0.1567	335.8053	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1560.1968	0.1409	219.8175	(264)
Space and water heating			555.6228	(265)
Pumps, fans and electric keep-hot	348.0636	0.1387	48.2807	(267)
Energy for lighting	326.5283	0.1443	47.1281	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1475.8928	0.1335	-197.0448	
PV Unit electricity exported	-1792.3824	0.1207	-216.3441	
Total			-413.3888	(269)
Total CO2, kg/year			237.6428	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.3700	(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	2143.3667	1.5800	3386.5137	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1560.1968	1.5210	2372.9997	(278)
Space and water heating			5759.5134	(279)
Pumps, fans and electric keep-hot	348.0636	1.5128	526.5506	(281)
Energy for lighting	326.5283	1.5338	500.8401	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1475.8928	1.4934	-2204.0818	
PV Unit electricity exported	-1792.3824	0.4428	-793.6663	
Total			-2997.7480	(283)
Total Primary energy kWh/year			3789.1560	(286)
Dwelling Primary energy Rate (DPER)			21.7800	(287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	92.0000 (1b)	x 2.4000 (2b)	= 220.8000 (1b) - (3b)	
First floor	82.0000 (1c)	x 2.6600 (2c)	= 218.1200 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.0000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	438.9200 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0911 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3411	(18)
Number of sides sheltered	1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)

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Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3155 (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	0.4023	0.3944	0.3865	0.3471	0.3392	0.2998	0.2998	0.2919	0.3155	0.3392	0.3550	0.3708	(22b)
Effective ac	0.5809	0.5778	0.5747	0.5602	0.5575	0.5449	0.5449	0.5426	0.5498	0.5575	0.5630	0.5687	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			39.4800	1.1450	45.2061			(27)
gf			92.0000	0.1300	11.9600			(28a)
External Wall 1	147.0000	41.3700	105.6300	0.1800	19.0134			(29a)
gf flat roof	10.0000		10.0000	0.1100	1.1000			(30)
sloped roof	8.0000		8.0000	0.1100	0.8800			(30)
flat c	75.8000		75.8000	0.1100	8.3380			(30)
Total net area of external elements Aum(A, m2)			332.8000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.3875			(33)
Main dwelling								
Party Wall 1			50.0000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	0.0000	0.0500	0.0000	
E3 Sill	0.0000	0.0500	0.0000	
E4 Jamb	0.0000	0.0500	0.0000	
E5 Ground floor (normal)	44.0000	0.1600	7.0400	
E6 Intermediate floor within a dwelling	39.0000	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	0.0000	0.0600	0.0000	
E11 Eaves (insulation at rafter level)	0.0000	0.0400	0.0000	
E12 Gable (insulation at ceiling level)	0.0000	0.0600	0.0000	
E13 Gable (insulation at rafter level)	0.0000	0.0800	0.0000	
E16 Corner (normal)	0.0000	0.0900	0.0000	
E17 Corner (inverted - internal area greater than external area)	0.0000	-0.0900	-0.0000	
R1 Head of roof window	0.0000	0.0800	0.0000	
R2 Sill of roof window	0.0000	0.0600	0.0000	
R3 Jamb of roof window	0.0000	0.0800	0.0000	
E14 Flat roof	0.0000	0.0800	0.0000	
E18 Party wall between dwellings	0.0000	0.0600	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				7.0400 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	95.4275 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	84.1443	83.6891	83.2429	81.1472	80.7551	78.9298	78.9298	78.5918	79.6329	80.7551	81.5483	82.3776	(38)
Heat transfer coeff	179.5718	179.1166	178.6704	176.5747	176.1826	174.3573	174.3573	174.0193	175.0604	176.1826	176.9758	177.8051	(39)
Average = Sum(39)m / 12 =												176.5728	
HLP	1.0320	1.0294	1.0268	1.0148	1.0125	1.0021	1.0021	1.0001	1.0061	1.0125	1.0171	1.0219	(40)
HLP (average)												1.0148	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9679 (42)
Hot water usage for mixer showers													
73.9818	72.8700	71.2499	68.1501	65.8625	63.3114	61.8614	63.4692	65.2318	67.9708	71.1372	73.6983	73.6983	(42a)
Hot water usage for baths													
31.9378	31.4635	30.7955	29.5640	28.6418	27.6192	27.0669	27.7302	28.4524	29.5465	30.8035	31.8298	31.8298	(42b)
Hot water usage for other uses													
45.0243	43.3870	41.7498	40.1125	38.4753	36.8380	36.8380	38.4753	40.1125	41.7498	43.3870	45.0243	45.0243	(42c)
Average daily hot water use (litres/day)												138.7513	(43)
Daily hot water use													
150.9439	147.7205	143.7952	137.8266	132.9796	127.7687	125.7663	129.6747	133.7966	139.2671	145.3277	150.5524	150.5524	(44)
Energy conte	239.0582	210.3520	221.0079	188.6777	179.0161	157.1065	152.1035	160.5644	164.9846	188.9842	207.0459	235.7287	(45)
Energy content (annual)										Total = Sum(45)m =		2304.6298	
Distribution loss (46)m = 0.15 x (45)m													
35.8587	31.5528	33.1512	28.3017	26.8524	23.5660	22.8155	24.0847	24.7477	28.3476	31.0569	35.3593	35.3593	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0208	(55)
Total storage loss													
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	(56)
If cylinder contains dedicated solar storage													
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	(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													
293.9650	259.9453	275.9147	241.8133	233.9229	210.2421	207.0103	215.4712	218.1202	243.8910	260.1815	290.6355	290.6355	(62)
WWHRS	-33.8214	-29.9119	-31.3220	-25.9359	-24.1713	-20.6836	-19.3875	-20.6167	-21.4000	-25.2282	-28.5805	-33.1951	(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													
260.1436	230.0333	244.5926	215.8774	209.7516	189.5586	187.6227	194.8545	196.7202	218.6627	231.6010	257.4405	257.4405	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2636.8588	(64)
Electric shower(s)												2637	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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													

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123.4123 109.6166 117.4105 105.2438 103.4483 94.7464 94.4998 97.3131 97.3659 106.7627 111.3513 122.3052 (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	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.2842	192.9575	174.2842	180.0937	174.2842	180.0937	174.2842	174.2842	180.0937	174.2842	180.0937	174.2842	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.6074	349.1937	340.1563	320.9167	296.6302	273.8042	258.5551	254.9688	264.0062	283.2458	307.5324	330.3583	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	(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)	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	(71)
Water heating gains (Table 5)	165.8767	163.1200	157.8099	146.1720	139.0434	131.5922	127.0159	130.7972	135.2304	143.4982	154.6545	164.3888	(72)
Total internal gains	756.2869	775.7898	742.7689	717.7009	680.4763	653.0087	627.3738	627.5687	646.8488	671.5468	712.7991	739.5498	(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	16.4500	10.6334	0.6300	0.7000	0.7700	53.4576 (74)
South	15.2600	46.7521	0.6300	0.7000	0.7700	218.0355 (78)
West	7.7700	19.6403	0.6300	0.7000	0.7700	46.6380 (80)

Solar gains	318.1311	550.4800	778.7085	1012.0631	1179.8913	1192.5801	1140.8800	1011.8615	858.6230	615.0158	382.5454	271.3205 (83)
Total gains	1074.4180	1326.2698	1521.4774	1729.7640	1860.3676	1845.5888	1768.2538	1639.4302	1505.4718	1286.5625	1095.3445	1010.8702 (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	67.2897	67.4607	67.6292	68.4318	68.5841	69.3021	69.3021	69.4368	69.0238	68.5841	68.2767	67.9583	
alpha	5.4860	5.4974	5.5086	5.5621	5.5723	5.6201	5.6201	5.6291	5.6016	5.5723	5.5518	5.5306	
util living area	0.9977	0.9924	0.9773	0.9216	0.7893	0.5900	0.4316	0.4838	0.7421	0.9540	0.9938	0.9983	(86)
MIT	19.7868	20.0126	20.3044	20.6574	20.8925	20.9829	20.9975	20.9954	20.9426	20.6177	20.1341	19.7523	(87)
Th 2	20.0567	20.0589	20.0610	20.0710	20.0729	20.0816	20.0816	20.0832	20.0783	20.0729	20.0691	20.0651	(88)
util rest of house	0.9969	0.9899	0.9699	0.8974	0.7353	0.5116	0.3427	0.3898	0.6648	0.9344	0.9913	0.9978	(89)
MIT 2	18.6362	18.9254	19.2950	19.7304	19.9860	20.0722	20.0808	20.0816	20.0411	19.6944	19.0893	18.5983	(90)
Living area fraction	fLA = Living area / (4) = 0.0977 (91)												
MIT	18.7486	19.0317	19.3936	19.8209	20.0746	20.1612	20.1704	20.1709	20.1292	19.7846	19.1914	18.7110	(92)
Temperature adjustment	0.0000												
adjusted MIT	18.7486	19.0317	19.3936	19.8209	20.0746	20.1612	20.1704	20.1709	20.1292	19.7846	19.1914	18.7110	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9862	0.9630	0.8897	0.7354	0.5186	0.3514	0.3989	0.6694	0.9266	0.9880	0.9966	(94)
Useful gains	1069.4073	1307.9155	1465.1201	1538.9023	1368.1833	957.1002	621.3795	653.9322	1007.7327	1192.1925	1082.1972	1007.4103	(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													
	2594.5595	2531.2152	2303.7001	1928.3627	1475.4518	969.6359	622.5224	656.2104	1055.4704	1618.1674	2139.8873	2580.1310	(97)
Space heating kWh													
	1134.7132	822.0574	623.9035	280.4115	79.8077	0.0000	0.0000	0.0000	0.0000	316.9253	761.5369	1170.1042	(98a)
Space heating requirement - total per year (kWh/year)												5189.4598	
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													
	1134.7132	822.0574	623.9035	280.4115	79.8077	0.0000	0.0000	0.0000	0.0000	316.9253	761.5369	1170.1042	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5189.4598	
Space heating per m2													
										(98c) / (4) =		29.8245	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)

0.0000 (201)

Fraction of space heat from main system(s)

1.0000 (202)

Efficiency of main space heating system 1 (in %)

92.3000 (206)

Efficiency of main space heating system 2 (in %)

0.0000 (207)

Efficiency of secondary/supplementary heating system, %

0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1134.7132	822.0574	623.9035	280.4115	79.8077	0.0000	0.0000	0.0000	0.0000	316.9253	761.5369	1170.1042	(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)	1229.3751	890.6364	675.9518	303.8045	86.4656	0.0000	0.0000	0.0000	0.0000	343.3644	825.0670	1267.7185	(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)

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Water heating													
Water heating requirement	260.1436	230.0333	244.5926	215.8774	209.7516	189.5586	187.6227	194.8545	196.7202	218.6627	231.6010	257.4405 (64)	
Efficiency of water heater												79.8000 (216)	
(217)m	86.9707	86.6630	86.0663	84.6473	82.0932	79.8000	79.8000	79.8000	79.8000	84.8912	86.5243	87.0299 (217)	
Fuel for water heating, kWh/month	299.1165	265.4344	284.1909	255.0315	255.5041	237.5421	235.1162	244.1785	246.5166	257.5801	267.6715	295.8069 (219)	
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)	
Lighting	36.2128	29.0513	26.1574	19.1641	14.8029	12.0941	13.5037	17.5526	22.7991	29.9136	33.7874	37.2193 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-77.1703	-104.5517	-144.4393	-155.7931	-162.4925	-149.5586	-147.4773	-141.7030	-131.0104	-116.0900	-83.2139	-67.2065 (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	-57.5358	-119.1045	-233.3487	-345.7936	-452.9272	-453.7160	-448.5804	-381.9408	-282.6754	-168.9883	-76.3469	-45.6665 (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												5622.3833 (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												3143.6894 (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)												292.2582 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4547.3305 (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												4597.0004 (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	5622.3833	0.2100	1180.7005 (261)	
Total CO2 associated with community systems			0.0000 (373)	
Water heating (other fuel)	3143.6894	0.2100	660.1748 (264)	
Space and water heating			1840.8753 (265)	
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)	
Energy for lighting	292.2582	0.1443	42.1819 (268)	
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1480.7064	0.1355	-200.6129	
PV Unit electricity exported	-3066.6241	0.1263	-387.2743	
Total			-587.8872 (269)	
Total CO2, kg/year			1307.0993 (272)	
EPC Target Carbon Dioxide Emission Rate (TER)			7.5100 (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	5622.3833	1.1300	6353.2931 (275)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	3143.6894	1.1300	3552.3690 (278)	
Space and water heating			9905.6621 (279)	
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)	
Energy for lighting	292.2582	1.5338	448.2754 (282)	
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1480.7064	1.5008	-2222.2111	
PV Unit electricity exported	-3066.6241	0.4636	-1421.6144	
Total			-3643.8255 (283)	
Total Primary energy kWh/year			6840.2128 (286)	
Target Primary Energy Rate (TPER)			39.3100 (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)	
Main dwelling	92.0000 (1b)	x 2.4000 (2b)	= 220.8000 (1b) - (3b)	

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First floor	82.0000 (1c)	x	2.6600 (2c)	=	218.1200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.0000				(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	438.9200 (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) =	0.0911 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2911	(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) =	0.2693 (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	0.3434	0.3366	0.3299	0.2962	0.2895	0.2558	0.2558	0.2491	0.2693	0.2895	0.3030	0.3164	(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	0.5589	0.5567	0.5544	0.5439	0.5419	0.5327	0.5327	0.5310	0.5363	0.5419	0.5459	0.5501	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
fd			1.8900	1.4000	2.6460		(26)
w			39.4800	1.1450	45.2061		(27)
gf			92.0000	0.1200	11.0400		(28a)
External Wall 1	147.0000	41.3700	105.6300	0.2100	22.1823		(29a)
gf flat roof	10.0000		10.0000	0.1200	1.2000		(30)
sloped roof	8.0000		8.0000	0.1400	1.1200		(30)
flat c	75.8000		75.8000	0.1100	8.3380		(30)
Total net area of external elements Aum(A, m2)			332.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7324		(33)
Main dwelling							
Party Wall 1			50.0000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	0.0000	0.0190	0.0000	
E2 Other lintels (including other steel lintels)	0.0000	0.0160	0.0000	
E3 Sill	0.0000	0.0170	0.0000	
E4 Jamb	0.0000	0.0540	2.3760	
E5 Ground floor (normal)	44.0000	0.0080	0.3120	
E6 Intermediate floor within a dwelling	39.0000	0.0480	0.0000	
E10 Eaves (insulation at ceiling level)	0.0000	0.0410	0.0000	
E11 Eaves (insulation at rafter level)	0.0000	0.0560	0.0000	
E12 Gable (insulation at ceiling level)	0.0000	0.0580	0.0000	
E13 Gable (insulation at rafter level)	0.0000	0.0400	0.0000	
E16 Corner (normal)	0.0000	-0.0680	-0.0000	
E17 Corner (inverted - internal area greater than external area)	0.0000	0.1200	0.0000	
R1 Head of roof window	0.0000	0.1200	0.0000	
R2 Sill of roof window	0.0000	0.1200	0.0000	
R3 Jamb of roof window	0.0000	0.1200	0.0000	
E14 Flat roof	0.0000	0.0460	0.0000	
E18 Party wall between dwellings	0.0000	0.0360	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				2.6880 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	94.4204 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	80.9598	80.6282	80.3033	78.7769	78.4913	77.1618	77.1618	76.9156	77.6739	78.4913	79.0690	79.6730	(38)
Heat transfer coeff	175.3802	175.0487	174.7237	173.1973	172.9117	171.5822	171.5822	171.3361	172.0943	172.9117	173.4894	174.0934	(39)
Average = Sum(39)m / 12 =												173.1959	
HLP	1.0079	1.0060	1.0042	0.9954	0.9937	0.9861	0.9861	0.9847	0.9890	0.9937	0.9971	1.0005	(40)
HLP (average)												0.9954	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9679 (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	31.2258	30.7545	30.0839	29.0797	28.1746	26.9287	25.9835	27.1393	27.7459	28.9804	30.2639	31.2011	(42b)
Hot water usage for other uses	45.0243	43.3870	41.7498	40.1125	38.4753	36.8380	36.8380	38.4753	40.1125	41.7498	43.3870	45.0243	(42c)
Average daily hot water use (litres/day)												69.8849	(43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.2501	74.1415	71.8337	69.1922	66.6499	63.7668	62.8216	65.6146	67.8585	70.7302	73.6509	76.2253	(44)
Energy conte	112.2533	98.1042	102.6488	90.3823	85.8851	73.7441	69.4197	77.2296	78.7124	91.1430	99.5417	111.9425	(45)
Energy content (annual)	Total = Sum(45)m = 1091.0068												
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	95.4153	83.3886	87.2515	76.8249	73.0024	62.6825	59.0067	65.6452	66.9056	77.4716	84.6104	95.1511	(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	95.4153	83.3886	87.2515	76.8249	73.0024	62.6825	59.0067	65.6452	66.9056	77.4716	84.6104	95.1511	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 927.3558 (64)												927 (64)
Electric shower(s)	59.2471	52.7896	57.6443	55.0092	56.0414	53.4581	55.2400	56.0414	55.0092	57.6443	56.5603	59.2471	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 673.9321 (64a)												673.9321 (64a)	
Heat gains from water heating, kWh/month	38.6656	34.0446	36.2239	32.9585	32.2610	29.0352	28.5617	30.4217	30.4787	33.7790	35.2927	38.5996	(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	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.2842	192.9575	174.2842	180.0937	174.2842	180.0937	174.2842	174.2842	180.0937	174.2842	180.0937	174.2842	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.6074	349.1937	340.1563	320.9167	296.6302	273.8042	258.5551	254.9688	264.0062	283.2458	307.5324	330.3583	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	(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)	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	(71)
Water heating gains (Table 5)	51.9699	50.6615	48.6881	45.7758	43.3615	40.3266	38.3894	40.8893	42.3315	45.4018	49.0176	51.8811	(72)
Total internal gains	639.3800	660.3313	630.6471	614.3047	581.7944	561.7431	538.7472	537.6609	553.9500	570.4504	604.1622	624.0421	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W	
North	16.4500	10.6334	0.6300	0.7000	0.7700	53.4576	(74)
South	15.2600	46.7521	0.6300	0.7000	0.7700	218.0355	(78)
West	7.7700	19.6403	0.6300	0.7000	0.7700	46.6380	(80)

Solar gains	318.1311	550.4800	778.7085	1012.0631	1179.8913	1192.5801	1140.8800	1011.8615	858.6230	615.0158	382.5454	271.3205	(83)
Total gains	957.5111	1210.8113	1409.3556	1626.3678	1761.6857	1754.3232	1679.6273	1549.5223	1412.5730	1185.4661	986.7076	895.3626	(84)

7. Mean internal temperature (heating season)

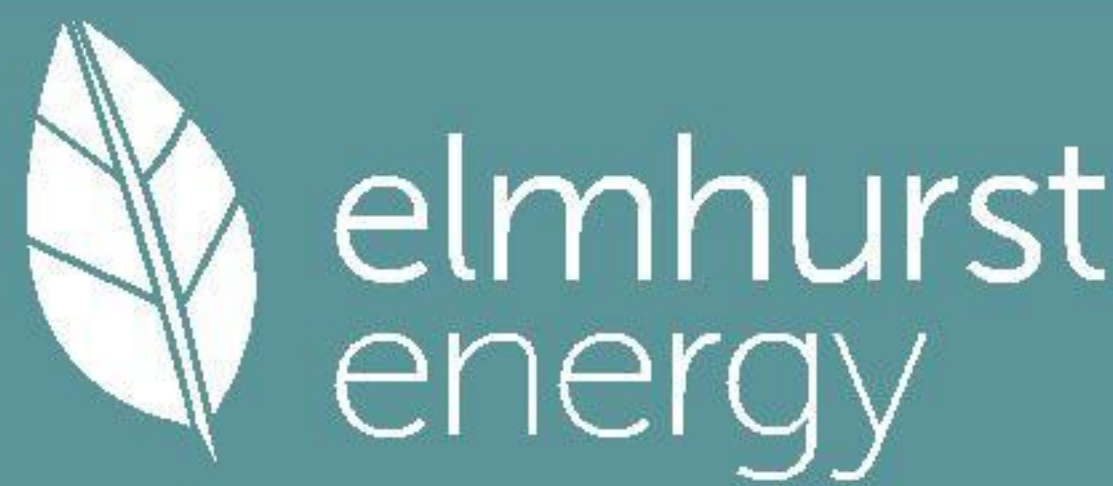
Temperature during heating periods in the living area from Table 9, Th1 (C)

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	68.8979	69.0284	69.1568	69.7663	69.8815	70.4230	70.4230	70.5242	70.2134	69.8815	69.6488	69.4072
alpha	5.5932	5.6019	5.6105	5.6511	5.6588	5.6949	5.6949	5.7016	5.6809	5.6588	5.6433	5.6271
util living area	0.9987	0.9950	0.9831	0.9344	0.8085	0.6090	0.4469	0.5033	0.7678	0.9656	0.9962	0.9991 (86)
MIT	19.7525	19.9791	20.2735	20.6349	20.8835	20.9811	20.9972	20.9947	20.9347	20.5856	20.0947	19.7142 (87)
Th 2	20.0767	20.0783	20.0799	20.0872	20.0885	20.0949	20.0949	20.0961	20.0925	20.0885	20.0858	20.0829 (88)
util rest of house	0.9983	0.9933	0.9774	0.9132	0.7566	0.5301	0.3564	0.4072	0.6925	0.9502	0.9947	0.9988 (89)
MIT 2	18.9313	19.1583	19.4500	19.8004	20.0140	20.0867	20.0942	20.0947	20.0588	19.7624	19.2800	18.8981 (90)
Living area fraction	fLA = Living area / (4) =											0.0977 (91)
MIT	19.0116	19.2385	19.5305	19.8819	20.0990	20.1741	20.1825	20.1826	20.1444	19.8428	19.3596	18.9778 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.0116	19.2385	19.5305	19.8819	20.0990	20.1741	20.1825	20.1826	20.1444	19.8428	19.3596	18.9778 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9912	0.9730	0.9075	0.7573	0.5372	0.3652	0.4166	0.6972	0.9448	0.9929	0.9983	(94)
Useful gains	955.1534	1200.1667	1371.3426	1475.9913	1334.1184	942.4340	613.4118	645.4698	984.8214	1120.0568	979.7301	893.8238	(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	2580.1160	2509.9285	2276.7355	1902.0392	1452.2820	956.4188	614.6857	648.0954	1040.1996	1598.1959	2126.9127	2572.7203	(97)
Space heating kWh	1208.9722	880.1600	673.6123	306.7545	87.9138	0.0000	0.0000	0.0000	0.0000	355.7355	825.9715	1249.0990	(98a)
Space heating requirement - total per year (kWh/year)	5588.2187												
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												

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Space heating kWh	1208.9722	880.1600	673.6123	306.7545	87.9138	0.0000	0.0000	0.0000	0.0000	355.7355	825.9715	1249.0990 (98c)
Space heating requirement after solar contribution – total per year (kWh/year)												5588.2187
Space heating per m2												(98c) / (4) = 32.1162 (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	1612.8731	1269.7086	1302.1540	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9218	0.9633	0.9438	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1486.7846	1223.1533	1229.0053	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1973.2969	1889.3993	1740.6861	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	350.2889	495.6870	380.6905	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	87.5722	123.9217	95.1726	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												306.6666 (107)
Energy for space heating												32.1162 (99)
Energy for space cooling												1.7625 (108)
Total												33.8787 (109)
Fabric Energy Efficiency (DFEE)												33.9 (109)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	92.0000 (1b)	x 2.4000 (2b)	= 220.8000 (1b) – (3b)
First floor	82.0000 (1c)	x 2.6600 (2c)	= 218.1200 (1c) – (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	438.9200 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0911 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3411 (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) = 0.3155 (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	0.4023	0.3944	0.3865	0.3471	0.3392	0.2998	0.2998	0.2919	0.3155	0.3392	0.3550	0.3708 (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	0.5809	0.5778	0.5747	0.5602	0.5575	0.5449	0.5449	0.5426	0.5498	0.5575	0.5630	0.5687 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type			39.4800	1.1450	45.2061		(27)
gf			92.0000	0.1300	11.9600		(28a)
External Wall 1	147.0000	41.3700	105.6300	0.1800	19.0134		(29a)
gf flat roof	10.0000		10.0000	0.1100	1.1000		(30)
sloped roof	8.0000		8.0000	0.1100	0.8800		(30)
flat c	75.8000		75.8000	0.1100	8.3380		(30)
Total net area of external elements Aum(A, m2)			332.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		88.3875		(33)
Main dwelling							

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Party Wall 1	50.0000	0.0000	0.0000	(32)									
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				250.0000 (35)									
List of Thermal Bridges													
K1 Element		Length	Psi-value	Total									
E2 Other lintels (including other steel lintels)		0.0000	0.0500	0.0000									
E3 Sill		0.0000	0.0500	0.0000									
E4 Jamb		0.0000	0.0500	0.0000									
E5 Ground floor (normal)		44.0000	0.1600	7.0400									
E6 Intermediate floor within a dwelling		39.0000	0.0000	0.0000									
E10 Eaves (insulation at ceiling level)		0.0000	0.0600	0.0000									
E11 Eaves (insulation at rafter level)		0.0000	0.0400	0.0000									
E12 Gable (insulation at ceiling level)		0.0000	0.0600	0.0000									
E13 Gable (insulation at rafter level)		0.0000	0.0800	0.0000									
E16 Corner (normal)		0.0000	0.0900	0.0000									
E17 Corner (inverted - internal area greater than external area)		0.0000	-0.0900	-0.0000									
R1 Head of roof window		0.0000	0.0800	0.0000									
R2 Sill of roof window		0.0000	0.0600	0.0000									
R3 Jamb of roof window		0.0000	0.0800	0.0000									
E14 Flat roof		0.0000	0.0800	0.0000									
E18 Party wall between dwellings		0.0000	0.0600	0.0000									
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				7.0400 (36)									
Point Thermal bridges				(36a) = 0.0000									
Total fabric heat loss			(33) + (36) + (36a) =	95.4275 (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)
Heat transfer coeff	84.1443	83.6891	83.2429	81.1472	80.7551	78.9298	78.9298	78.5918	79.6329	80.7551	81.5483	82.3776	(39)
Average = Sum(39)m / 12 =	179.5718	179.1166	178.6704	176.5747	176.1826	174.3573	174.3573	174.0193	175.0604	176.1826	176.9758	177.8051	176.5728
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	1.0320	1.0294	1.0268	1.0148	1.0125	1.0021	1.0021	1.0001	1.0061	1.0125	1.0171	1.0219	1.0148
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9679 (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	31.9378	31.4635	30.7955	29.5640	28.6418	27.6192	27.0669	27.7302	28.4524	29.5465	30.8035	31.8298	(42b)
Hot water usage for other uses	45.0243	43.3870	41.7498	40.1125	38.4753	36.8380	36.8380	38.4753	40.1125	41.7498	43.3870	45.0243	(42c)
Average daily hot water use (litres/day)													70.5425 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	76.9621	74.8505	72.5453	69.6765	67.1171	64.4573	63.9049	66.2055	68.5649	71.2963	74.1905	76.8541	(44)
Energy content (annual)	121.8891	106.5861	111.4995	95.3837	90.3525	79.2577	77.2875	81.9762	84.5474	96.7484	105.6979	120.3350	(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	103.6058	90.5982	94.7745	81.0761	76.7996	67.3691	65.6944	69.6798	71.8653	82.2362	89.8433	102.2847	(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	103.6058	90.5982	94.7745	81.0761	76.7996	67.3691	65.6944	69.6798	71.8653	82.2362	89.8433	102.2847	(64)
12Total per year (kWh/year)													995.8268 (64)
Electric shower(s)	59.2471	52.7896	57.6443	55.0092	56.0414	53.4581	55.2400	56.0414	55.0092	57.6443	56.5603	59.2471	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													673.9321 (64a)
Heat gains from water heating, kWh/month	40.7132	35.8470	38.1047	34.0213	33.2103	30.2068	30.2336	31.4303	31.7186	34.9701	36.6009	40.3830	(65)

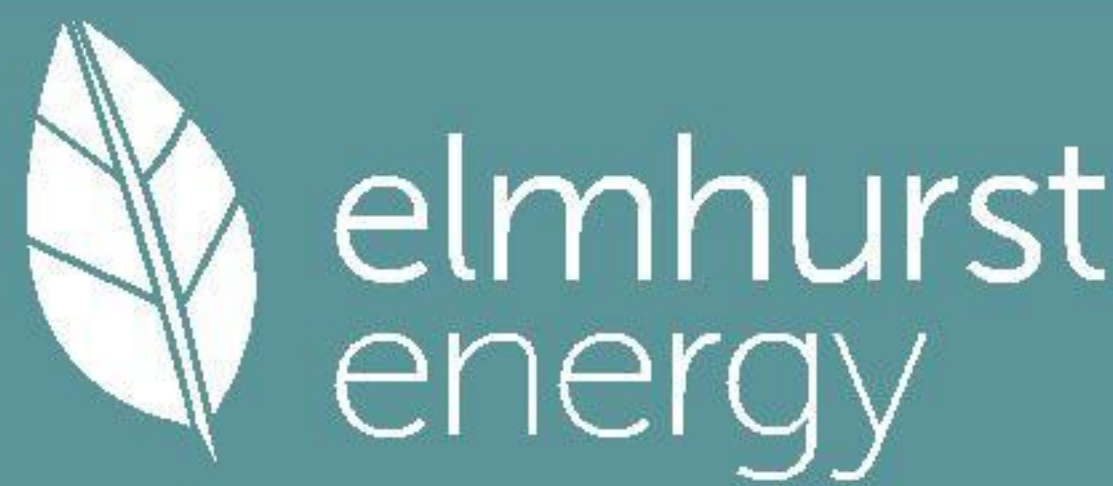
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	148.3950	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	174.2842	192.9575	174.2842	180.0937	174.2842	180.0937	174.2842	174.2842	180.0937	174.2842	180.0937	174.2842	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	345.6074	349.1937	340.1563	320.9167	296.6302	273.8042	258.5551	254.9688	264.0062	283.2458	307.5324	330.3583	(69)
Pumps, fans	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	37.8395	(70)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(71)
Water heating gains (Table 5)	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	(72)
Total internal gains	54.7221	53.3437	51.2160	47.2518	44.6375	41.9539	40.6366	42.2450	44.0536	47.0028	50.8346	54.2782	(73)
	642.1322	663.0135	633.1750	615.7808	583.0704	563.3703	540.9944	539.0166	555.6721	572.0514	605.9792	626.4392	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W
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		W/m2	or Table 6b	or Table 6c	Table 6d	
North	16.4500	10.6334	0.6300	0.7000	0.7700	53.4576 (74)
South	15.2600	46.7521	0.6300	0.7000	0.7700	218.0355 (78)
West	7.7700	19.6403	0.6300	0.7000	0.7700	46.6380 (80)

Solar gains	318.1311	550.4800	778.7085	1012.0631	1179.8913	1192.5801	1140.8800	1011.8615	858.6230	615.0158	382.5454	271.3205	(83)
Total gains	960.2633	1213.4935	1411.8835	1627.8439	1762.9616	1755.9504	1681.8745	1550.8781	1414.2951	1187.0672	988.5245	897.7596	(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	67.2897	67.4607	67.6292	68.4318	68.5841	69.3021	69.3021	69.4368	69.0238	68.5841	68.2767	67.9583
alpha	5.4860	5.4974	5.5086	5.5621	5.5723	5.6201	5.6201	5.6291	5.6016	5.5723	5.5518	5.5306
util living area	0.9987	0.9950	0.9836	0.9370	0.8152	0.6164	0.4531	0.5100	0.7745	0.9667	0.9962	0.9991 (86)
MIT	19.7157	19.9441	20.2425	20.6139	20.8727	20.9788	20.9968	20.9940	20.9288	20.5673	20.0686	19.6815 (87)
Th 2	20.0567	20.0589	20.0610	20.0710	20.0729	20.0816	20.0816	20.0832	20.0783	20.0729	20.0691	20.0651 (88)
util rest of house	0.9982	0.9934	0.9780	0.9162	0.7634	0.5360	0.3602	0.4116	0.6987	0.9516	0.9947	0.9988 (89)
MIT 2	18.8788	19.1079	19.4043	19.7671	19.9912	20.0724	20.0808	20.0816	20.0413	19.7321	19.2408	18.8513 (90)
Living area fraction	fLA = Living area / (4) =											0.0977 (91)
MIT	18.9606	19.1896	19.4862	19.8499	20.0773	20.1610	20.1703	20.1707	20.1280	19.8137	19.3217	18.9325 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.9606	19.1896	19.4862	19.8499	20.0773	20.1610	20.1703	20.1707	20.1280	19.8137	19.3217	18.9325 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9912	0.9736	0.9103	0.7637	0.5432	0.3693	0.4212	0.7032	0.9461	0.9929	0.9982	(94)
Useful gains	957.8472	1202.8631	1374.5935	1481.8072	1346.3722	953.8664	621.0373	653.1824	994.5356	1123.1223	981.5355	896.1774	(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	2632.6262	2559.4994	2320.2490	1933.4695	1475.9409	969.5971	622.5099	656.1801	1055.2699	1623.2907	2162.9406	2619.5061	(97)
Space heating kWh	1246.0355	911.6596	703.5677	325.1969	96.3991	0.0000	0.0000	0.0000	0.0000	372.1253	850.6117	1282.1565	(98a)
Space heating requirement - total per year (kWh/year)	5787.7523												
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	1246.0355	911.6596	703.5677	325.1969	96.3991	0.0000	0.0000	0.0000	0.0000	372.1253	850.6117	1282.1565	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5787.7523												
Space heating per m2	(98c) / (4) =											33.2629 (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	1638.9586	1290.2440	1322.5465	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9159	0.9598	0.9391	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1501.0695	1238.3582	1242.0439	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1974.9242	1891.6465	1742.0418	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	341.1754	486.0465	371.9985	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	85.2938	121.5116	92.9996	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												299.8051 (107)
Energy for space heating												33.2629 (99)
Energy for space cooling												1.7230 (108)
Total												34.9860 (109)
Fabric Energy Efficiency (TFEE)												35.0 (109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	92.0000 (1b)	x 2.4000 (2b)	= 220.8000 (1b) - (3b)
First floor	82.0000 (1c)	x 2.6600 (2c)	= 218.1200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 438.9200 (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	Air changes per hour / (5) =	0.0000 (8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.2000	(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) =	0.1850 (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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)
Mechanical extract ventilation - decentralised													
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
fd			1.8900	1.4000	2.6460		(26)
w			39.4800	1.1450	45.2061		(27)
gf			92.0000	0.1200	11.0400		(28a)
External Wall 1	147.0000	41.3700	105.6300	0.2100	22.1823		(29a)
gf flat roof	10.0000		10.0000	0.1200	1.2000		(30)
sloped roof	8.0000		8.0000	0.1400	1.1200		(30)
flat c	75.8000		75.8000	0.1100	8.3380		(30)
Total net area of external elements Aum(A, m2)			332.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7324		(33)
Main dwelling							
Party Wall 1			50.0000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
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List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	0.0000	0.0190	0.0000
E3 Sill	0.0000	0.0160	0.0000
E4 Jamb	0.0000	0.0170	0.0000
E5 Ground floor (normal)	44.0000	0.0540	2.3760
E6 Intermediate floor within a dwelling	39.0000	0.0080	0.3120
E10 Eaves (insulation at ceiling level)	0.0000	0.0480	0.0000
E11 Eaves (insulation at rafter level)	0.0000	0.0410	0.0000
E12 Gable (insulation at ceiling level)	0.0000	0.0560	0.0000
E13 Gable (insulation at rafter level)	0.0000	0.0580	0.0000
E16 Corner (normal)	0.0000	0.0400	0.0000
E17 Corner (inverted - internal area greater than external area)	0.0000	-0.0680	-0.0000
R1 Head of roof window	0.0000	0.1200	0.0000
R2 Sill of roof window	0.0000	0.1200	0.0000
R3 Jamb of roof window	0.0000	0.1200	0.0000
E14 Flat roof	0.0000	0.0460	0.0000
E18 Party wall between dwellings	0.0000	0.0360	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			2.6880 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =		94.4204 (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)
Heat transfer coeff	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	
Average = Sum(39)m / 12 =	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	(39)
													166.8422
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	(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												2.9679 (42)
Hot water usage for mixer showers												
81.1267	79.8847	78.0543	75.2384	72.7155	69.1860	66.3943	69.6579	71.2994	74.7952	78.4358	81.0536 (42a)	
Hot water usage for baths												
31.2258	30.7545	30.0839	29.0797	28.1746	26.9287	25.9835	27.1393	27.7459	28.9804	30.2639	31.2011 (42b)	
Hot water usage for other uses												
45.0243	43.3870	41.7498	40.1125	38.4753	36.8380	36.8380	38.4753	40.1125	41.7498	43.3870	45.0243 (42c)	
Average daily hot water use (litres/day)												144.6775 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
157.3768	154.0262	149.8879	144.4306	139.3654	132.9527	129.2159	135.2725	139.1578	145.5254	152.0868	157.2789	(44)
Energy conte	231.6859	203.8078	214.1868	188.6625	179.5864	153.7554	142.7873	159.2183	161.4161	187.5242	205.5503	230.9756 (45)
Energy content (annual)										Total = Sum(45)m =	2259.1566	
Distribution loss (46)m = 0.15 x (45)m												
34.7529	30.5712	32.1280	28.2994	26.9380	23.0633	21.4181	23.8827	24.2124	28.1286	30.8326	34.6463 (46)	

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Water storage loss:												
Store volume											250.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):											2.2200 (48)	
Temperature factor from Table 2b											0.5400 (49)	
Enter (49) or (54) in (55)											1.1988 (55)	
Total storage loss												
	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (56)
If cylinder contains dedicated solar storage												
	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (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												
	292.1111	258.3854	274.6120	247.1385	240.0116	212.2314	203.2125	219.6435	219.8921	247.9494	264.0263	291.4008 (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												
	292.1111	258.3854	274.6120	247.1385	240.0116	212.2314	203.2125	219.6435	219.8921	247.9494	264.0263	291.4008 (64)
Total per year (kWh/year) = Sum(64)m =											2970.6146 (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												
	125.3757	111.4282	119.5573	109.5111	108.0526	97.9045	95.8170	101.2802	100.4517	110.6920	115.1263	125.1396 (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	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	46.2328	41.0635	33.3951	25.2822	18.8988	15.9551	17.2401	22.4093	30.0777	38.1906	44.5741	47.5177 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	515.8319	521.1846	507.6960	478.9801	442.7316	408.6631	385.9032	380.5505	394.0391	422.7550	459.0035	493.0720 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753 (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)												
	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160 (71)
Water heating gains (Table 5)												
	168.5158	165.8157	160.6952	152.0987	145.2321	135.9784	128.7862	136.1293	139.5162	148.7795	159.8976	168.1983 (72)
Total internal gains												
	848.7137	846.1972	819.9196	774.4944	724.9957	675.7299	647.0628	654.2224	678.7664	727.8584	781.6085	826.9214 (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				16.4500	10.6334	0.6300		0.7000		1.0000		69.4255 (74)	
South				15.2600	46.7521	0.6300		0.7000		1.0000		283.1630 (78)	
West				7.7700	19.6403	0.6300		0.7000		1.0000		60.5689 (80)	
Solar gains	413.1573	714.9091	1011.3098	1314.3677	1532.3263	1548.8053	1481.6624	1314.1058	1115.0948	798.7218	496.8122	352.3642	(83)
Total gains	1261.8710	1561.1063	1831.2294	2088.8621	2257.3221	2224.5352	2128.7252	1968.3282	1793.8612	1526.5802	1278.4207	1179.2856	(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	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237
alpha	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282
util living area												
	0.9946	0.9818	0.9436	0.8386	0.6612	0.4765	0.3444	0.3889	0.6235	0.9022	0.9858	0.9963 (86)
MIT												
	20.2137	20.3946	20.6158	20.8189	20.9184	20.9430	20.9463	20.9458	20.9311	20.7755	20.4399	20.1674 (87)
Th 2												
	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178 (88)
util rest of house												
	0.9929	0.9765	0.9284	0.8029	0.6068	0.4124	0.2756	0.3149	0.5512	0.8698	0.9807	0.9951 (89)
MIT 2												
	19.1979	19.4262	19.6981	19.9299	20.0281	20.0475	20.0493	20.0491	20.0400	19.8897	19.4854	19.1389 (90)
Living area fraction												
									fLA = Living area / (4) =			0.0977 (91)
MIT												
	19.2972	19.5208	19.7878	20.0168	20.1151	20.1350	20.1369	20.1367	20.1271	19.9762	19.5787	19.2394 (92)
Temperature adjustment												
												0.0000
adjusted MIT												
	19.2972	19.5208	19.7878	20.0168	20.1151	20.1350	20.1369	20.1367	20.1271	19.9762	19.5787	19.2394 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9907	0.9720	0.9217	0.7984	0.6066	0.4137	0.2771	0.3165	0.5520	0.8638	0.9767	0.9935 (94)
Useful gains	1250.1879	1517.3422	1687.7541	1667.7089	1369.2962	920.2460	589.8668	622.9195	990.1322	1318.6154	1248.5936	1171.5723 (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												
	2502.1579	2439.3737	2216.9595	1854.7485	1403.9887	923.4688	590.1081	623.4437	1005.5725	1564.3452	2081.9726	2509.2015 (97)
Space heating kWh												
	931.4657	619.6051	393.7289	134.6685	25.8113	0.0000	0.0000	0.0000	0.0000	182.8230	600.0329	995.1961 (98a)
Space heating requirement - total per year (kWh/year)												3883.3315
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												
	931.4657	619.6051	393.7289	134.6685	25.8113	0.0000	0.0000	0.0000	0.0000	182.8230	600.0329	995.1961 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3883.3315
Space heating per m2											(98c) / (4) =	22.3180 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													219.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	931.4657	619.6051	393.7289	134.6685	25.8113	0.0000	0.0000	0.0000	0.0000	182.8230	600.0329	995.1961	(98)	
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)	
Space heating fuel (main heating system)	424.7449	282.5377	179.5389	61.4083	11.7699	0.0000	0.0000	0.0000	0.0000	83.3666	273.6128	453.8058	(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	292.1111	258.3854	274.6120	247.1385	240.0116	212.2314	203.2125	219.6435	219.8921	247.9494	264.0263	291.4008	(64)	
Efficiency of water heater													190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)	
Fuel for water heating, kWh/month	153.4197	135.7066	144.2290	129.7996	126.0565	111.4661	106.7293	115.3590	115.4896	130.2255	138.6693	153.0467	(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	29.5616	26.7008	29.5616	28.6080	29.5616	28.6080	29.5616	29.5616	28.6080	29.5616	28.6080	29.5616	(231)	
Lighting	40.4673	32.4643	29.2305	21.4155	16.5420	13.5149	15.0901	19.6147	25.4776	33.4280	37.7569	41.5920	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-54.9650	-87.6698	-140.3067	-166.1322	-181.9029	-170.2517	-166.7726	-154.2691	-129.0657	-101.2924	-62.7434	-46.0263	(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	-16.2998	-42.4640	-108.6405	-203.0741	-302.1212	-316.3261	-308.9047	-243.2890	-156.9255	-72.7295	-24.0581	-12.0449	(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													1770.7850	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													190.4000	
Water heating fuel used													1560.1968	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(MEVDecentralised, DataSheet: total watage = 29.2500, total flow = 45.0000, SFP = 0.6500)														
mechanical ventilation fans (SFP = 0.6500)													348.0636	(230a)
Total electricity for the above, kWh/year													348.0636	(231)
Electricity for lighting (calculated in Appendix L)													326.5939	(232)

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

PV generation														-3268.2753	(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														737.3640	(238)

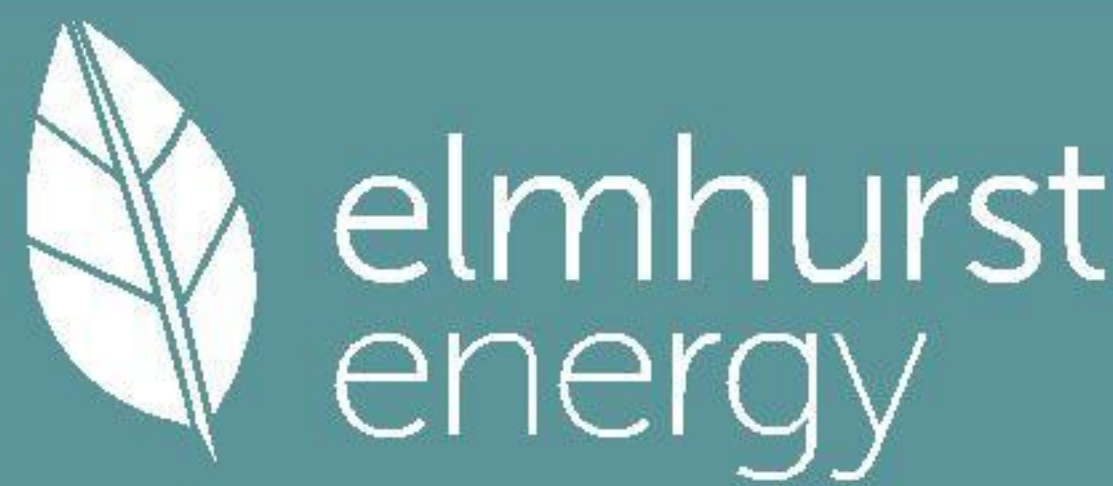
10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1770.7850	16.4900	292.0024	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1560.1968	16.4900	257.2764	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	348.0636	16.4900	57.3957	(249)
Energy for lighting	326.5939	16.4900	53.8553	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1461.3979	16.4900	-240.9845	
PV Unit electricity exported	-1806.8774	5.5900	-101.0044	
Total			-341.9890	(252)
Total energy cost			318.5410	(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] =	0.5236	(257)
SAP value			91.5120	
SAP rating (Section 12)			92	(258)
SAP band			A	

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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	1770.7850	0.1575	278.8677 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1560.1968	0.1409	219.8175 (264)
Space and water heating			498.6851 (265)
Pumps, fans and electric keep-hot	348.0636	0.1387	48.2807 (267)
Energy for lighting	326.5939	0.1443	47.1376 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1461.3979	0.1334	-194.9399
PV Unit electricity exported	-1806.8774	0.1210	-218.6318
Total			-413.5717 (269)
Total CO2, kg/year			180.5317 (272)
CO2 emissions per m2			1.0400 (273)
EI value			98.8954
EI rating			99 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	92.0000 (1b)	x 2.4000 (2b)	= 220.8000 (1b) - (3b)
First floor	82.0000 (1c)	x 2.6600 (2c)	= 218.1200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	438.9200 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (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) = 0.1850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate	0.2220	0.2081	0.2035	0.1804	0.1804	0.1665	0.1711	0.1619	0.1711	0.1850	0.1896	0.2035 (22b)
Mechanical extract ventilation - decentralised												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)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
fd			1.8900	1.4000	2.6460		(26)
w			39.4800	1.1450	45.2061		(27)
gf			92.0000	0.1200	11.0400		(28a)
External Wall 1	147.0000	41.3700	105.6300	0.2100	22.1823		(29a)
gf flat roof	10.0000		10.0000	0.1200	1.2000		(30)
sloped roof	8.0000		8.0000	0.1400	1.1200		(30)
flat c	75.8000		75.8000	0.1100	8.3380		(30)
Total net area of external elements Aum(A, m2)			332.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7324		(33)
Main dwelling							
Party Wall 1			50.0000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				0.0000	0.0190		0.0000
E3 Sill				0.0000	0.0160		0.0000
E4 Jamb				0.0000	0.0170		0.0000

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E5 Ground floor (normal)	44.0000	0.0540	2.3760	
E6 Intermediate floor within a dwelling	39.0000	0.0080	0.3120	
E10 Eaves (insulation at ceiling level)	0.0000	0.0480	0.0000	
E11 Eaves (insulation at rafter level)	0.0000	0.0410	0.0000	
E12 Gable (insulation at ceiling level)	0.0000	0.0560	0.0000	
E13 Gable (insulation at rafter level)	0.0000	0.0580	0.0000	
E16 Corner (normal)	0.0000	0.0400	0.0000	
E17 Corner (inverted - internal area greater than external area)	0.0000	-0.0680	-0.0000	
R1 Head of roof window	0.0000	0.1200	0.0000	
R2 Sill of roof window	0.0000	0.1200	0.0000	
R3 Jamb of roof window	0.0000	0.1200	0.0000	
E14 Flat roof	0.0000	0.0460	0.0000	
E18 Party wall between dwellings	0.0000	0.0360	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			2.6880	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	94.4204	(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	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	(38)
Heat transfer coeff													
	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	(39)
Average = Sum(39)m / 12 =												166.8422	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	(40)
HLP (average)												0.9589	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9679	(42)
Hot water usage for mixer showers														
	81.1267	79.8847	78.0543	75.2384	72.7155	69.1860	66.3943	69.6579	71.2994	74.7952	78.4358	81.0536	(42a)	
Hot water usage for baths														
	31.2258	30.7545	30.0839	29.0797	28.1746	26.9287	25.9835	27.1393	27.7459	28.9804	30.2639	31.2011	(42b)	
Hot water usage for other uses														
	45.0243	43.3870	41.7498	40.1125	38.4753	36.8380	36.8380	38.4753	40.1125	41.7498	43.3870	45.0243	(42c)	
Average daily hot water use (litres/day)													144.6775	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use														
	157.3768	154.0262	149.8879	144.4306	139.3654	132.9527	129.2159	135.2725	139.1578	145.5254	152.0868	157.2789	(44)	
Energy conte	231.6859	203.8078	214.1868	188.6625	179.5864	153.7554	142.7873	159.2183	161.4161	187.5242	205.5503	230.9756	(45)	
Energy content (annual)														
Distribution loss (46)m = 0.15 x (45)m													2259.1566	
	34.7529	30.5712	32.1280	28.2994	26.9380	23.0633	21.4181	23.8827	24.2124	28.1286	30.8326	34.6463	(46)	
Water storage loss:														
Store volume													250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2200	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													1.1988	(55)
Total storage loss														
	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628	(56)	
If cylinder contains dedicated solar storage														
	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628	(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														
	292.1111	258.3854	274.6120	247.1385	240.0116	212.2314	203.2125	219.6435	219.8921	247.9494	264.0263	291.4008	(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														
	292.1111	258.3854	274.6120	247.1385	240.0116	212.2314	203.2125	219.6435	219.8921	247.9494	264.0263	291.4008	(64)	
													Total per year (kWh/year) = Sum(64)m =	2970.6146 (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														
	125.3757	111.4282	119.5573	109.5111	108.0526	97.9045	95.8170	101.2802	100.4517	110.6920	115.1263	125.1396	(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	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	(66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5														
	46.2328	41.0635	33.3951	25.2822	18.8988	15.9551	17.2401	22.4093	30.0777	38.1906	44.5741	47.5177	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5														
	515.8319	521.1846	507.6960	478.9801	442.7316	408.6631	385.9032	380.5505	394.0391	422.7550	459.0035	493.0720	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5														
	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	(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)														
	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	(71)	
Water heating gains (Table 5)														
	168.5158	165.8157	160.6952	152.0987	145.2321	135.9784	128.7862	136.1293	139.5162	148.7795	159.8976	168.1983	(72)	
Total internal gains														
	848.7137	846.1972	819.9196	774.4944	724.9957	675.7299	647.0628	654.2224	678.7664	727.8584	781.6085	826.9214	(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	16.4500	12.7054	0.6300	0.7000	1.0000	82.9535	(74)
South	15.2600	53.5774	0.6300	0.7000	1.0000	324.5016	(78)
West	7.7700	23.7288	0.6300	0.7000	1.0000	73.1776	(80)

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Solar gains	480.6328	740.6912	1048.8025	1446.7858	1630.6126	1765.3196	1667.7669	1487.0859	1241.4136	886.1760	583.7958	396.3307	(83)
Total gains	1329.3465	1586.8884	1868.7221	2221.2802	2355.6083	2441.0495	2314.8297	2141.3083	1920.1800	1614.0344	1365.4043	1223.2521	(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	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	
alpha	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	
util living area	0.9913	0.9774	0.9284	0.7845	0.5829	0.3819	0.2594	0.2726	0.5157	0.8362	0.9730	0.9939	(86)
MIT	20.2997	20.4433	20.6671	20.8624	20.9332	20.9457	20.9467	20.9466	20.9415	20.8501	20.5524	20.2668	(87)
Th 2	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	(88)
util rest of house	0.9885	0.9707	0.9094	0.7426	0.5261	0.3222	0.1959	0.2039	0.4425	0.7882	0.9634	0.9918	(89)
MIT 2	19.3073	19.4873	19.7592	19.9745	20.0402	20.0490	20.0494	20.0494	20.0468	19.9682	19.6258	19.2658	(90)
Living area fraction	fLA = Living area / (4) =												0.0977 (91)
MIT	19.4042	19.5807	19.8479	20.0613	20.1274	20.1366	20.1371	20.1371	20.1342	20.0544	19.7163	19.3636	(92)
Temperature adjustment													0.0000
adjusted MIT	19.4042	19.5807	19.8479	20.0613	20.1274	20.1366	20.1371	20.1371	20.1342	20.0544	19.7163	19.3636	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9856	0.9656	0.9027	0.7397	0.5267	0.3234	0.1973	0.2055	0.4439	0.7844	0.9578	0.9895	(94)
Useful gains	1310.1727	1532.3713	1686.8679	1643.1512	1240.6799	789.5167	456.6311	439.9400	852.2953	1266.0137	1307.7381	1210.3969	(95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000	(96)
Heat loss rate W	2403.2323	2365.9393	2126.8937	1762.0638	1255.8889	790.2639	456.6597	439.9745	856.6087	1393.8608	1938.0879	2363.0882	(97)
Space heating kWh	813.2363	560.1577	327.3792	85.6171	11.3154	0.0000	0.0000	0.0000	0.0000	95.1183	453.8519	857.6023	(98a)
Space heating requirement - total per year (kWh/year)												3204.2782	
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	813.2363	560.1577	327.3792	85.6171	11.3154	0.0000	0.0000	0.0000	0.0000	95.1183	453.8519	857.6023	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3204.2782	
Space heating per m2												(98c) / (4) =	18.4154 (99)

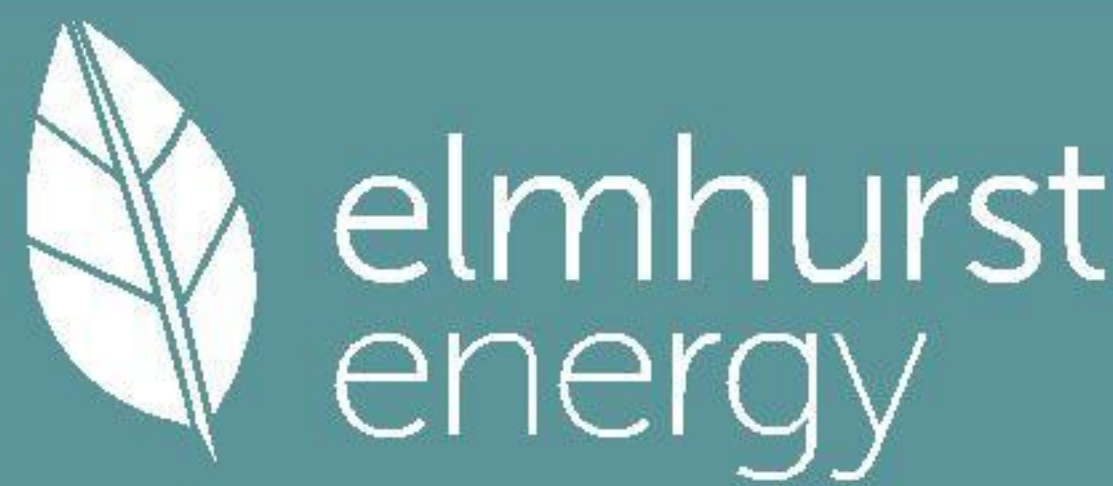
9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)	219.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	813.2363	560.1577	327.3792	85.6171	11.3154	0.0000	0.0000	0.0000	0.0000	95.1183	453.8519	857.6023	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	370.8328	255.4299	149.2837	39.0411	5.1598	0.0000	0.0000	0.0000	0.0000	43.3736	206.9548	391.0635	(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	292.1111	258.3854	274.6120	247.1385	240.0116	212.2314	203.2125	219.6435	219.8921	247.9494	264.0263	291.4008	(64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	153.4197	135.7066	144.2290	129.7996	126.0565	111.4661	106.7293	115.3590	115.4896	130.2255	138.6693	153.0467	(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	29.5616	26.7008	29.5616	28.6080	29.5616	28.6080	29.5616	29.5616	28.6080	29.5616	28.6080	29.5616	(231)
Lighting	40.4673	32.4643	29.2305	21.4155	16.5420	13.5149	15.0901	19.6147	25.4776	33.4280	37.7569	41.5920	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-64.7127	-92.8808	-146.1125	-175.3986	-187.7929	-181.3848	-176.8946	-165.8574	-140.0682	-110.2605	-73.3656	-52.7678	(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	-22.2333	-48.2956	-122.2747	-241.8537	-335.7039	-379.9304	-365.9790	-293.9612	-189.3753	-91.5006	-33.5893	-15.7304	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													1461.1392 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													190.4000
Water heating fuel used													1560.1968 (219)
Space cooling fuel													0.0000 (221)

Electricity for pumps and fans:

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(MEVDecentralised, DataSheet: total watage = 29.2500, total flow = 45.0000, SFP = 0.6500)			
mechanical ventilation fans (SFP = 0.6500)			348.0636 (230a)
Total electricity for the above, kWh/year			348.0636 (231)
Electricity for lighting (calculated in Appendix L)			326.5939 (232)
Energy saving/generation technologies (Appendices M ,N and Q)			
PV generation			-3707.9236 (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			-11.9302 (238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1461.1392	26.0600	380.7729 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1560.1968	26.0600	406.5873 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	348.0636	26.0600	90.7054 (249)
Energy for lighting	326.5939	26.0600	85.1104 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1567.4963	26.0600	-408.4895
PV Unit electricity exported	-2140.4273	5.8100	-124.3588
Total			-532.8484 (252)
Total energy cost			430.3275 (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	1461.1392	0.1583	231.3112 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1560.1968	0.1409	219.8175 (264)
Space and water heating			451.1287 (265)
Pumps, fans and electric keep-hot	348.0636	0.1387	48.2807 (267)
Energy for lighting	326.5939	0.1443	47.1376 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1567.4963	0.1336	-209.3756
PV Unit electricity exported	-2140.4273	0.1209	-258.7563
Total			-468.1319 (269)
Total CO2, kg/year			78.4151 (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	1461.1392	1.5860	2317.3916 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1560.1968	1.5210	2372.9997 (278)
Space and water heating			4690.3914 (279)
Pumps, fans and electric keep-hot	348.0636	1.5128	526.5506 (281)
Energy for lighting	326.5939	1.5338	500.9407 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1567.4963	1.4936	-2341.2282
PV Unit electricity exported	-2140.4273	0.4435	-949.2178
Total			-3290.4460 (283)
Total Primary energy kWh/year			2427.4366 (286)

SAP 10 EPC IMPROVEMENTS

DE-15 P

Current energy efficiency rating:	A 92
Current environmental impact rating:	A 99

N Solar water heating	Recommended		
U Solar photovoltaic panels	Already installed		
V2 Wind turbine	Not applicable		
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 71	-39 kg (49.8%)

Typical annual savings			Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£71	0.22 kg/m²	A 93	A 99
Total Savings	£71	0.22 kg/m²		
Potential energy efficiency rating:			A 93	
Potential environmental impact rating:				A 99

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

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Electricity	Current £963	Potential £880	Saving £84
Space heating	£471	£493	-£21
Water heating	£407	£302	£105
Lighting	£85	£85	£0
Generated (PV)	-£533	-£520	-£12
Total cost of fuels	£430	£360	£72
Total cost of uses	£430	£360	£72
Delivered energy	-0 kWh/m²	-2 kWh/m²	2 kWh/m²
Carbon dioxide emissions	0.1 tonnes	0.0 tonnes	0.0 tonnes
CO2 emissions per m²	0 kg/m²	0 kg/m²	0 kg/m²
Primary energy	14 kWh/m²	12 kWh/m²	2 kWh/m²

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 (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	92.0000 (1b)	x 2.4000 (2b)	= 220.8000 (1b) - (3b)
First floor	82.0000 (1c)	x 2.6600 (2c)	= 218.1200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 438.9200 (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) =	Air changes per hour
Pressure test		0.0000 / (5) = 0.0000 (8)
Pressure Test Method		Yes
Measured/design AP50		Blower Door
Infiltration rate		4.0000 (17)
Number of sides sheltered		0.2000 (18)
		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850 (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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174 (22b)
Mechanical extract ventilation - decentralised												
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
fd			1.8900	1.4000	2.6460		(26)
w			39.4800	1.1450	45.2061		(27)
gf			92.0000	0.1200	11.0400		(28a)
External Wall 1	147.0000	41.3700	105.6300	0.2100	22.1823		(29a)
gf flat roof	10.0000		10.0000	0.1200	1.2000		(30)
sloped roof	8.0000		8.0000	0.1400	1.1200		(30)
flat c	75.8000		75.8000	0.1100	8.3380		(30)
Total net area of external elements Aum(A, m2)			332.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7324		(33)
Main dwelling							
Party Wall 1			50.0000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	0.0000	0.0190	0.0000
E3 Sill	0.0000	0.0160	0.0000
E4 Jamb	0.0000	0.0170	0.0000
E5 Ground floor (normal)	44.0000	0.0540	2.3760
E6 Intermediate floor within a dwelling	39.0000	0.0080	0.3120
E10 Eaves (insulation at ceiling level)	0.0000	0.0480	0.0000
E11 Eaves (insulation at rafter level)	0.0000	0.0410	0.0000
E12 Gable (insulation at ceiling level)	0.0000	0.0560	0.0000

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E13 Gable (insulation at rafter level)	0.0000	0.0580	0.0000
E16 Corner (normal)	0.0000	0.0400	0.0000
E17 Corner (inverted - internal area greater than external area)	0.0000	-0.0680	-0.0000
R1 Head of roof window	0.0000	0.1200	0.0000
R2 Sill of roof window	0.0000	0.1200	0.0000
R3 Jamb of roof window	0.0000	0.1200	0.0000
E14 Flat roof	0.0000	0.0460	0.0000
E18 Party wall between dwellings	0.0000	0.0360	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			2.6880 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =		94.4204 (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
	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218 (38)
Heat transfer coeff	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422 (39)
Average = Sum(39)m / 12 =												166.8422
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589 (40)
HLP (average)												0.9589
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9679 (42)
Hot water usage for mixer showers	81.1267	79.8847	78.0543	75.2384	72.7155	69.1860	66.3943	69.6579	71.2994	74.7952	78.4358	81.0536 (42a)	
Hot water usage for baths	31.2258	30.7545	30.0839	29.0797	28.1746	26.9287	25.9835	27.1393	27.7459	28.9804	30.2639	31.2011 (42b)	
Hot water usage for other uses	45.0243	43.3870	41.7498	40.1125	38.4753	36.8380	36.8380	38.4753	40.1125	41.7498	43.3870	45.0243 (42c)	
Average daily hot water use (litres/day)												144.6775 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	157.3768	154.0262	149.8879	144.4306	139.3654	132.9527	129.2159	135.2725	139.1578	145.5254	152.0868	157.2789 (44)	
Energy content (annual)	231.6859	203.8078	214.1868	188.6625	179.5864	153.7554	142.7873	159.2183	161.4161	187.5242	205.5503	230.9756 (45)	
Distribution loss (46)m = 0.15 x (45)m	34.7529	30.5712	32.1280	28.2994	26.9380	23.0633	21.4181	23.8827	24.2124	28.1286	30.8326	34.6463 (46)	
Water storage loss:													
Store volume												250.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												2.2200 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												1.1988 (55)	
Total storage loss	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (56)	
If cylinder contains dedicated solar storage	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (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	292.1111	258.3854	273.2162	240.3849	227.2173	199.6247	190.1856	207.5470	214.4892	246.5537	264.0263	291.4008 (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												594.0627 (H24)	
Heat delivered to space heating												0.0000 (H29)	
Solar input												594.0627	
Solar input	-0.0000	-10.0412	-52.3548	-78.1427	-104.5315	-95.0633	-92.1150	-82.4650	-54.5237	-24.8254	-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	292.1111	248.3442	220.8614	162.2421	122.6858	104.5614	98.0706	125.0820	159.9656	221.7283	264.0263	291.4008 (64)	
								Total per year (kWh/year) = Sum(64)m =				2311.0796 (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	125.3757	111.4282	118.4407	104.1082	97.8172	87.8191	85.3954	91.6031	96.1294	109.5754	115.1263	125.1396 (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	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.2328	41.0635	33.3951	25.2822	18.8988	15.9551	17.2401	22.4093	30.0777	38.1906	44.5741	47.5177 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	515.8319	521.1846	507.6960	478.9801	442.7316	408.6631	385.9032	380.5505	394.0391	422.7550	459.0035	493.0720 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753 (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)	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160 (71)
Water heating gains (Table 5)	168.5158	165.8157	159.1944	144.5947	131.4747	121.9710	114.7788	123.1224	133.5130	147.2787	159.8976	168.1983 (72)
Total internal gains	848.7137	846.1972	818.4188	766.9904	711.2384	661.7225	633.0553	641.2155	672.7632	726.3576	781.6085	826.9214 (73)

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6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d		Gains W
North					16.4500	10.6334	0.6300		0.7000	1.0000		69.4255 (74)
South					15.2600	46.7521	0.6300		0.7000	1.0000		283.1630 (78)
West					7.7700	19.6403	0.6300		0.7000	1.0000		60.5689 (80)
Solar gains	413.1573	714.9091	1011.3098	1314.3677	1532.3263	1548.8053	1481.6624	1314.1058	1115.0948	798.7218	496.8122	352.3642 (83)
Total gains	1261.8710	1561.1063	1829.7286	2081.3581	2243.5647	2210.5278	2114.7177	1955.3213	1787.8580	1525.0794	1278.4207	1179.2856 (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	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237
alpha	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282
util living area												
	0.9946	0.9818	0.9438	0.8402	0.6645	0.4794	0.3467	0.3915	0.6254	0.9026	0.9858	0.9963 (86)
MIT	20.2137	20.3946	20.6153	20.8175	20.9177	20.9429	20.9463	20.9458	20.9309	20.7750	20.4399	20.1674 (87)
Th 2	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178 (88)
util rest of house												
	0.9929	0.9765	0.9286	0.8046	0.6101	0.4150	0.2774	0.3170	0.5529	0.8702	0.9807	0.9951 (89)
MIT 2	19.1979	19.4262	19.6975	19.9285	20.0275	20.0474	20.0493	20.0491	20.0399	19.8892	19.4854	19.1389 (90)
Living area fraction									fLA = Living area / (4) =			0.0977 (91)
MIT	19.2972	19.5208	19.7872	20.0153	20.1145	20.1349	20.1369	20.1367	20.1269	19.9758	19.5787	19.2394 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2972	19.5208	19.7872	20.0153	20.1145	20.1349	20.1369	20.1367	20.1269	19.9758	19.5787	19.2394 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9907	0.9720	0.9219	0.8001	0.6099	0.4162	0.2789	0.3186	0.5537	0.8642	0.9767	0.9935 (94)
Useful gains	1250.1879	1517.3422	1686.7725	1665.3041	1368.2520	920.1285	589.8569	622.8983	989.8641	1317.9042	1248.5936	1171.5723 (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												
	2502.1579	2439.3737	2216.8590	1854.5092	1403.8881	923.4572	590.1071	623.4414	1005.5463	1564.2731	2081.9726	2509.2015 (97)
Space heating kWh												
	931.4657	619.6051	394.3844	136.2277	26.5133	0.0000	0.0000	0.0000	0.0000	183.2985	600.0329	995.1961 (98a)
Space heating requirement - total per year (kWh/year)												3886.7236
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												
	931.4657	619.6051	394.3844	136.2277	26.5133	0.0000	0.0000	0.0000	0.0000	183.2985	600.0329	995.1961 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3886.7236
Space heating per m2										(98c) / (4) =		22.3375 (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 %)												219.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												
	931.4657	619.6051	394.3844	136.2277	26.5133	0.0000	0.0000	0.0000	0.0000	183.2985	600.0329	995.1961 (98)
Space heating efficiency (main heating system 1)												
	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)												
	424.7449	282.5377	179.8378	62.1193	12.0899	0.0000	0.0000	0.0000	0.0000	83.5834	273.6128	453.8058 (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												
	292.1111	248.3442	220.8614	162.2421	122.6858	104.5614	98.0706	125.0820	159.9656	221.7283	264.0263	291.4008 (64)
Efficiency of water heater												
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month												
	153.4197	130.4329	115.9986	85.2112	64.4358	54.9167	51.5077	65.6943	84.0155	116.4539	138.6693	153.0467 (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	36.3561	32.8378	36.3561	35.1833	36.3561	35.1833	36.3561	36.3561	35.1833	36.3561	35.1833	36.3561 (231)
Lighting	40.4673	32.4643	29.2305	21.4155	16.5420	13.5149	15.0901	19.6147	25.4776	33.4280	37.7569	41.5920 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-55.0120	-87.6879	-139.1725	-161.7989	-172.0710	-159.9093	-156.7934	-147.0678	-126.2108	-100.9797	-62.8257	-46.0611 (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	-16.2528	-42.4459	-109.7747	-207.4074	-311.9531	-326.6685	-318.8840	-250.4903	-159.7804	-73.0421	-23.9759	-12.0101 (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)

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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												1772.3318	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1213.8023	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, DataSheet: total watage = 29.2500, total flow = 45.0000, SFP = 0.6500)													
mechanical ventilation fans (SFP = 0.6500)												348.0636	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												428.0636	(231)
Electricity for lighting (calculated in Appendix L)												326.5939	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3268.2753	(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												472.5163	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1772.3318	16.4900	292.2575 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1213.8023	16.4900	200.1560 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	348.0636	16.4900	57.3957 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	326.5939	16.4900	53.8553 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1415.5901	16.4900	-233.4308
PV Unit electricity exported	-1852.6852	5.5900	-103.5651
Total			-336.9959 (252)
Total energy cost			279.8606 (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] = 0.4600 (257)
SAP value	92.5427
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	1772.3318	0.1575	279.0868 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1213.8023	0.1450	175.9536 (264)
Space and water heating			455.0404 (265)
Pumps, fans and electric keep-hot	428.0636	0.1387	59.3777 (267)
Energy for lighting	326.5939	0.1443	47.1376 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1415.5901	0.1337	-189.3314
PV Unit electricity exported	-1852.6852	0.1208	-223.7695
Total			-413.1009 (269)
Total CO2, kg/year			148.4548 (272)
CO2 emissions per m2			0.8500 (273)
EI value			99.0916
EI rating			99 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	92.0000 (1b)	x 2.4000 (2b)	= 220.8000 (1b) - (3b)
First floor	82.0000 (1c)	x 2.6600 (2c)	= 218.1200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	174.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	438.9200 (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	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000 (17)	
Infiltration rate		0.2000 (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) =	0.1850 (21)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000	(22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000	(22a)
Adj infilt rate	0.2220	0.2081	0.2035	0.1804	0.1804	0.1665	0.1711	0.1619	0.1711	0.1850	0.1896	0.2035	(22b)
Mechanical extract ventilation - decentralised													
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
fd			1.8900	1.4000	2.6460			(26)
w			39.4800	1.1450	45.2061			(27)
gf			92.0000	0.1200	11.0400			(28a)
External Wall 1	147.0000	41.3700	105.6300	0.2100	22.1823			(29a)
gf flat roof	10.0000		10.0000	0.1200	1.2000			(30)
sloped roof	8.0000		8.0000	0.1400	1.1200			(30)
flat c	75.8000		75.8000	0.1100	8.3380			(30)
Total net area of external elements Aum(A, m2)			332.8000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7324			(33)
Main dwelling								
Party Wall 1			50.0000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)				0.0000	0.0190	0.0000		
E3 Sill				0.0000	0.0160	0.0000		
E4 Jamb				0.0000	0.0170	0.0000		
E5 Ground floor (normal)				44.0000	0.0540	2.3760		
E6 Intermediate floor within a dwelling				39.0000	0.0080	0.3120		
E10 Eaves (insulation at ceiling level)				0.0000	0.0480	0.0000		
E11 Eaves (insulation at rafter level)				0.0000	0.0410	0.0000		
E12 Gable (insulation at ceiling level)				0.0000	0.0560	0.0000		
E13 Gable (insulation at rafter level)				0.0000	0.0580	0.0000		
E16 Corner (normal)				0.0000	0.0400	0.0000		
E17 Corner (inverted - internal area greater than external area)				0.0000	-0.0680	-0.0000		
R1 Head of roof window				0.0000	0.1200	0.0000		
R2 Sill of roof window				0.0000	0.1200	0.0000		
R3 Jamb of roof window				0.0000	0.1200	0.0000		
E14 Flat roof				0.0000	0.0460	0.0000		
E18 Party wall between dwellings				0.0000	0.0360	0.0000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.6880	(36)
Point Thermal bridges							(36a) =	0.0000
Total fabric heat loss							(33) + (36) + (36a) =	94.4204 (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)
	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	72.4218	
Heat transfer coeff	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	166.8422	(39)
Average = Sum(39)m / 12 =													166.8422
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9679 (42)
Hot water usage for mixer showers													
	81.1267	79.8847	78.0543	75.2384	72.7155	69.1860	66.3943	69.6579	71.2994	74.7952	78.4358	81.0536	(42a)
Hot water usage for baths													
	31.2258	30.7545	30.0839	29.0797	28.1746	26.9287	25.9835	27.1393	27.7459	28.9804	30.2639	31.2011	(42b)
Hot water usage for other uses													
	45.0243	43.3870	41.7498	40.1125	38.4753	36.8380	36.8380	38.4753	40.1125	41.7498	43.3870	45.0243	(42c)
Average daily hot water use (litres/day)													144.6775 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	157.3768	154.0262	149.8879	144.4306	139.3654	132.9527	129.2159	135.2725	139.1578	145.5254	152.0868	157.2789	(44)
Energy conte	231.6859	203.8078	214.1868	188.6625	179.5864	153.7554	142.7873	159.2183	161.4161	187.5242	205.5503	230.9756	(45)

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Energy content (annual)										Total = Sum(45)m =		2259.1566
Distribution loss (46)m = 0.15 x (45)m												
34.7529	30.5712	32.1280	28.2994	26.9380	23.0633	21.4181	23.8827	24.2124	28.1286	30.8326	34.6463 (46)	
Water storage loss:												
Store volume											250.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												
Temperature factor from Table 2b											0.5400 (49)	
Enter (49) or (54) in (55)											1.1988 (55)	
Total storage loss												
37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (56)	
If cylinder contains dedicated solar storage												
37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (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 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month												
292.1111	258.3854	273.2162	240.3849	227.2173	199.6247	190.1856	207.5470	214.4892	246.5537	264.0263	291.4008 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
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											699.3384 (H24)	
Heat delivered to space heating											0.0000 (H29)	
Solar input											699.3384	
Solar input	-0.0000	-13.7593	-58.2125	-90.9520	-114.0229	-111.6400	-106.9612	-98.6464	-67.3527	-35.7598	-2.0317 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h												
292.1111	244.6261	215.0038	149.4329	113.1944	87.9846	83.2244	108.9006	147.1365	210.7939	261.9947	291.4008 (64)	
Total per year (kWh/year) = Sum(64)m =											2205.8038 (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												
125.3757	111.4282	118.4407	104.1082	97.8172	87.8191	85.3954	91.6031	96.1294	109.5754	115.1263	125.1396 (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	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	178.0740	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.2328	41.0635	33.3951	25.2822	18.8988	15.9551	17.2401	22.4093	30.0777	38.1906	44.5741	47.5177	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	515.8319	521.1846	507.6960	478.9801	442.7316	408.6631	385.9032	380.5505	394.0391	422.7550	459.0035	493.0720	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	55.7753	(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)													
	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	-118.7160	(71)
Water heating gains (Table 5)	168.5158	165.8157	159.1944	144.5947	131.4747	121.9710	114.7788	123.1224	133.5130	147.2787	159.8976	168.1983	(72)
Total internal gains	848.7137	846.1972	818.4188	766.9904	711.2384	661.7225	633.0553	641.2155	672.7632	726.3576	781.6085	826.9214	(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					16.4500	12.7054		0.6300	0.7000		1.0000		82.9535 (74)	
South					15.2600	53.5774		0.6300	0.7000		1.0000		324.5016 (78)	
West					7.7700	23.7288		0.6300	0.7000		1.0000		73.1776 (80)	
Solar gains	480.6328	740.6912	1048.8025	1446.7858	1630.6126	1765.3196	1667.7669	1487.0859	1241.4136	886.1760	583.7958	396.3307	(83)	
Total gains	1329.3465	1586.8884	1867.2213	2213.7762	2341.8510	2427.0421	2300.8222	2128.3014	1914.1768	1612.5336	1365.4043	1223.2521	(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	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237	72.4237
alpha	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282	5.8282
util living area	0.9913	0.9774	0.9287	0.7862	0.5860	0.3841	0.2610	0.2743	0.5172	0.8366	0.9730	0.9939 (86)
MIT	20.2997	20.4433	20.6667	20.8615	20.9328	20.9457	20.9467	20.9466	20.9415	20.8498	20.5524	20.2668 (87)
Th 2	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178	20.1178 (88)
util rest of house	0.9885	0.9707	0.9097	0.7444	0.5290	0.3240	0.1971	0.2052	0.4438	0.7887	0.9634	0.9918 (89)
MIT 2	19.3073	19.4873	19.7587	19.9736	20.0399	20.0490	20.0494	20.0494	20.0468	19.9679	19.6258	19.2658 (90)
Living area fraction									flA = Living area / (4) =			0.0977 (91)
MIT	19.4042	19.5807	19.8474	20.0603	20.1271	20.1366	20.1371	20.1371	20.1342	20.0541	19.7163	19.3636 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4042	19.5807	19.8474	20.0603	20.1271	20.1366	20.1371	20.1371	20.1342	20.0541	19.7163	19.3636 (93)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9856	0.9656	0.9029	0.7415	0.5296	0.3253	0.1985	0.2067	0.4452	0.7848	0.9578	0.9895	(94)
Useful gains	1310.1727	1532.3713	1685.9828	1641.5233	1240.2062	789.4908	456.6300	439.9387	852.2193	1265.5757	1307.7381	1210.3969	(95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000	(96)
Heat loss rate W	2403.2323	2365.9393	2126.8034	1761.9041	1255.8433	790.2612	456.6595	439.9744	856.6011	1393.8172	1938.0879	2363.0882	(97)
Space heating kWh	813.2363	560.1577	327.9705	86.6742	11.6340	0.0000	0.0000	0.0000	0.0000	95.4117	453.8519	857.6023	(98a)
Space heating requirement - total per year (kWh/year)												3206.5386	
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	813.2363	560.1577	327.9705	86.6742	11.6340	0.0000	0.0000	0.0000	0.0000	95.4117	453.8519	857.6023	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3206.5386	
Space heating per m2										(98c) / (4) =		18.4284	(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 %)													219.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	813.2363	560.1577	327.9705	86.6742	11.6340	0.0000	0.0000	0.0000	0.0000	95.4117	453.8519	857.6023	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	370.8328	255.4299	149.5533	39.5231	5.3050	0.0000	0.0000	0.0000	0.0000	43.5074	206.9548	391.0635	(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	292.1111	244.6261	215.0038	149.4329	113.1944	87.9846	83.2244	108.9006	147.1365	210.7939	261.9947	291.4008	(64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	153.4197	128.4801	112.9221	78.4837	59.4508	46.2104	43.7103	57.1957	77.2776	110.7111	137.6022	153.0467	(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	36.3561	32.8378	36.3561	35.1833	36.3561	35.1833	36.3561	36.3561	35.1833	36.3561	35.1833	36.3561	(231)
Lighting	40.4673	32.4643	29.2305	21.4155	16.5420	13.5149	15.0901	19.6147	25.4776	33.4280	37.7569	41.5920	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-64.7789	-92.8542	-144.6134	-169.2389	-175.9529	-167.3681	-163.6615	-155.7858	-135.8058	-109.4985	-73.4674	-52.8154	(233a)
(233a)m	-64.7789	-92.8542	-144.6134	-169.2389	-175.9529	-167.3681	-163.6615	-155.7858	-135.8058	-109.4985	-73.4674	-52.8154	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
(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)	-22.1671	-48.3221	-123.7737	-248.0134	-347.5439	-393.9471	-379.2120	-304.0328	-193.6377	-92.2626	-33.4874	-15.6828	(233b)
(233b)m	-22.1671	-48.3221	-123.7737	-248.0134	-347.5439	-393.9471	-379.2120	-304.0328	-193.6377	-92.2626	-33.4874	-15.6828	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
(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												1462.1699	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1158.5104	(219)
Space cooling fuel												0.0000	(221)

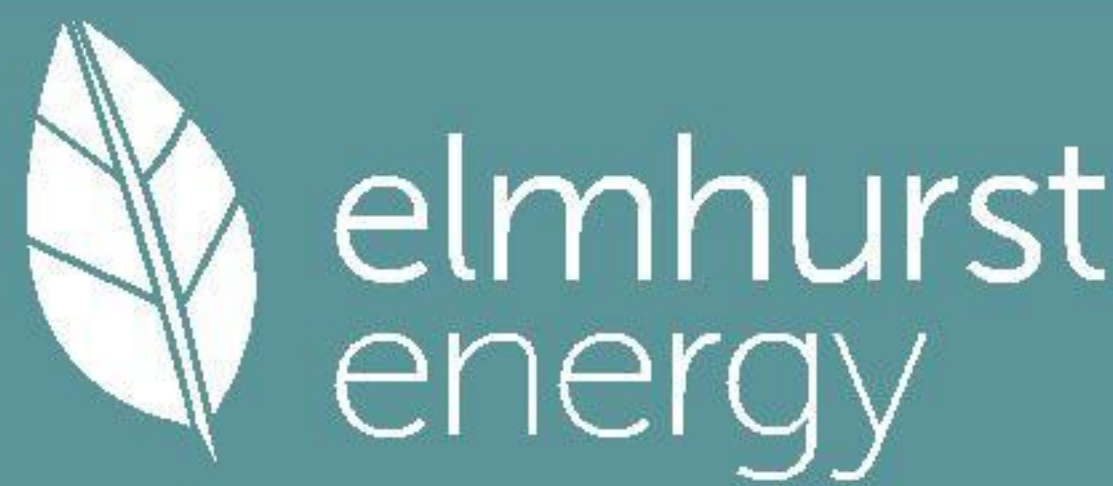
Electricity for pumps and fans:														
(MEVDecentralised, DataSheet: total watage = 29.2500, total flow = 45.0000, SFP = 0.6500)														
mechanical ventilation fans (SFP = 0.6500)													348.0636	(230a)
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													428.0636	(231)
Electricity for lighting (calculated in Appendix L)													326.5939	(232)

Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-3707.9236	(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													-332.5858	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1462.1699	26.0600	381.0415	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1158.5104	26.0600	301.9078	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	348.0636	26.0600	90.7054	(249)
Pump for solar water heating	80.0000	26.0600	20.8480	(249)
Energy for lighting	326.5939	26.0600	85.1104	(250)
Additional standing charges			0.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1505.8409	26.0600	-392.4222
PV Unit electricity exported	-2202.0827	5.8100	-127.9410
Total			-520.3632 (252)
Total energy cost			359.2499 (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	1462.1699	0.1583	231.4588 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1158.5104	0.1458	168.9241 (264)
Space and water heating			400.3829 (265)
Pumps, fans and electric keep-hot	428.0636	0.1387	59.3777 (267)
Energy for lighting	326.5939	0.1443	47.1376 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1505.8409	0.1340	-201.8296
PV Unit electricity exported	-2202.0827	0.1206	-265.6678
Total			-467.4974 (269)
Total CO2, kg/year			39.4008 (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	1462.1699	1.5860	2318.9691 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1158.5104	1.5394	1783.3865 (278)
Space and water heating			4102.3557 (279)
Pumps, fans and electric keep-hot	428.0636	1.5128	647.5746 (281)
Energy for lighting	326.5939	1.5338	500.9407 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1505.8409	1.4953	-2251.7360
PV Unit electricity exported	-2202.0827	0.4425	-974.5309
Total			-3226.2669 (283)
Total Primary energy kWh/year			2024.6040 (286)