

Full SAP Calculation Printout



Property Reference	AandK-7105-23		Issued on Date	13/11/2023	
Assessment Reference	SEC1 - ASHP ROI TF 0.15	Prop Type Ref	DS		
Property	Proposed dwelling, NE of Meadowside, Prosper Road, Roche, Cornwall, PL26 8PR				
SAP Rating	96 A	DER	-0.02	TER	7.83
Environmental	100 A	% DER < TER			100.26
CO ₂ Emissions (t/year)	-0.14	DFEE	39.97	TFEE	45.03
Compliance Check	See BREL	% DFEE < TFEE			11.24
% DPER < TPER	78.10	DPER	9.24	TPER	42.20
Assessor Details	Mr. Stuart Thomas			Assessor ID	V220-0003
Client	A & K Architectural Services , A & K Architectural Services				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	155.3200 (1b)	2.8400 (2b)	441.1088 (1b) - (3b)
First floor	85.4400 (1c)	2.4000 (2c)	205.0560 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	240.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	646.1648 (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	2.0000											(17)
Infiltration rate	0.1000											(18)
Number of sides sheltered	2											(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.0850 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
	0.1084	0.1063	0.1041	0.0935	0.0914	0.0808	0.0808	0.0786	0.0850	0.0914	0.0956	0.0999
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.9000 (23c)
Effective ac	0.1989	0.1967	0.1946	0.1840	0.1819	0.1712	0.1712	0.1691	0.1755	0.1819	0.1861	0.1904

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			42.4400	1.1450	48.5954		(27)
Door			4.3700	1.2000	5.2440		(26a)
4-5			2.1500	1.0536	2.2653		(27a)
6			1.0800	1.0536	1.1379		(27a)
21-23			3.2300	1.0536	3.4033		(27a)
Floor 1 P/a 0.38			155.3200	0.1200	18.6384	110.0000	17085.2000 (28a)
External Wall 1 Brick	87.3000	26.3300	60.9700	0.1700	10.3649	9.0000	548.7300 (29a)
External Wall 2 render	100.4500	16.8800	83.5700	0.1700	14.2069	18.0000	1504.2600 (29a)
External Wall 3 dormer	14.6300	3.6000	11.0300	0.1800	1.9854	9.0000	99.2700 (29a)
External Wall 4 "attic"	62.1300		62.1300	0.0900	5.5917	9.0000	559.1700 (29a)
External Roof 2 "attic"	44.5600		44.5600	0.0900	4.0104	9.0000	401.0400 (30)
External Roof 1 sloping	149.0400	6.4600	142.5800	0.1300	18.5354	9.0000	1283.2200 (30)
Total net area of external elements Aum(A, m ²)			613.4300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	133.9790	(33)

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Internal Wall 1 GF	320.4600	9.0000	2884.1400 (32c)
Internal Wall 2 TF	172.8700	9.0000	1555.8300 (32c)
Internal Floor 1	85.4400	18.0000	1537.9200 (32d)
Internal Ceiling 1	85.4400	9.0000	768.9600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 28227.7400 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 117.2443 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	32.9400	0.0300	0.9882
E17 Corner (inverted - internal area greater than external area)	13.0200	-0.0150	-0.1953
E11 Eaves (insulation at rafter level)	44.0000	0.0390	1.7160
R4 Ridge (vaulted ceiling)	35.2500	0.1200	4.2300
E13 Gable (insulation at rafter level)	39.6300	0.0240	0.9511
E5 Ground floor (normal)	59.1000	0.0210	1.2411
E6 Intermediate floor within a dwelling	24.8000	0.0800	1.9840
R7 Flat ceiling (inverted)	7.1300	0.1200	0.8556
E2 Other lintels (including other steel lintels)	23.4800	0.0840	1.9723
E3 Sill	21.4500	0.0430	0.9223
E4 Jamb	58.3400	0.0340	1.9836
R1 Head of roof window	4.6800	0.2400	1.1232
R2 Sill of roof window	4.6800	0.2400	1.1232
R3 Jamb of roof window	16.5600	0.2400	3.9744

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.8697 (36)
 Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 156.8488 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.4070	41.9539	41.5007	39.2351	38.7820	36.5164	36.5164	36.0633	37.4226	38.7820	39.6882	40.5945 (38)
Heat transfer coeff	199.2558	198.8026	198.3495	196.0839	195.6308	193.3652	193.3652	192.9120	194.2714	195.6308	196.5370	197.4433 (39)
Average = Sum(39)m / 12 =												195.9706

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8276	0.8257	0.8238	0.8144	0.8126	0.8031	0.8031	0.8013	0.8069	0.8126	0.8163	0.8201 (40)
HLP (average)												0.8140
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0549 (42)	
Hot water usage for mixer showers														
Hot water usage for baths														
Hot water usage for other uses														
Average daily hot water use (litres/day)														
Daily hot water use														
Energy content (annual)														
Distribution loss (46)m = 0.15 x (45)m														
Water storage loss:														
Store volume														250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):														2.0400 (48)
Temperature factor from Table 2b														0.5400 (49)
Enter (49) or (54) in (55)														1.1016 (55)
Total storage loss														
If cylinder contains dedicated solar storage														
Primary loss														
Combi loss														
Total heat required for water heating calculated for each month														
WWHRS														
PV diverter														
Solar input														
FGHRS														
Output from w/h														
12Total per year (kWh/year)														
Electric shower(s)														
Heat gains from water heating, kWh/month														

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	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	206.9402	229.1124	206.9402	213.8382	206.9402	213.8382	206.9402	206.9402	213.8382	206.9402	213.8382	206.9402 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.3035	412.5404	401.8635	379.1337	350.4414	323.4747	305.4592	301.2223	311.8992	334.6290	363.3213	390.2881 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746 (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)	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967 (71)
Water heating gains (Table 5)	155.8353	153.3204	148.6232	138.5272	132.2981	125.8054	121.9063	125.2631	129.1814	136.3845	146.0730	154.5601 (72)
Total internal gains	839.9028	863.7970	826.2507	800.3229	758.5035	731.9421	703.1295	702.2494	723.7426	746.7775	792.0564	820.6121 (73)

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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			
Northeast			3.5200	11.2829	0.7600	0.7000	0.7700		14.6423 (75)			
Southeast			18.7400	36.7938	0.7600	0.7000	0.7700		254.2082 (77)			
Southwest			1.5800	36.7938	0.7600	0.7000	0.7700		21.4327 (79)			
Northwest			18.6000	11.2829	0.7600	0.7000	0.7700		77.3713 (81)			
Southeast			1.0800	26.0000	0.6800	0.7000	1.0000		12.0295 (82)			
Southwest			2.1500	26.0000	0.6800	0.7000	1.0000		23.9476 (82)			
Northwest			3.2300	26.0000	0.6800	0.7000	1.0000		35.9770 (82)			
Solar gains	439.6086	806.2579	1245.5407	1765.2912	2167.8584	2232.7954	2119.3424	1808.8136	1425.0450	930.4616	537.2575	369.1509 (83)
Total gains	1279.5114	1670.0549	2071.7914	2565.6142	2926.3619	2964.7375	2822.4719	2511.0630	2148.7876	1677.2391	1329.3139	1189.7630 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.3516	39.4413	39.5314	39.9882	40.0808	40.5504	40.5504	40.6457	40.3613	40.0808	39.8960	39.7129
alpha	3.6234	3.6294	3.6354	3.6659	3.6721	3.7034	3.7034	3.7097	3.6908	3.6721	3.6597	3.6475
util living area	0.9805	0.9526	0.8914	0.7539	0.5757	0.4077	0.2990	0.3485	0.5777	0.8546	0.9619	0.9846 (86)
Living	19.5875	19.8835	20.2552	20.6340	20.8293	20.8981	20.9122	20.9090	20.8525	20.5290	19.9815	19.5380
Non living	18.5399	18.9147	19.3774	19.8355	20.0531	20.1295	20.1412	20.1408	20.0865	19.7258	19.0484	18.4818
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2774	19.8835	20.2552	20.6340	20.8293	20.8981	20.9122	20.9090	20.8525	20.5290	19.9815	19.7425 (87)
Th 2	20.2295	20.2311	20.2327	20.2408	20.2425	20.2506	20.2506	20.2522	20.2473	20.2425	20.2392	20.2360 (88)
util rest of house	0.9775	0.9457	0.8768	0.7263	0.5373	0.3627	0.2490	0.2937	0.5256	0.8295	0.9553	0.9822 (89)
MIT 2	19.5559	18.9147	19.3774	19.8355	20.0531	20.1295	20.1412	20.1408	20.0865	19.7258	19.0484	18.7979 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.6425	19.0310	19.4828	19.9313	20.1462	20.2217	20.2337	20.2330	20.1784	19.8222	19.1604	18.9113 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.6425	19.0310	19.4828	19.9313	20.1462	20.2217	20.2337	20.2330	20.1784	19.8222	19.1604	18.9113 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9748	0.9325	0.8604	0.7142	0.5323	0.3610	0.2479	0.2922	0.5206	0.8137	0.9433	0.9769 (94)
Useful gains	1247.2439	1557.3446	1782.5996	1832.4001	1557.5895	1070.1323	699.5646	733.8210	1118.7335	1364.6864	1253.9088	1162.2449 (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	3057.0777	2809.2724	2575.1267	2163.0637	1652.3436	1087.0395	702.6305	739.4326	1180.8621	1804.1493	2370.3078	2904.6389 (97)
Space heating kWh	1346.5163	841.2955	589.6402	238.0778	70.4971	0.0000	0.0000	0.0000	0.0000	326.9604	803.8073	1296.3411 (98a)
Space heating requirement - total per year (kWh/year)	5513.1357											
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	1346.5163	841.2955	589.6402	238.0778	70.4971	0.0000	0.0000	0.0000	0.0000	326.9604	803.8073	1296.3411 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5513.1357											
Space heating per m2	(98c) / (4) = 22.8989 (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 %)												334.5422 (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	1346.5163	841.2955	589.6402	238.0778	70.4971	0.0000	0.0000	0.0000	0.0000	326.9604	803.8073	1296.3411 (98)
Space heating efficiency (main heating system 1)	334.5422	334.5422	334.5422	334.5422	334.5422	0.0000	0.0000	0.0000	0.0000	334.5422	334.5422	334.5422 (210)
Space heating fuel (main heating system)	402.4952	251.4767	176.2529	71.1652	21.0727	0.0000	0.0000	0.0000	0.0000	97.7337	240.2708	387.4970 (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	267.9740	236.9584	251.8361	221.8505	215.3073	194.3026	192.0546	199.5658	201.6129	224.4509	238.1903	265.1206 (64)
Efficiency of water heater (217)m	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231 (216)
Fuel for water heating, kWh/month	141.9932	125.5587	133.4421	117.5534	114.0863	102.9564	101.7652	105.7453	106.8300	118.9313	126.2115	140.4812 (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	66.2838	59.8692	66.2838	64.1456	66.2838	64.1456	66.2838	66.2838	64.1456	66.2838	64.1456	66.2838 (231)
Lighting	50.4025	40.4348	36.4070	26.6733	20.6033	16.8330	18.7950	24.4304	31.7327	41.6350	47.0267	51.8033 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-93.8785	-136.7625	-200.9740	-222.7300	-235.3299	-216.6815	-214.1849	-201.9669	-177.8940	-153.0459	-103.3005	-79.9923 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												

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(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-38.3659	-89.9444	-198.5388	-327.8978	-454.9814	-465.3439	-457.4739	-378.7656	-266.7695	-140.6672	-54.8116	-29.7952	(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													1647.9642 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													188.7231
Water heating fuel used													1435.5548 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.9900)													
mechanical ventilation fans (SFP = 0.9900)													780.4378 (230a)
Total electricity for the above, kWh/year													780.4378 (231)
Electricity for lighting (calculated in Appendix L)													406.7771 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-4940.0962 (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													-669.3622 (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	1647.9642	0.1569	258.5026 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1435.5548	0.1408	202.1790 (264)
Space and water heating			460.6815 (265)
Pumps, fans and electric keep-hot	780.4378	0.1387	108.2564 (267)
Energy for lighting	406.7771	0.1443	58.7105 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2036.7410	0.1347	-274.3982
PV Unit electricity exported	-2903.3552	0.1236	-358.7432
Total			-633.1414 (269)
Total CO2, kg/year			-5.4930 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.0200 (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	1647.9642	1.5807	2604.8607 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1435.5548	1.5208	2183.1346 (278)
Space and water heating			4787.9953 (279)
Pumps, fans and electric keep-hot	780.4378	1.5128	1180.6464 (281)
Energy for lighting	406.7771	1.5338	623.9283 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2036.7410	1.4979	-3050.9131
PV Unit electricity exported	-2903.3552	0.4535	-1316.5745
Total			-4367.4876 (283)
Total Primary energy kWh/year			2225.0824 (286)
Dwelling Primary energy Rate (DPER)			9.2400 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	155.3200 (1b)	x 2.8400 (2b)	= 441.1088 (1b) - (3b)
First floor	85.4400 (1c)	x 2.4000 (2c)	= 205.0560 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	240.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 646.1648 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)

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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) = 0.0619 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 5.0000 (17)
 Infiltration rate 0.3119 (18)
 Number of sides sheltered 2 (19)
 Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2651 (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												
Effective ac	0.3380	0.3314	0.3248	0.2916	0.2850	0.2519	0.2519	0.2452	0.2651	0.2850	0.2983	0.3115
	0.5571	0.5549	0.5527	0.5425	0.5406	0.5317	0.5317	0.5301	0.5351	0.5406	0.5445	0.5485

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Semi-glazed door			4.3700	1.0000	4.3700		(26a)
TER Opening Type (Uw = 1.20)			42.4400	1.1450	48.5954		(27)
4-5			2.1500	1.5918	3.4223		(27a)
6			1.0800	1.5918	1.7191		(27a)
21-23			3.2300	1.5918	5.1414		(27a)
Floor 1 P/a 0.38			155.3200	0.1300	20.1916		(28a)
External Wall 1 Brick	87.3000	26.3300	60.9700	0.1800	10.9746		(29a)
External Wall 2 render	100.4500	16.8800	83.5700	0.1800	15.0426		(29a)
External Wall 3 dormer	14.6300	3.6000	11.0300	0.1800	1.9854		(29a)
External Wall 4 "attic"	62.1300		62.1300	0.1800	11.1834		(29a)
External Roof 2 "attic"	44.5600		44.5600	0.1100	4.9016		(30)
External Roof 1 sloping	149.0400	6.4600	142.5800	0.1100	15.6838		(30)
Total net area of external elements Aum(A, m2)			613.4300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	143.2112	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 117.2443 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	32.9400	0.0900	2.9646
E17 Corner (inverted - internal area greater than external area)	13.0200	-0.0900	-1.1718
E11 Eaves (insulation at rafter level)	44.0000	0.0400	1.7600
R4 Ridge (vaulted ceiling)	35.2500	0.0800	2.8200
E13 Gable (insulation at rafter level)	39.6300	0.0800	3.1704
E5 Ground floor (normal)	59.1000	0.1600	9.4560
E6 Intermediate floor within a dwelling	24.8000	0.0000	0.0000
R7 Flat ceiling (inverted)	7.1300	0.0400	0.2852
E2 Other lintels (including other steel lintels)	23.4800	0.0500	1.1740
E3 Sill	21.4500	0.0500	1.0725
E4 Jamb	58.3400	0.0500	2.9170
R1 Head of roof window	4.6800	0.0800	0.3744
R2 Sill of roof window	4.6800	0.0600	0.2808
R3 Jamb of roof window	16.5600	0.0800	1.3248

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 26.4279 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 169.6391 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	118.7994	118.3264	117.8627	115.6848	115.2773	113.3804	113.3804	113.0291	114.1111	115.2773	116.1016	116.9634
Average = Sum(39)m / 12 =	288.4385	287.9655	287.5018	285.3239	284.9164	283.0195	283.0195	282.6682	283.7502	284.9164	285.7407	286.6025

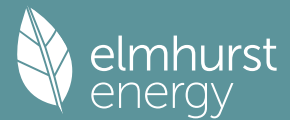
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1980	1.1961	1.1941	1.1851	1.1834	1.1755	1.1755	1.1741	1.1786	1.1834	1.1868	1.1904
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0549 (42)

Hot water usage for mixer showers	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hot water usage for baths	87.0357	85.7431	83.9228	80.5666	78.0535	75.2669	73.7617	75.5692	77.5372	80.5190	83.9444	86.7414
Hot water usage for other uses	45.9154	44.2458	42.5761	40.9065	39.2368	37.5672	37.5672	39.2368	40.9065	42.5761	44.2458	45.9154
Average daily hot water use (litres/day)												
Daily hot water use	132.9511	129.9888	126.4989	121.4730	117.2903	112.8340	111.3288	114.8060	118.4437	123.0951	128.1901	132.6568
Energy conte	210.5620	185.1024	194.4241	166.2905	157.8953	138.7426	134.6426	142.1538	146.0529	167.0389	182.6303	207.7086
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	31.5843	27.7654	29.1636	24.9436	23.6843	20.8114	20.1964	21.3231	21.9079	25.0558	27.3946	31.1563
Water storage loss:												
Store volume												250.0000
a) If manufacturer declared loss factor is known (kWh/day):												1.8903
Temperature factor from Table 2b												0.5400
Enter (49) or (54) in (55)												1.0208
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
If cylinder contains dedicated solar storage												

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Primary 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 (57)
Combi 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)
Total heat required for water heating calculated for each month	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)
WWHRS	265.4688	234.6956	249.3309	219.4261	212.8021	191.8782	189.5493	197.0606	199.1885	221.9457	235.7659	262.6153 (62)
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 (63a)
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 (63b)
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 (63c)
Output from w/h	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)
Total per year (kWh/year)	265.4688	234.6956	249.3309	219.4261	212.8021	191.8782	189.5493	197.0606	199.1885	221.9457	235.7659	262.6153 (64)
Electric shower(s)	Total per year (kWh/year) = Sum(64)m =											2679.7272 (64)
												2680 (64)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	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)
	113.9373	101.2211	108.5715	97.8001	96.4256	88.6404	88.6941	91.1916	91.0711	99.4659	103.2331	112.9885 (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	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	206.6073	228.7438	206.6073	213.4942	206.6073	213.4942	206.6073	206.6073	213.4942	206.6073	213.4942	206.6073 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.3035	412.5404	401.8635	379.1337	350.4414	323.4747	305.4592	301.2223	311.8992	334.6290	363.3213	390.2881 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967 (71)
Water heating gains (Table 5)	153.1415	150.6267	145.9294	135.8335	129.6043	123.1117	119.2125	122.5693	126.4876	133.6907	143.3793	151.8663 (72)
Total internal gains	839.8761	863.7347	826.2240	800.2852	758.4768	728.9043	700.1028	699.2227	720.7048	746.7508	792.0186	820.5855 (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
Northeast	3.5200	11.2829	0.6300	0.7000	0.7700	12.1377 (75)
Southeast	18.7400	36.7938	0.6300	0.7000	0.7700	210.7252 (77)
Southwest	1.5800	36.7938	0.6300	0.7000	0.7700	17.7666 (79)
Northwest	18.6000	11.2829	0.6300	0.7000	0.7700	64.1368 (81)
Southeast	1.0800	26.0000	0.6300	0.7000	1.0000	11.1450 (82)
Southwest	2.1500	26.0000	0.6300	0.7000	1.0000	22.1867 (82)
Northwest	3.2300	26.0000	0.6300	0.7000	1.0000	33.3317 (82)

Solar gains	371.4296	682.9195	1058.3973	1503.8173	1848.8598	1904.8483	1807.8329	1541.7843	1212.3249	789.1165	454.2647	311.6744 (83)
Total gains	1211.3057	1546.6542	1884.6213	2304.1025	2607.3366	2633.7526	2507.9357	2241.0070	1933.0297	1535.8674	1246.2833	1132.2598 (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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	27.1844	27.2291	27.2730	27.4812	27.5205	27.7049	27.7049	27.7394	27.6336	27.5205	27.4411	27.3586
util living area	2.8123	2.8153	2.8182	2.8321	2.8347	2.8470	2.8470	2.8493	2.8422	2.8347	2.8294	2.8239
	0.9845	0.9692	0.9385	0.8657	0.7452	0.5908	0.4600	0.5213	0.7444	0.9187	0.9739	0.9871 (86)
MIT	18.2600	18.6269	19.1835	19.8934	20.4632	20.8056	20.9302	20.8995	20.6054	19.8213	18.9077	18.1983 (87)
Th 2	19.9216	19.9231	19.9247	19.9319	19.9333	19.9396	19.9396	19.9408	19.9372	19.9333	19.9306	19.9277 (88)
util rest of house	0.9817	0.9638	0.9274	0.8412	0.6990	0.5168	0.3619	0.4206	0.6802	0.8985	0.9683	0.9848 (89)
MIT 2	16.7041	17.1708	17.8737	18.7539	19.4234	19.7929	19.9030	19.8838	19.6040	18.6867	17.5364	16.6289 (90)
Living area fraction	16.8908	17.3455	18.0308	18.8906	19.5482	19.9144	20.0263	20.0057	19.7242	18.8229	17.7010	16.8172 (92)
MIT	16.8908	17.3455	18.0308	18.8906	19.5482	19.9144	20.0263	20.0057	19.7242	18.8229	17.7010	16.8172 (92)
Temperature adjustment												0.0000
adjusted MIT	16.8908	17.3455	18.0308	18.8906	19.5482	19.9144	20.0263	20.0057	19.7242	18.8229	17.7010	16.8172 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9691	0.9444	0.9006	0.8118	0.6801	0.5149	0.3704	0.4272	0.6653	0.8702	0.9507	0.9738 (94)
Ext temp.	1173.9262	1460.6389	1697.3826	1870.5598	1773.2970	1356.0201	928.8875	957.3649	1286.1117	1336.5845	1184.7891	1102.6186 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	3631.6700	3583.8832	3315.1315	2850.5699	2236.0665	1504.0870	969.7031	1019.2081	1595.8541	2342.8292	3029.1315	3616.1164 (97)
Space heating requirement - total per year (kWh/year)	1828.5614	1426.8202	1203.6051	705.6072	344.3005	0.0000	0.0000	0.0000	0.0000	748.6460	1327.9266	1870.0424 (98a)
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)	1828.5614	1426.8202	1203.6051	705.6072	344.3005	0.0000	0.0000	0.0000	0.0000	748.6460	1327.9266	1870.0424 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9455.5095
Space heating per m2												39.2736 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	1828.5614	1426.8202	1203.6051	705.6072	344.3005	0.0000	0.0000	0.0000	0.0000	748.6460	1327.9266	1870.0424	(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)	1981.1066	1545.8507	1304.0142	764.4716	373.0233	0.0000	0.0000	0.0000	0.0000	811.1008	1438.7070	2026.0481	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	265.4688	234.6956	249.3309	219.4261	212.8021	191.8782	189.5493	197.0606	199.1885	221.9457	235.7659	262.6153	(64)
Efficiency of water heater (217)m	87.5482	87.4075	87.1140	86.4862	85.1325	79.8000	79.8000	79.8000	79.8000	86.5674	87.3152	79.8000	(216)
Fuel for water heating, kWh/month	303.2257	268.5073	286.2122	253.7122	249.9659	240.4489	237.5305	246.9431	249.6097	256.3848	270.0170	299.8452	(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	7.3041	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.9289	34.4392	31.0087	22.7183	17.5482	14.3371	16.0081	20.8079	27.0274	35.4615	40.0536	44.1220	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-116.2071	-151.0013	-200.1333	-206.7442	-208.3949	-189.1892	-186.3942	-182.4597	-174.3550	-162.8275	-122.8699	-101.9979	(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	-111.2120	-226.5886	-437.6713	-640.0650	-830.5941	-829.2956	-819.9067	-701.5877	-524.0545	-318.4590	-146.5103	-88.5611	(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													10244.3223 (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													3162.4024 (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)													346.4610 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-7677.0801 (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													6162.1056 (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	10244.3223	0.2100	2151.3077	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3162.4024	0.2100	664.1045	(264)
Space and water heating			2815.4122	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	346.4610	0.1443	50.0050	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2002.5742	0.1364	-273.2177	
PV Unit electricity exported	-5674.5059	0.1267	-718.9030	
Total			-992.1207	(269)
Total CO2, kg/year			1885.2258	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.8300	(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	10244.3223	1.1300	11576.0842	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3162.4024	1.1300	3573.5147	(278)
Space and water heating			15149.5989	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	346.4610	1.5338	531.4134	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2002.5742	1.5043	-3012.5416	
PV Unit electricity exported	-5674.5059	0.4651	-2639.0607	
Total			-5651.6023	(283)
Total Primary energy kWh/year			10159.5109	(286)
Target Primary Energy Rate (TPER)			42.2000	(287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	155.3200 (1b)	x 2.8400 (2b)	= 441.1088 (1b) - (3b)
First floor	85.4400 (1c)	x 2.4000 (2c)	= 205.0560 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	240.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 646.1648 (5)

2. Ventilation rate

		m ³ per hour											
Number of open chimneys	0 * 80 =	0.0000	(6a)										
Number of open flues	0 * 20 =	0.0000	(6b)										
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)										
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)										
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)										
Number of blocked chimneys	0 * 20 =	0.0000	(6f)										
Number of intermittent extract fans	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) =	0.0619	(8)										
Pressure test	Yes												
Pressure Test Method	Blower Door												
Measured/design AP50	2.0000		(17)										
Infiltration rate	0.1619		(18)										
Number of sides sheltered	2		(19)										
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1376	(21)										
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1755	0.1720	0.1686	0.1514	0.1479	0.1307	0.1307	0.1273	0.1376	0.1479	0.1548	0.1617	(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	0.5154	0.5148	0.5142	0.5115	0.5109	0.5085	0.5085	0.5081	0.5095	0.5109	0.5120	0.5131	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			42.4400	1.1450	48.5954		(27)
Door			4.3700	1.2000	5.2440		(26a)
4-5			2.1500	1.0536	2.2653		(27a)
6			1.0800	1.0536	1.1379		(27a)
21-23			3.2300	1.0536	3.4033		(27a)
Floor 1 P/a 0.38			155.3200	0.1200	18.6384	110.0000	17085.2000 (28a)
External Wall 1 Brick	87.3000	26.3300	60.9700	0.1700	10.3649	9.0000	548.7300 (29a)
External Wall 2 render	100.4500	16.8800	83.5700	0.1700	14.2069	18.0000	1504.2600 (29a)
External Wall 3 dormer	14.6300	3.6000	11.0300	0.1800	1.9854	9.0000	99.2700 (29a)
External Wall 4 "attic"	62.1300		62.1300	0.0900	5.5917	9.0000	559.1700 (29a)
External Roof 2 "attic"	44.5600		44.5600	0.0900	4.0104	9.0000	401.0400 (30)
External Roof 1 sloping	149.0400	6.4600	142.5800	0.1300	18.5354	9.0000	1283.2200 (30)
Total net area of external elements Aum(A, m ²)			613.4300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	133.9790		(33)
Internal Wall 1 GF			320.4600			9.0000	2884.1400 (32c)
Internal Wall 2 TF			172.8700			9.0000	1555.8300 (32c)
Internal Floor 1			85.4400			18.0000	1537.9200 (32d)
Internal Ceiling 1			85.4400			9.0000	768.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28227.7400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							117.2443 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				32.9400	0.0300	0.9882	
E17 Corner (inverted - internal area greater than external area)				13.0200	-0.0150	-0.1953	
E11 Eaves (insulation at rafter level)				44.0000	0.0390	1.7160	
R4 Ridge (vaulted ceiling)				35.2500	0.1200	4.2300	
E13 Gable (insulation at rafter level)				39.6300	0.0240	0.9511	
E5 Ground floor (normal)				59.1000	0.0210	1.2411	
E6 Intermediate floor within a dwelling				24.8000	0.0800	1.9840	
R7 Flat ceiling (inverted)				7.1300	0.1200	0.8556	
E2 Other lintels (including other steel lintels)				23.4800	0.0840	1.9723	
E3 Sill				21.4500	0.0430	0.9223	
E4 Jamb				58.3400	0.0340	1.9836	
R1 Head of roof window				4.6800	0.2400	1.1232	
R2 Sill of roof window				4.6800	0.2400	1.1232	
R3 Jamb of roof window				16.5600	0.2400	3.9744	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.8697 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	156.8488 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	109.8996	109.7722	109.6472	109.0604	108.9506	108.4395	108.4395	108.3449	108.6364	108.9506	109.1727	109.4049	(38)
Heat transfer coeff	266.7484	266.6210	266.4960	265.9092	265.7994	265.2883	265.2883	265.1937	265.4852	265.7994	266.0215	266.2537	(39)
Average = Sum(39)m / 12 =												265.9087	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1079	1.1074	1.1069	1.1045	1.1040	1.1019	1.1019	1.1015	1.1027	1.1040	1.1049	1.1059	(40)
HLP (average)												1.1045	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0549	(42)
Hot water usage for mixer showers												0.0000	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	32.5652	32.0816	31.4005	30.1448	29.2045	28.1618	27.5986	28.2749	29.0113	30.1270	31.4086	32.4551	(42b)
Average daily hot water use (litres/day)	45.9154	44.2458	42.5761	40.9065	39.2368	37.5672	37.5672	39.2368	40.9065	42.5761	44.2458	45.9154	(42c)
												71.9344	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	78.4807	76.3274	73.9766	71.0512	68.4413	65.7290	65.1658	67.5118	69.9178	72.7031	75.6544	78.3706	(44)
Energy content (annual)	124.2942	108.6891	113.6993	97.2656	92.1351	80.8215	80.8215	83.5937	86.2156	98.6574	107.7835	122.7094	(45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m =	1194.6767
Water 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	(46)
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	105.6500	92.3858	96.6444	82.6757	78.3148	68.6982	66.9905	71.0546	73.2833	83.8588	91.6160	104.3030	(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	105.6500	92.3858	96.6444	82.6757	78.3148	68.6982	66.9905	71.0546	73.2833	83.8588	91.6160	104.3030	(64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m =	1015.4752
Electric shower(s)	60.4155	53.8307	58.7811	56.0941	57.1467	54.5124	56.3294	57.1467	56.0941	58.7811	57.6758	60.4155	(64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	687.2230
Heat gains from water heating, kWh/month	41.5164	36.5541	38.8564	34.6925	33.8654	30.8026	30.8300	32.0503	32.3443	35.6600	37.3229	41.1796	(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	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	206.9402	229.1124	206.9402	213.8382	206.9402	213.8382	206.9402	206.9402	213.8382	206.9402	213.8382	206.9402	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.3035	412.5404	401.8635	379.1337	350.4414	323.4747	305.4592	301.2223	311.8992	334.6290	363.3213	390.2881	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	(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)	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	(71)
Water heating gains (Table 5)	55.8016	54.3960	52.2263	48.1840	45.5180	42.7815	41.4382	43.0784	44.9227	47.9301	51.8374	55.3489	(72)
Total internal gains	739.8691	764.8726	729.8539	709.9797	671.7234	648.9181	622.6614	620.0647	639.4839	658.3231	697.8208	721.4010	(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							
Northeast	3.5200	11.2829	0.7600	0.7000	0.7700	14.6423 (75)							
Southeast	18.7400	36.7938	0.7600	0.7000	0.7700	254.2082 (77)							
Southwest	1.5800	36.7938	0.7600	0.7000	0.7700	21.4327 (79)							
Northwest	18.6000	11.2829	0.7600	0.7000	0.7700	77.3713 (81)							
Southeast	1.0800	26.0000	0.6800	0.7000	1.0000	12.0295 (82)							
Southwest	2.1500	26.0000	0.6800	0.7000	1.0000	23.9476 (82)							
Northwest	3.2300	26.0000	0.6800	0.7000	1.0000	35.9770 (82)							
Solar gains	439.6086	806.2579	1245.5407	1765.2912	2167.8584	2232.7954	2119.3424	1808.8136	1425.0450	930.4616	537.2575	369.1509	(83)
Total gains	1179.4777	1571.1305	1975.3946	2475.2709	2839.5818	2881.7136	2742.0038	2428.8783	2064.5289	1588.7847	1235.0783	1090.5519	(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	29.3949	29.4089	29.4227	29.4877	29.4998	29.5567	29.5567	29.5672	29.5348	29.4998	29.4752	29.4495	
alpha	2.9597	2.9606	2.9615	2.9658	2.9667	2.9704	2.9704	2.9711	2.9690	2.9667	2.9650	2.9633	

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util living area	0.9855	0.9670	0.9279	0.8361	0.6940	0.5319	0.4057	0.4677	0.7017	0.9075	0.9739	0.9884 (86)
MIT	18.4397	18.8430	19.4199	20.1063	20.6096	20.8713	20.9572	20.9346	20.7016	19.9702	19.0580	18.3580 (87)
Th 2	19.9944	19.9948	19.9952	19.9972	19.9976	19.9993	19.9993	19.9996	19.9986	19.9976	19.9968	19.9960 (88)
util rest of house												
MIT 2	0.9830	0.9614	0.9157	0.8093	0.6472	0.4636	0.3207	0.3778	0.6375	0.8860	0.9685	0.9864 (89)
Living area fraction	17.6404	18.0394	18.6047	19.2595	19.7113	19.9243	19.9818	19.9708	19.8040	19.1487	18.2574	17.5603 (90)
MIT	17.7363	18.1358	18.7025	19.3611	19.8191	20.0379	20.0988	20.0864	19.9117	19.2473	18.3534	17.6560 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7363	18.1358	18.7025	19.3611	19.8191	20.0379	20.0988	20.0864	19.9117	19.2473	18.3534	17.6560 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9747	0.9473	0.8958	0.7897	0.6382	0.4664	0.3294	0.3860	0.6313	0.8657	0.9561	0.9793 (94)
Useful gains	1149.6159	1488.3607	1769.6570	1954.6811	1812.1460	1344.0425	903.2632	937.4285	1303.2940	1375.4423	1180.9080	1068.0001 (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	3584.1048	3528.9455	3251.9163	2781.7093	2158.0543	1442.6111	928.1921	977.6128	1542.9163	2298.4343	2993.6523	3582.7192 (97)
Space heating kWh	1811.2597	1371.2730	1102.8009	595.4603	257.3558	0.0000	0.0000	0.0000	0.0000	686.7060	1305.1759	1870.9510 (98a)
Space heating requirement - total per year (kWh/year)												9000.9827
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	1811.2597	1371.2730	1102.8009	595.4603	257.3558	0.0000	0.0000	0.0000	0.0000	686.7060	1305.1759	1870.9510 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9000.9827
Space heating per m2												(98c) / (4) = 37.3857 (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	2493.7100	1963.1334	2015.4717	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8304	0.8814	0.8427	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2070.9001	1730.3106	1698.3633	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3177.4828	3023.2412	2676.4196	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	796.7395	961.9404	727.6739	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	199.1849	240.4851	181.9185	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												621.5884 (107)
Energy for space heating												37.3857 (99)
Energy for space cooling												2.5818 (108)
Total												39.9675 (109)
Fabric Energy Efficiency (DFEE)												40.0 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	155.3200 (1b)	x 2.8400 (2b)	= 441.1088 (1b) - (3b)
First floor	85.4400 (1c)	x 2.4000 (2c)	= 205.0560 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	240.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	646.1648 (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) = 0.0619 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3119 (18)
Number of sides sheltered	2 (19)

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Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2651 (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												
	0.3380	0.3314	0.3248	0.2916	0.2850	0.2519	0.2519	0.2452	0.2651	0.2850	0.2983	0.3115 (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	0.5571	0.5549	0.5527	0.5425	0.5406	0.5317	0.5317	0.5301	0.5351	0.5406	0.5445	0.5485 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Semi-glazed door			4.3700	1.0000	4.3700		(26a)
TER Opening Type (Uw = 1.20)			42.4400	1.1450	48.5954		(27)
4-5			2.1500	1.5918	3.4223		(27a)
6			1.0800	1.5918	1.7191		(27a)
21-23			3.2300	1.5918	5.1414		(27a)
Floor 1 P/a 0.38			155.3200	0.1300	20.1916		(28a)
External Wall 1 Brick	87.3000	26.3300	60.9700	0.1800	10.9746		(29a)
External Wall 2 render	100.4500	16.8800	83.5700	0.1800	15.0426		(29a)
External Wall 3 dormer	14.6300	3.6000	11.0300	0.1800	1.9854		(29a)
External Wall 4 "attic"	62.1300		62.1300	0.1800	11.1834		(29a)
External Roof 2 "attic"	44.5600		44.5600	0.1100	4.9016		(30)
External Roof 1 sloping	149.0400	6.4600	142.5800	0.1100	15.6838		(30)
Total net area of external elements Aum(A, m2)			613.4300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	143.2112	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 117.2443 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	32.9400	0.0900	2.9646
E17 Corner (inverted - internal area greater than external area)	13.0200	-0.0900	-1.1718
E11 Eaves (insulation at rafter level)	44.0000	0.0400	1.7600
R4 Ridge (vaulted ceiling)	35.2500	0.0800	2.8200
E13 Gable (insulation at rafter level)	39.6300	0.0800	3.1704
E5 Ground floor (normal)	59.1000	0.1600	9.4560
E6 Intermediate floor within a dwelling	24.8000	0.0000	0.0000
R7 Flat ceiling (inverted)	7.1300	0.0400	0.2852
E2 Other lintels (including other steel lintels)	23.4800	0.0500	1.1740
E3 Sill	21.4500	0.0500	1.0725
E4 Jamb	58.3400	0.0500	2.9170
R1 Head of roof window	4.6800	0.0800	0.3744
R2 Sill of roof window	4.6800	0.0600	0.2808
R3 Jamb of roof window	16.5600	0.0800	1.3248

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 26.4279 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 169.6391 (37)

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

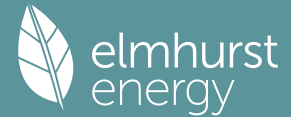
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	118.7994	118.3264	117.8627	115.6848	115.2773	113.3804	113.3804	113.0291	114.1111	115.2773	116.1016	116.9634 (38)
Heat transfer coeff	288.4385	287.9655	287.5018	285.3239	284.9164	283.0195	283.0195	282.6682	283.7502	284.9164	285.7407	286.6025 (39)
Average = Sum(39)m / 12 =												285.3219

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1980	1.1961	1.1941	1.1851	1.1834	1.1755	1.1755	1.1741	1.1786	1.1834	1.1868	1.1904 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42)
Hot water usage for baths	32.5652	32.0816	31.4005	30.1448	29.2045	28.1618	27.5986	28.2749	29.0113	30.1270	31.4086	32.4551 (42b)
Hot water usage for other uses	45.9154	44.2458	42.5761	40.9065	39.2368	37.5672	37.5672	39.2368	40.9065	42.5761	44.2458	45.9154 (42c)
Average daily hot water use (litres/day)												71.9344 (43)
Daily hot water use	78.4807	76.3274	73.9766	71.0512	68.4413	65.7290	65.1658	67.5118	69.9178	72.7031	75.6544	78.3706 (44)
Energy conte	124.2942	108.6891	113.6993	97.2656	92.1351	80.8215	78.8124	83.5937	86.2156	98.6574	107.7835	122.7094 (45)
Energy content (annual)										Total = Sum(45)m =		1194.6767
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	105.6500	92.3858	96.6444	82.6757	78.3148	68.6982	66.9905	71.0546	73.2833	83.8588	91.6160	104.3030 (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	105.6500	92.3858	96.6444	82.6757	78.3148	68.6982	66.9905	71.0546	73.2833	83.8588	91.6160	104.3030 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1015.4752 (64)
Electric shower(s)	60.4155	53.8307	58.7811	56.0941	57.1467	54.5124	56.3294	57.1467	56.0941	58.7811	57.6758	60.4155 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												687.2230 (64a)
Heat gains from water heating, kWh/month												

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41.5164 36.5541 38.8564 34.6925 33.8654 30.8026 30.8300 32.0503 32.3443 35.6600 37.3229 41.1796 (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	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459	152.7459 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	206.6073	228.7438	206.6073	213.4942	206.6073	213.4942	206.6073	206.6073	213.4942	206.6073	213.4942	206.6073 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.3035	412.5404	401.8635	379.1337	350.4414	323.4747	305.4592	301.2223	311.8992	334.6290	363.3213	390.2881 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746	38.2746 (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)	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967 (71)
Water heating gains (Table 5)	55.8016	54.3960	52.2263	48.1840	45.5180	42.7815	41.4382	43.0784	44.9227	47.9301	51.8374	55.3489 (72)
Total internal gains	739.5362	764.5040	729.5210	709.6357	671.3905	648.5741	622.3285	619.7318	639.1399	657.9902	697.4768	721.0681 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF Table 6d	Access factor Table 6d	Gains W					
Northeast	3.5200	11.2829	0.6300	0.7000	0.7700	12.1377 (75)						
Southeast	18.7400	36.7938	0.6300	0.7000	0.7700	210.7252 (77)						
Southwest	1.5800	36.7938	0.6300	0.7000	0.7700	17.7666 (79)						
Northwest	18.6000	11.2829	0.6300	0.7000	0.7700	64.1368 (81)						
Southeast	1.0800	26.0000	0.6300	0.7000	1.0000	11.1450 (82)						
Southwest	2.1500	26.0000	0.6300	0.7000	1.0000	22.1867 (82)						
Northwest	3.2300	26.0000	0.6300	0.7000	1.0000	33.3317 (82)						
Solar gains	371.4296	682.9195	1058.3973	1503.8173	1848.8598	1904.8483	1807.8329	1541.7843	1212.3249	789.1165	454.2647	311.6744 (83)
Total gains	1110.9658	1447.4236	1787.9183	2213.4530	2520.2503	2553.4224	2430.1614	2161.5161	1851.4648	1447.1067	1151.7414	1032.7425 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	27.1844	27.2291	27.2730	27.4812	27.5205	27.7049	27.7049	27.7394	27.6336	27.5205	27.4411	27.3586
tau	2.8123	2.8153	2.8182	2.8321	2.8347	2.8470	2.8470	2.8493	2.8422	2.8347	2.8294	2.8239
util living area	0.9875	0.9737	0.9453	0.8754	0.7574	0.6036	0.4721	0.5360	0.7600	0.9283	0.9784	0.9898 (86)
MIT	18.1878	18.5591	19.1239	19.8503	20.4374	20.7943	20.9254	20.8920	20.5812	19.7699	18.8418	18.1260 (87)
Th 2	19.9216	19.9231	19.9247	19.9319	19.9333	19.9396	19.9396	19.9408	19.9372	19.9333	19.9306	19.9277 (88)
util rest of house	0.9852	0.9690	0.9352	0.8522	0.7122	0.5293	0.3723	0.4338	0.6973	0.9100	0.9738	0.9879 (89)
MIT 2	17.3427	17.7116	18.2689	18.9744	19.5149	19.8180	19.9089	19.8927	19.6593	18.9139	18.0001	17.2851 (90)
Living area fraction	17.4441	17.8133	18.3715	19.0795	19.6256	19.9351	20.0309	20.0126	19.7699	19.0167	18.1011	17.3860 (92)
MIT	17.4441	17.8133	18.3715	19.0795	19.6256	19.9351	20.0309	20.0126	19.7699	19.0167	18.1011	17.3860 (93)
Temperature adjustment												0.0000
adjusted MIT	17.4441	17.8133	18.3715	19.0795	19.6256	19.9351	20.0309	20.0126	19.7699	19.0167	18.1011	17.3860 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9774	0.9559	0.9159	0.8296	0.6974	0.5289	0.3814	0.4413	0.6858	0.8893	0.9622	0.9812 (94)
Useful gains	1085.8490	1383.6192	1637.5404	1836.3657	1757.5975	1350.5478	926.9211	953.8069	1269.7349	1286.9330	1108.2111	1013.3592 (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	3791.2599	3718.5842	3413.0804	2904.4670	2258.1271	1509.9470	971.0115	1021.1655	1608.8417	2398.0425	3143.4664	3779.1349 (97)
Space heating kWh	2012.8257	1569.0965	1321.0018	769.0329	372.3940	0.0000	0.0000	0.0000	0.0000	826.6655	1465.3838	2057.7371 (98a)
Space heating requirement - total per year (kWh/year)												10394.1372
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	2012.8257	1569.0965	1321.0018	769.0329	372.3940	0.0000	0.0000	0.0000	0.0000	826.6655	1465.3838	2057.7371 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10394.1372
Space heating per m ²												(98c) / (4) = 43.1722 (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	2660.3833	2094.3443	2148.2785	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7588	0.8216	0.7753	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2018.7072	1720.7478	1665.6376	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2801.0099	2665.6008	2369.6603	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	563.2580	702.9707	523.7929	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	140.8145	175.7427	130.9482	0.0000	0.0000	0.0000	0.0000 (107)

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Space cooling requirement	447.5054 (107)
Energy for space heating	43.1722 (99)
Energy for space cooling	1.8587 (108)
Total	45.0309 (109)
Fabric Energy Efficiency (TFEE)	45.0 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	155.3200 (1b)	x 2.8400 (2b)	= 441.1088 (1b) - (3b)
First floor	85.4400 (1c)	x 2.4000 (2c)	= 205.0560 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	240.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 646.1648 (5)

2. Ventilation rate

	m ³ per hour											
Number of open chimneys	0 * 80 =	0.0000 (6a)										
Number of open flues	0 * 20 =	0.0000 (6b)										
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)										
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)										
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)										
Number of blocked chimneys	0 * 20 =	0.0000 (6f)										
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)										
Number of passive vents	0 * 10 =	0.0000 (7b)										
Number of flueless gas fires	0 * 40 =	0.0000 (7c)										
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)										
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50		2.0000 (17)										
Infiltration rate		0.1000 (18)										
Number of sides sheltered		2 (19)										
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0850 (21)										
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1084	0.1063	0.1041	0.0935	0.0914	0.0808	0.0808	0.0786	0.0850	0.0914	0.0956	0.0999 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.9000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.1989	0.1967	0.1946	0.1840	0.1819	0.1712	0.1712	0.1691	0.1755	0.1819	0.1861	0.1904 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			42.4400	1.1450	48.5954		(27)
Door			4.3700	1.2000	5.2440		(26a)
4-5			2.1500	1.0536	2.2653		(27a)
6			1.0800	1.0536	1.1379		(27a)
21-23			3.2300	1.0536	3.4033		(27a)
Floor 1 P/a 0.38			155.3200	0.1200	18.6384	110.0000	17085.2000 (28a)
External Wall 1 Brick	87.3000	26.3300	60.9700	0.1700	10.3649	9.0000	548.7300 (29a)
External Wall 2 render	100.4500	16.8800	83.5700	0.1700	14.2069	18.0000	1504.2600 (29a)
External Wall 3 dormer	14.6300	3.6000	11.0300	0.1800	1.9854	9.0000	99.2700 (29a)
External Wall 4 "attic"	62.1300		62.1300	0.0900	5.5917	9.0000	559.1700 (29a)
External Roof 2 "attic"	44.5600		44.5600	0.0900	4.0104	9.0000	401.0400 (30)
External Roof 1 sloping	149.0400	6.4600	142.5800	0.1300	18.5354	9.0000	1283.2200 (30)
Total net area of external elements Aum(A, m ²)			613.4300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	133.9790		(33)
Internal Wall 1 GF			320.4600			9.0000	2884.1400 (32c)
Internal Wall 2 TF			172.8700			9.0000	1555.8300 (32c)
Internal Floor 1			85.4400			18.0000	1537.9200 (32d)
Internal Ceiling 1			85.4400			9.0000	768.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28227.7400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							117.2443 (35)

List of Thermal Bridges	K1 Element	Length	Psi-value	Total
E16 Corner (normal)		32.9400	0.0300	0.9882
E17 Corner (inverted - internal area greater than external area)		13.0200	-0.0150	-0.1953
E11 Eaves (insulation at rafter level)		44.0000	0.0390	1.7160
R4 Ridge (vaulted ceiling)		35.2500	0.1200	4.2300
E13 Gable (insulation at rafter level)		39.6300	0.0240	0.9511
E5 Ground floor (normal)		59.1000	0.0210	1.2411
E6 Intermediate floor within a dwelling		24.8000	0.0800	1.9840
R7 Flat ceiling (inverted)		7.1300	0.1200	0.8556
E2 Other lintels (including other steel lintels)		23.4800	0.0840	1.9723

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E3 Sill		21.4500	0.0430	0.9223
E4 Jamb		58.3400	0.0340	1.9836
R1 Head of roof window		4.6800	0.2400	1.1232
R2 Sill of roof window		4.6800	0.2400	1.1232
R3 Jamb of roof window		16.5600	0.2400	3.9744
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				22.8697 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 156.8488 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	42.4070	41.9539	41.5007	39.2351	38.7820	36.5164	36.5164	36.0633	37.4226	38.7820	39.6882	40.5945 (38)
Average = Sum(39)m / 12 =	199.2558	198.8026	198.3495	196.0839	195.6308	193.3652	193.3652	192.9120	194.2714	195.6308	196.5370	197.4433 (39)
												195.9706
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8276	0.8257	0.8238	0.8144	0.8126	0.8031	0.8031	0.8013	0.8069	0.8126	0.8163	0.8201 (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													3.0549 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	87.0357	85.7431	83.9228	80.5666	78.0535	75.2669	73.7617	75.5692	77.5372	80.5190	83.9444	86.7414	86.7414 (42b)
Hot water usage for other uses	45.9154	44.2458	42.5761	40.9065	39.2368	37.5672	37.5672	39.2368	40.9065	42.5761	44.2458	45.9154	45.9154 (42c)
Average daily hot water use (litres/day)													122.4371 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	132.9511	129.9888	126.4989	121.4730	117.2903	112.8340	111.3288	114.8060	118.4437	123.0951	128.1901	132.6568	132.6568 (44)
Energy content (annual)	210.5620	185.1024	194.4241	166.2905	157.8953	138.7426	134.6426	142.1538	146.0529	167.0389	182.6303	207.7086	207.7086 (45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2033.2440
Water storage loss:	31.5843	27.7654	29.1636	24.9436	23.6843	20.8114	20.1964	21.3231	21.9079	25.0558	27.3946	31.1563	31.1563 (46)
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0400 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1016 (55)
Total storage loss	34.1496	30.8448	34.1496	33.0480	34.1496	33.0480	34.1496	34.1496	33.0480	34.1496	33.0480	34.1496	34.1496 (56)
If cylinder contains dedicated solar storage	34.1496	30.8448	34.1496	33.0480	34.1496	33.0480	34.1496	34.1496	33.0480	34.1496	33.0480	34.1496	34.1496 (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	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	0.0000 (61)
Total heat required for water heating calculated for each month	267.9740	236.9584	251.8361	221.8505	215.3073	194.3026	192.0546	199.5658	201.6129	224.4509	238.1903	265.1206	265.1206 (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	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	267.9740	236.9584	251.8361	221.8505	215.3073	194.3026	192.0546	199.5658	201.6129	224.4509	238.1903	265.1206	265.1206 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	115.9415	103.0313	110.5756	99.7396	98.4298	90.5799	90.6983	93.1957	93.0106	101.4701	105.1726	114.9927	114.9927 (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	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.5835	51.1452	41.5940	31.4894	23.5387	19.8723	21.4728	27.9111	37.4622	47.5669	55.5176	59.1839	59.1839 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	609.4082	615.7320	599.7963	565.8712	523.0469	482.7980	455.9093	449.5856	465.5212	499.4463	542.2707	582.5195	582.5195 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967 (71)
Water heating gains (Table 5)	155.8353	153.3204	148.6232	138.5272	132.2981	125.8054	121.9063	125.2631	129.1814	136.3845	146.0730	154.5601	154.5601 (72)
Total internal gains	940.3098	937.6804	907.4963	853.3706	796.3664	745.9586	716.7711	720.2425	749.6476	800.8805	861.3441	913.7463	913.7463 (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							
Northeast	3.5200	11.2829	0.7600	0.7000	0.7700	14.6423 (75)							
Southeast	18.7400	36.7938	0.7600	0.7000	0.7700	254.2082 (77)							
Southwest	1.5800	36.7938	0.7600	0.7000	0.7700	21.4327 (79)							
Northwest	18.6000	11.2829	0.7600	0.7000	0.7700	77.3713 (81)							
Southeast	1.0800	26.0000	0.6800	0.7000	1.0000	12.0295 (82)							
Southwest	2.1500	26.0000	0.6800	0.7000	1.0000	23.9476 (82)							
Northwest	3.2300	26.0000	0.6800	0.7000	1.0000	35.9770 (82)							
Solar gains	439.6086	806.2579	1245.5407	1765.2912	2167.8584	2232.7954	2119.3424	1808.8136	1425.0450	930.4616	537.2575	369.1509	369.1509 (83)
Total gains	1379.9184	1743.9383	2153.0370	2618.6618	2964.2248	2978.7540	2836.1135	2529.0561	2174.6926	1731.3421	1398.6016	1282.8972	1282.8972 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.3516	39.4413	39.5314	39.9882	40.0808	40.5504	40.5504	40.6457	40.3613	40.0808	39.8960	39.7129	
alpha	3.6234	3.6294	3.6354	3.6659	3.6721	3.7034	3.7034	3.7097	3.6908	3.6721	3.6597	3.6475	
util living area	0.9755	0.9466	0.8812	0.7453	0.5698	0.4059	0.2976	0.3462	0.5722	0.8444	0.9559	0.9806 (86)	
Living	19.6461	19.9219	20.2876	20.6452	20.8321	20.8984	20.9123	20.9092	20.8544	20.5474	20.0190	19.5935	
Non living	18.6141	18.9625	19.4164	19.8480	20.0559	20.1297	20.1412	20.1409	20.0883	19.7468	19.0951	18.5523	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3074	19.9219	20.2876	20.6452	20.8321	20.8984	20.9123	20.9092	20.8544	20.5474	20.0190	19.7902 (87)	
Th 2	20.2295	20.2311	20.2327	20.2408	20.2425	20.2506	20.2506	20.2522	20.2473	20.2425	20.2392	20.2360 (88)	
util rest of house	0.9718	0.9390	0.8657	0.7174	0.5316	0.3611	0.2478	0.2916	0.5203	0.8183	0.9484	0.9776 (89)	
MIT 2	19.5855	18.9625	19.4164	19.8480	20.0559	20.1297	20.1412	20.1409	20.0883	19.7468	19.0951	18.8557 (90)	
Living area fraction									fLA = Living area / (4) =				
MIT	19.6721	19.0776	19.5209	19.9437	20.1490	20.2219	20.2337	20.2331	20.1802	19.8429	19.2060	18.9678 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.6721	19.0776	19.5209	19.9437	20.1490	20.2219	20.2337	20.2331	20.1802	19.8429	19.2060	18.9678 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9687	0.9251	0.8493	0.7057	0.5267	0.3594	0.2467	0.2902	0.5155	0.8027	0.9356	0.9713 (94)
Useful gains	1336.6605	1613.3688	1828.6054	1847.8836	1561.2935	1070.4227	699.6228	733.9743	1121.0470	1389.7306	1308.5613	1246.1285 (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	3062.9799	2818.5536	2582.6987	2165.4826	1652.8931	1087.0818	702.6393	739.4555	1181.2071	1808.1951	2379.2754	2915.8107 (97)
Space heating kWh	1284.3817	809.8842	561.0454	228.6713	68.1501	0.0000	0.0000	0.0000	0.0000	311.3376	770.9141	1242.2435 (98a)
Space heating requirement - total per year (kWh/year)												5276.6279
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	1284.3817	809.8842	561.0454	228.6713	68.1501	0.0000	0.0000	0.0000	0.0000	311.3376	770.9141	1242.2435 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5276.6279
Space heating per m2												21.9165 (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 %)													334.5422 (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	1284.3817	809.8842	561.0454	228.6713	68.1501	0.0000	0.0000	0.0000	0.0000	311.3376	770.9141	1242.2435 (98)	
Space heating efficiency (main heating system 1)	334.5422	334.5422	334.5422	334.5422	334.5422	0.0000	0.0000	0.0000	0.0000	334.5422	334.5422	334.5422 (210)	
Space heating fuel (main heating system)	383.9222	242.0873	167.7054	68.3535	20.3712	0.0000	0.0000	0.0000	0.0000	93.0638	230.4385	371.3264 (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	267.9740	236.9584	251.8361	221.8505	215.3073	194.3026	192.0546	199.5658	201.6129	224.4509	238.1903	265.1206 (64)	
Efficiency of water heater (217)m	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231 (216)	
Fuel for water heating, kWh/month	141.9932	125.5587	133.4421	117.5534	114.0863	102.9564	101.7652	105.7453	106.8300	118.9313	126.2115	140.4812 (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	66.2838	59.8692	66.2838	64.1456	66.2838	64.1456	66.2838	66.2838	64.1456	66.2838	64.1456	66.2838 (231)	
Lighting	50.4025	40.4348	36.4070	26.6733	20.6033	16.8330	18.7950	24.4304	31.7327	41.6350	47.0267	51.8033 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-93.6062	-136.3950	-200.2829	-222.3185	-235.1857	-216.6815	-214.1849	-201.9669	-177.8940	-152.7117	-103.0494	-79.7999 (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	-38.6382	-90.3119	-199.2299	-328.3093	-455.1256	-465.3439	-457.4739	-378.7656	-266.7695	-141.0014	-55.0626	-29.9876 (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												1577.2682 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												188.7231	
Water heating fuel used												1435.5548 (219)	
Space cooling fuel												0.0000 (221)	

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Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.9900) mechanical ventilation fans (SFP = 0.9900)	780.4378 (230a) 780.4378 (231)
Total electricity for the above, kWh/year	406.7771 (232)
Electricity for lighting (calculated in Appendix L)	
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-4940.0962 (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	-740.0582 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1577.2682	16.4900	260.0915	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1435.5548	16.4900	236.7230	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	780.4378	16.4900	128.6942	(249)
Energy for lighting	406.7771	16.4900	67.0775	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2034.0767	16.4900	-335.4193	
PV Unit electricity exported	-2906.0195	5.5900	-162.4465	
Total			-497.8657	(252)
Total energy cost			194.7205	(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] =	0.2453	(257)
SAP value		96.0235	
SAP rating (Section 12)		96	(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	1577.2682	0.1569	247.4148	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1435.5548	0.1408	202.1790	(264)
Space and water heating			449.5938	(265)
Pumps, fans and electric keep-hot	780.4378	0.1387	108.2564	(267)
Energy for lighting	406.7771	0.1443	58.7105	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2034.0767	0.1347	-273.9967	
PV Unit electricity exported	-2906.0195	0.1236	-359.1954	
Total			-633.1920	(269)
Total CO2, kg/year			-16.6314	(272)
CO2 emissions per m2			-0.0700	(273)
EI value			100.0780	
EI rating			100	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	155.3200 (1b)	x	2.8400 (2b)	=	441.1088	(1b) - (3b)
First floor	85.4400 (1c)	x	2.4000 (2c)	=	205.0560	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	240.7600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	646.1648	(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)

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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	0.0000 / (5) = 0.0000 (8)
Pressure Test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50			2.0000 (17)
Infiltration rate			0.1000 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.0850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.6000	6.3000	6.2000	5.5000	5.4000	4.8000	4.8000	4.7000	5.2000	6.0000	6.1000	6.5000 (22)
Wind factor	1.6500	1.5750	1.5500	1.3750	1.3500	1.2000	1.2000	1.1750	1.3000	1.5000	1.5250	1.6250 (22a)
Adj infiltr rate	0.1403	0.1339	0.1318	0.1169	0.1148	0.1020	0.1020	0.0999	0.1105	0.1275	0.1296	0.1381 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.9000 (23c)
Effective ac	0.2307	0.2244	0.2222	0.2074	0.2052	0.1925	0.1925	0.1904	0.2010	0.2180	0.2201	0.2286 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Window (Uw = 1.20)			42.4400	1.1450	48.5954		(27)
Door			4.3700	1.2000	5.2440		(26a)
4-5			2.1500	1.0536	2.2653		(27a)
6			1.0800	1.0536	1.1379		(27a)
21-23			3.2300	1.0536	3.4033		(27a)
Floor 1 P/a 0.38			155.3200	0.1200	18.6384	110.0000	17085.2000 (28a)
External Wall 1 Brick	87.3000	26.3300	60.9700	0.1700	10.3649	9.0000	548.7300 (29a)
External Wall 2 render	100.4500	16.8800	83.5700	0.1700	14.2069	18.0000	1504.2600 (29a)
External Wall 3 dormer	14.6300	3.6000	11.0300	0.1800	1.9854	9.0000	99.2700 (29a)
External Wall 4 "attic"	62.1300		62.1300	0.0900	5.5917	9.0000	559.1700 (29a)
External Roof 2 "attic"	44.5600		44.5600	0.0900	4.0104	9.0000	401.0400 (30)
External Roof 1 sloping	149.0400	6.4600	142.5800	0.1300	18.5354	9.0000	1283.2200 (30)
Total net area of external elements Aum(A, m2)			613.4300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	133.9790	(33)
Internal Wall 1 GF			320.4600			9.0000	2884.1400 (32c)
Internal Wall 2 TF			172.8700			9.0000	1555.8300 (32c)
Internal Floor 1			85.4400			18.0000	1537.9200 (32d)
Internal Ceiling 1			85.4400			9.0000	768.9600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 28227.7400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							117.2443 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	32.9400	0.0300	0.9882
E17 Corner (inverted - internal area greater than external area)	13.0200	-0.0150	-0.1953
E11 Eaves (insulation at rafter level)	44.0000	0.0390	1.7160
R4 Ridge (vaulted ceiling)	35.2500	0.1200	4.2300
E13 Gable (insulation at rafter level)	39.6300	0.0240	0.9511
E5 Ground floor (normal)	59.1000	0.0210	1.2411
E6 Intermediate floor within a dwelling	24.8000	0.0800	1.9840
R7 Flat ceiling (inverted)	7.1300	0.1200	0.8556
E2 Other lintels (including other steel lintels)	23.4800	0.0840	1.9723
E3 Sill	21.4500	0.0430	0.9223
E4 Jamb	58.3400	0.0340	1.9836
R1 Head of roof window	4.6800	0.2400	1.1232
R2 Sill of roof window	4.6800	0.2400	1.1232
R3 Jamb of roof window	16.5600	0.2400	3.9744

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

Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	156.8488 (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
(39)m	49.2038	47.8445	47.3913	44.2195	43.7664	41.0476	41.0476	40.5945	42.8601	46.4851	46.9382	48.7507 (38)
Heat transfer coeff	206.0526	204.6932	204.2401	201.0683	200.6151	197.8964	197.8964	197.4433	199.7089	203.3339	203.7870	205.5995 (39)
Average = Sum(39)m / 12 =												201.8612

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8558	0.8502	0.8483	0.8351	0.8333	0.8220	0.8220	0.8201	0.8295	0.8446	0.8464	0.8540 (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	3.0549 (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	87.0357	85.7431	83.9228	80.5666	78.0535	75.2669	73.7617	75.5692	77.5372	80.5190	83.9444	86.7414 (42b)
Hot water usage for other uses	45.9154	44.2458	42.5761	40.9065	39.2368	37.5672	37.5672	39.2368	40.9065	42.5761	44.2458	45.9154 (42c)
Average daily hot water use (litres/day)												122.4371 (43)
Daily hot water use	132.9511	129.9888	126.4989	121.4730	117.2903	112.8340	111.3288	114.8060	118.4437	123.0951	128.1901	132.6568 (44)
Energy conte	210.5620	185.1024	194.4241	166.2905	157.8953	138.7426	134.6426	142.1538	146.0529	167.0389	182.6303	207.7086 (45)
Energy content (annual)												Total = Sum(45)m = 2033.2440
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	31.5843	27.7654	29.1636	24.9436	23.6843	20.8114	20.1964	21.3231	21.9079	25.0558	27.3946	31.1563 (46)
Store volume												250.0000 (47)

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a) If manufacturer declared loss factor is known (kWh/day):													2.0400 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1016 (55)
Total storage loss	34.1496	30.8448	34.1496	33.0480	34.1496	33.0480	34.1496	34.1496	33.0480	34.1496	33.0480	34.1496	(56)
If cylinder contains dedicated solar storage	34.1496	30.8448	34.1496	33.0480	34.1496	33.0480	34.1496	34.1496	33.0480	34.1496	33.0480	34.1496	(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	267.9740	236.9584	251.8361	221.8505	215.3073	194.3026	192.0546	199.5658	201.6129	224.4509	238.1903	265.1206	(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	267.9740	236.9584	251.8361	221.8505	215.3073	194.3026	192.0546	199.5658	201.6129	224.4509	238.1903	265.1206	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	115.9415	103.0313	110.5756	99.7396	98.4298	90.5799	90.6983	93.1957	93.0106	101.4701	105.1726	114.9927	(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	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.5835	51.1452	41.5940	31.4894	23.5387	19.8723	21.4728	27.9111	37.4622	47.5669	55.5176	59.1839	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	609.4082	615.7320	599.7963	565.8712	523.0469	482.7980	455.9093	449.5856	465.5212	499.4463	542.2707	582.5195	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	(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)	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	(71)
Water heating gains (Table 5)	155.8353	153.3204	148.6232	138.5272	132.2981	125.8054	121.9063	125.2631	129.1814	136.3845	146.0730	154.5601	(72)
Total internal gains	940.3098	937.6804	907.4963	853.3706	796.3664	745.9586	716.7711	720.2425	749.6476	800.8805	861.3441	913.7463	(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							
Northeast	3.5200	15.4448	0.7600	0.7000	0.7700	20.0433	(75)						
Southeast	18.7400	46.9996	0.7600	0.7000	0.7700	324.7196	(77)						
Southwest	1.5800	46.9996	0.7600	0.7000	0.7700	27.3776	(79)						
Northwest	18.6000	15.4448	0.7600	0.7000	0.7700	105.9108	(81)						
Southeast	1.0800	36.0000	0.6800	0.7000	1.0000	16.6562	(82)						
Southwest	2.1500	36.0000	0.6800	0.7000	1.0000	33.1582	(82)						
Northwest	3.2300	36.0000	0.6800	0.7000	1.0000	49.8144	(82)						
Solar gains	577.6801	898.9960	1381.8959	1999.9833	2305.4325	2553.2428	2160.2938	2023.0638	1617.4889	1055.7338	681.0593	499.7208	(83)
Total gains	1517.9899	1836.6763	2289.3922	2853.3539	3101.7989	3299.2014	2877.0649	2743.3064	2367.1365	1856.6143	1542.4034	1413.4671	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	38.0536	38.3063	38.3913	38.9969	39.0850	39.6219	39.6219	39.7129	39.2623	38.5624	38.4766	38.1374		
alpha	3.5369	3.5538	3.5594	3.5998	3.6057	3.6415	3.6415	3.6475	3.6175	3.5708	3.5651	3.5425		
util living area	0.9594	0.9284	0.8538	0.7164	0.5734	0.4040	0.3586	0.3677	0.5447	0.8042	0.9266	0.9642	(86)	
Living	19.8373	20.0459	20.3642	20.6662	20.8204	20.8943	20.9044	20.9039	20.8581	20.6086	20.2023	19.8340		
Non living	18.8386	19.1020	19.4918	19.8542	20.0257	20.1090	20.1184	20.1198	20.0717	19.7939	19.3042	18.8365		
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0		
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0		
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10		
MIT	20.4052	20.0459	20.3642	20.6662	20.8204	20.8943	20.9044	20.9039	20.8581	20.6086	20.2023	19.9971	(87)	
Th 2	20.2052	20.2100	20.2117	20.2230	20.2246	20.2343	20.2343	20.2360	20.2278	20.2149	20.2133	20.2068	(88)	
util rest of house	0.9530	0.9180	0.8348	0.6872	0.5357	0.3618	0.3088	0.3159	0.4929	0.7718	0.9137	0.9582	(89)	
MIT 2	19.6604	19.1020	19.4918	19.8542	20.0257	20.1090	20.1184	20.1198	20.0717	19.7939	19.3042	19.0834	(90)	
Living area fraction	19.7498	19.2152	19.5965	19.9516	20.1210	20.2032	20.2127	20.2139	20.1660	19.8917	19.4119	19.1931	(92)	
Temperature adjustment	19.7498	19.2152	19.5965	19.9516	20.1210	20.2032	20.2127	20.2139	20.1660	19.8917	19.4119	19.1931	(93)	
adjusted MIT	19.7498	19.2152	19.5965	19.9516	20.1210	20.2032	20.2127	20.2139	20.1660	19.8917	19.4119	19.1931	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9488	0.9021	0.8182	0.6763	0.5305	0.3601	0.3074	0.3144	0.4886	0.7569	0.8976	0.9488	(94)
Useful gains	1440.2327	1656.8975	1873.1171	1929.6851	1645.3528	1187.9004	884.3122	862.3840	1156.5268	1405.1844	1384.4225	1341.0703	(95)
Ext temp.	5.7000	6.0000	7.2000	8.9000	11.4000	14.1000	15.7000	15.8000	14.1000	11.3000	8.5000	6.1000	(96)
Heat loss rate W	2894.9911	2705.0683	2531.8606	2222.1270	1749.5724	1207.8053	893.0467	871.5015	1211.4402	1746.9783	2223.7120	2691.9305	(97)
Space heating kWh	1082.3403	704.3708	490.1052	210.5582	77.5394	0.0000	0.0000	0.0000	0.0000	254.2946	604.2884	1005.0399	(98a)
Space heating requirement - total per year (kWh/year)													4428.5368
Solar heating kWh													

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Space heating - main system 1	1309.8951	0.1567	205.3059 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1435.4003	0.1408	202.1572 (264)
Space and water heating			407.4631 (265)
Pumps, fans and electric keep-hot	780.4378	0.1387	108.2564 (267)
Energy for lighting	406.7771	0.1443	58.7105 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2189.4546	0.1355	-296.5871
PV Unit electricity exported	-3335.1914	0.1252	-417.4673
Total			-714.0544 (269)
Total CO2, kg/year			-139.6244 (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	1309.8951	1.5802	2069.8852 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1435.4003	1.5208	2182.8996 (278)
Space and water heating			4252.7848 (279)
Pumps, fans and electric keep-hot	780.4378	1.5128	1180.6464 (281)
Energy for lighting	406.7771	1.5338	623.9283 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2189.4546	1.5007	-3285.6751
PV Unit electricity exported	-3335.1914	0.4595	-1532.4416
Total			-4818.1167 (283)
Total Primary energy kWh/year			1239.2427 (286)

 SAP 10 EPC IMPROVEMENTS

SEC1 - ASHP ROI TF 0.15

Current energy efficiency rating:	A 96
Current environmental impact rating:	A 100

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

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.8	-£ 61	-42 kg (29.8%)
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Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
	Total Savings £0	0.00 kg/m²	

Potential energy efficiency rating:	A 96
Potential environmental impact rating:	A 100

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
 Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£846	£846	£0
Space heating	£450	£450	£0
Water heating	£309	£309	£0
Lighting	£87	£87	£0
Generated (PV)	-£657	-£657	£0
Total cost of fuels	£189	£189	£0
Total cost of uses	£189	£189	£0
Delivered energy	-7 kWh/m²	-7 kWh/m²	0 kWh/m²
Carbon dioxide emissions	-0.1 tonnes	-0.1 tonnes	0.0 tonnes
CO2 emissions per m²	-1 kg/m²	-1 kg/m²	0 kg/m²
Primary energy	5 kWh/m²	5 kWh/m²	0 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)
Ground floor	155.3200 (1b)	x 2.8400 (2b)	= 441.1088 (1b) - (3b)
First floor	85.4400 (1c)	x 2.4000 (2c)	= 205.0560 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	240.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 646.1648 (5)

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Hot water usage for other uses	87.0357	85.7431	83.9228	80.5666	78.0535	75.2669	73.7617	75.5692	77.5372	80.5190	83.9444	86.7414 (42b)
Average daily hot water use (litres/day)	45.9154	44.2458	42.5761	40.9065	39.2368	37.5672	37.5672	39.2368	40.9065	42.5761	44.2458	45.9154 (42c)
												122.4371 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	132.9511	129.9888	126.4989	121.4730	117.2903	112.8340	111.3288	114.8060	118.4437	123.0951	128.1901	132.6568 (44)
Distribution loss (46)m = 0.15 x (45)m	210.5620	185.1024	194.4241	166.2905	157.8953	138.7426	134.6426	142.1538	146.0529	167.0389	182.6303	207.7086 (45)
Water storage loss:	31.5843	27.7654	29.1636	24.9436	23.6843	20.8114	20.1964	21.3231	21.9079	25.0558	27.3946	31.1563 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0400 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1016 (55)
Total storage loss	34.1496	30.8448	34.1496	33.0480	34.1496	33.0480	34.1496	34.1496	33.0480	34.1496	33.0480	34.1496 (56)
If cylinder contains dedicated solar storage	34.1496	30.8448	34.1496	33.0480	34.1496	33.0480	34.1496	34.1496	33.0480	34.1496	33.0480	34.1496 (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	267.9740	236.9584	251.8361	221.8505	215.3073	194.3026	192.0546	199.5658	201.6129	224.4509	238.1903	265.1206 (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	267.9740	236.9584	251.8361	221.8505	215.3073	194.3026	192.0546	199.5658	201.6129	224.4509	238.1903	265.1206 (64)
												Total per year (kWh/year) = Sum(64)m = 2709.2240 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	115.9415	103.0313	110.5756	99.7396	98.4298	90.5799	90.6983	93.1957	93.0106	101.4701	105.1726	114.9927 (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	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.5835	51.1452	41.5940	31.4894	23.5387	19.8723	21.4728	27.9111	37.4622	47.5669	55.5176	59.1839 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	609.4082	615.7320	599.7963	565.8712	523.0469	482.7980	455.9093	449.5856	465.5212	499.4463	542.2707	582.5195 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844 (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)	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967 (71)
Water heating gains (Table 5)	155.8353	153.3204	148.6232	138.5272	132.2981	125.8054	121.9063	125.2631	129.1814	136.3845	146.0730	154.5601 (72)
Total internal gains	940.3098	937.6804	907.4963	853.3706	796.3664	745.9586	716.7711	720.2425	749.6476	800.8805	861.3441	913.7463 (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
Northeast	3.5200	11.2829	0.7600	0.7000	0.7700	14.6423 (75)
Southeast	18.7400	36.7938	0.7600	0.7000	0.7700	254.2082 (77)
Southwest	1.5800	36.7938	0.7600	0.7000	0.7700	21.4327 (79)
Northwest	18.6000	11.2829	0.7600	0.7000	0.7700	77.3713 (81)
Southeast	1.0800	26.0000	0.6800	0.7000	1.0000	12.0295 (82)
Southwest	2.1500	26.0000	0.6800	0.7000	1.0000	23.9476 (82)
Northwest	3.2300	26.0000	0.6800	0.7000	1.0000	35.9770 (82)

Solar gains	439.6086	806.2579	1245.5407	1765.2912	2167.8584	2232.7954	2119.3424	1808.8136	1425.0450	930.4616	537.2575	369.1509 (83)
Total gains	1379.9184	1743.9383	2153.0370	2618.6618	2964.2248	2978.7540	2836.1135	2529.0561	2174.6926	1731.3421	1398.6016	1282.8972 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.3516	39.4413	39.5314	39.9882	40.0808	40.5504	40.5504	40.6457	40.3613	40.0808	39.8960	39.7129
alpha	3.6234	3.6294	3.6354	3.6659	3.6721	3.7034	3.7034	3.7097	3.6908	3.6721	3.6597	3.6475
util living area	0.9755	0.9466	0.8812	0.7453	0.5698	0.4059	0.2976	0.3462	0.5722	0.8444	0.9559	0.9806 (86)
Living	19.6461	19.9219	20.2876	20.6452	20.8321	20.8984	20.9123	20.9092	20.8544	20.5474	20.0190	19.5935
Non living	18.6141	18.9625	19.4164	19.8480	20.0559	20.1297	20.1412	20.1409	20.0883	19.7468	19.0951	18.5523
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3074	19.9219	20.2876	20.6452	20.8321	20.8984	20.9123	20.9092	20.8544	20.5474	20.0190	19.7902 (87)
Th 2	20.2295	20.2311	20.2327	20.2408	20.2425	20.2506	20.2506	20.2522	20.2473	20.2425	20.2392	20.2360 (88)
util rest of house	0.9718	0.9390	0.8657	0.7174	0.5316	0.3611	0.2478	0.2916	0.5203	0.8183	0.9484	0.9776 (89)
MIT 2	19.5855	18.9625	19.4164	19.8480	20.0559	20.1297	20.1412	20.1409	20.0883	19.7468	19.0951	18.8557 (90)
Living area fraction										fLA = Living area / (4) =		0.1200 (91)
MIT	19.6721	19.0776	19.5209	19.9437	20.1490	20.2219	20.2337	20.2331	20.1802	19.8429	19.2060	18.9678 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6721	19.0776	19.5209	19.9437	20.1490	20.2219	20.2337	20.2331	20.1802	19.8429	19.2060	18.9678 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9687	0.9251	0.8493	0.7057	0.5267	0.3594	0.2467	0.2902	0.5155	0.8027	0.9356	0.9713	(94)
Useful gains	1336.6605	1613.3698	1828.6054	1847.8836	1561.2935	1070.4227	699.6228	733.9743	1121.0470	1389.7306	1308.5613	1246.1285	(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	3062.9799	2818.5536	2582.6987	2165.4826	1652.8931	1087.0818	702.6393	739.4555	1181.2071	1808.1951	2379.2754	2915.8107	(97)
Space heating kWh	1284.3817	809.8842	561.0454	228.6713	68.1501	0.0000	0.0000	0.0000	0.0000	311.3376	770.9141	1242.2435	(98a)
Space heating requirement - total per year (kWh/year)												5276.6279	
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	1284.3817	809.8842	561.0454	228.6713	68.1501	0.0000	0.0000	0.0000	0.0000	311.3376	770.9141	1242.2435	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5276.6279	
Space heating per m2										(98c) / (4) =		21.9165	(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 %)													334.5422	(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	1284.3817	809.8842	561.0454	228.6713	68.1501	0.0000	0.0000	0.0000	0.0000	311.3376	770.9141	1242.2435	(98)	
Space heating efficiency (main heating system 1)	334.5422	334.5422	334.5422	334.5422	334.5422	0.0000	0.0000	0.0000	0.0000	334.5422	334.5422	334.5422	(210)	
Space heating fuel (main heating system)	383.9222	242.0873	167.7054	68.3535	20.3712	0.0000	0.0000	0.0000	0.0000	93.0638	230.4385	371.3264	(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	267.9740	236.9584	251.8361	221.8505	215.3073	194.3026	192.0546	199.5658	201.6129	224.4509	238.1903	265.1206	(64)	
Efficiency of water heater	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	188.7231	(216)	
Fuel for water heating, kWh/month	141.9932	125.5587	133.4421	117.5534	114.0863	102.9564	101.7652	105.7453	106.8300	118.9313	126.2115	140.4812	(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	66.2838	59.8692	66.2838	64.1456	66.2838	64.1456	66.2838	66.2838	64.1456	66.2838	64.1456	66.2838	(231)	
Lighting	50.4025	40.4348	36.4070	26.6733	20.6033	16.8330	18.7950	24.4304	31.7327	41.6350	47.0267	51.8033	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-93.6062	-136.3950	-200.2829	-222.3185	-235.1857	-216.6815	-214.1849	-201.9669	-177.8940	-152.7117	-103.0494	-79.7999	(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	-38.6382	-90.3119	-199.2299	-328.3093	-455.1256	-465.3439	-457.4739	-378.7656	-266.7695	-141.0014	-55.0626	-29.9876	(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													1577.2682	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													188.7231	
Water heating fuel used													1435.5548	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.9900)														
mechanical ventilation fans (SFP = 0.9900)														
Total electricity for the above, kWh/year													780.4378	(230a)
Electricity for lighting (calculated in Appendix L)													406.7771	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-4940.0962	(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													-740.0582	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1577.2682	16.4900	260.0915
Total CO2 associated with community systems			0.0000
Water heating (other fuel)	1435.5548	16.4900	236.7230
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000
Pumps, fans and electric keep-hot	780.4378	16.4900	128.6942
Energy for lighting	406.7771	16.4900	67.0775
Additional standing charges			0.0000

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2034.0767	16.4900	-335.4193
PV Unit electricity exported	-2906.0195	5.5900	-162.4465
Total			-497.8657 (252)
Total energy cost			194.7205 (255)

 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.2453 (257)
SAP value		96.0235
SAP rating (Section 12)		96 (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	1577.2682	0.1569	247.4148 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1435.5548	0.1408	202.1790 (264)
Space and water heating			449.5938 (265)
Pumps, fans and electric keep-hot	780.4378	0.1387	108.2564 (267)
Energy for lighting	406.7771	0.1443	58.7105 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2034.0767	0.1347	-273.9967
PV Unit electricity exported	-2906.0195	0.1236	-359.1954
Total			-633.1920 (269)
Total CO2, kg/year			-16.6314 (272)
CO2 emissions per m2			-0.0700 (273)
EI value			100.0780
EI rating			100 (274)
EI band			A

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

 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	155.3200 (1b)	x 2.8400 (2b)	= 441.1088 (1b) - (3b)
First floor	85.4400 (1c)	x 2.4000 (2c)	= 205.0560 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	240.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	646.1648 (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		2.0000 (17)
Infiltration rate		0.1000 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.6000	6.3000	6.2000	5.5000	5.4000	4.8000	4.8000	4.7000	5.2000	6.0000	6.1000	6.5000 (22)
Wind factor	1.6500	1.5750	1.5500	1.3750	1.3500	1.2000	1.2000	1.1750	1.3000	1.5000	1.5250	1.6250 (22a)
Adj infilt rate	0.1403	0.1339	0.1318	0.1169	0.1148	0.1020	0.1020	0.0999	0.1105	0.1275	0.1296	0.1381 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.9000 (23c)
Effective ac	0.2307	0.2244	0.2222	0.2074	0.2052	0.1925	0.1925	0.1904	0.2010	0.2180	0.2201	0.2286 (25)

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3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			42.4400	1.1450	48.5954		(27)
Door			4.3700	1.2000	5.2440		(26a)
4-5			2.1500	1.0536	2.2653		(27a)
6			1.0800	1.0536	1.1379		(27a)
21-23			3.2300	1.0536	3.4033		(27a)
Floor 1 P/a 0.38			155.3200	0.1200	18.6384	110.0000	17085.2000 (28a)
External Wall 1 Brick	87.3000	26.3300	60.9700	0.1700	10.3649	9.0000	548.7300 (29a)
External Wall 2 render	100.4500	16.8800	83.5700	0.1700	14.2069	18.0000	1504.2600 (29a)
External Wall 3 dormer	14.6300	3.6000	11.0300	0.1800	1.9854	9.0000	99.2700 (29a)
External Wall 4 "attic"	62.1300		62.1300	0.0900	5.5917	9.0000	559.1700 (29a)
External Roof 2 "attic"	44.5600		44.5600	0.0900	4.0104	9.0000	401.0400 (30)
External Roof 1 sloping	149.0400	6.4600	142.5800	0.1300	18.5354	9.0000	1283.2200 (30)
Total net area of external elements Aum(A, m ²)			613.4300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	133.9790	(33)
Internal Wall 1 GF			320.4600			9.0000	2884.1400 (32c)
Internal Wall 2 TF			172.8700			9.0000	1555.8300 (32c)
Internal Floor 1			85.4400			18.0000	1537.9200 (32d)
Internal Ceiling 1			85.4400			9.0000	768.9600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 28227.7400 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 117.2443 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	32.9400	0.0300	0.9882
E17 Corner (inverted - internal area greater than external area)	13.0200	-0.0150	-0.1953
E11 Eaves (insulation at rafter level)	44.0000	0.0390	1.7160
R4 Ridge (vaulted ceiling)	35.2500	0.1200	4.2300
E13 Gable (insulation at rafter level)	39.6300	0.0240	0.9511
E5 Ground floor (normal)	59.1000	0.0210	1.2411
E6 Intermediate floor within a dwelling	24.8000	0.0800	1.9840
R7 Flat ceiling (inverted)	7.1300	0.1200	0.8556
E2 Other lintels (including other steel lintels)	23.4800	0.0840	1.9723
E3 Sill	21.4500	0.0430	0.9223
E4 Jamb	58.3400	0.0340	1.9836
R1 Head of roof window	4.6800	0.2400	1.1232
R2 Sill of roof window	4.6800	0.2400	1.1232
R3 Jamb of roof window	16.5600	0.2400	3.9744

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.8697 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 156.8488 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	49.2038	47.8445	47.3913	44.2195	43.7664	41.0476	41.0476	40.5945	42.8601	46.4851	46.9382	48.7507 (38)
Average = Sum(39)m / 12 =	206.0526	204.6932	204.2401	201.0683	200.6151	197.8964	197.8964	197.4433	199.7089	203.3339	203.7870	205.5995 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8558	0.8502	0.8483	0.8351	0.8333	0.8220	0.8220	0.8201	0.8295	0.8446	0.8464	0.8540 (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													3.0549 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	87.0357	85.7431	83.9228	80.5666	78.0535	75.2669	73.7617	75.5692	77.5372	80.5190	83.9444	86.7414	86.7414 (42b)
Hot water usage for other uses	45.9154	44.2458	42.5761	40.9065	39.2368	37.5672	37.5672	39.2368	40.9065	42.5761	44.2458	45.9154	45.9154 (42c)
Average daily hot water use (litres/day)													122.4371 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	132.9511	129.9888	126.4989	121.4730	117.2903	112.8340	111.3288	114.8060	118.4437	123.0951	128.1901	132.6568 (44)
Energy content (annual)	210.5620	185.1024	194.4241	166.2905	157.8953	138.7426	134.6426	142.1538	146.0529	167.0389	182.6303	207.7086 (45)

Distribution loss (46)m = 0.15 x (45)m = 2033.2440

Distribution loss	31.5843	27.7654	29.1636	24.9436	23.6843	20.8114	20.1964	21.3231	21.9079	25.0558	27.3946	31.1563 (46)
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Water storage loss: Store volume 250.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 2.0400 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 1.1016 (55)

Total storage loss 34.1496 30.8448 34.1496 33.0480 34.1496 33.0480 34.1496 34.1496 33.0480 34.1496 33.0480 34.1496 34.1496 (56)

If cylinder contains dedicated solar storage 34.1496 30.8448 34.1496 33.0480 34.1496 33.0480 34.1496 34.1496 33.0480 34.1496 33.0480 34.1496 34.1496 (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 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 0.0000 (61)

Total heat required for water heating calculated for each month 267.9740 236.9584 251.8361 221.8505 215.3073 194.3026 192.0546 199.5658 201.6129 224.4509 238.1903 265.1206 (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 0.0000 (63a)

PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h 267.9740 236.9584 251.8361 221.8505 215.3073 194.3026 192.0546 199.5658 201.6129 224.4509 238.1903 265.1206 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

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

Heat gains from water heating, kWh/month 115.9415 103.0313 110.5756 99.7396 98.4298 90.5799 90.6983 93.1957 93.0106 101.4701 105.1726 114.9927 (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
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(66)m	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	183.2951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.5835	51.1452	41.5940	31.4894	23.5387	19.8723	21.4728	27.9111	37.4622	47.5669	55.5176	59.1839	59.1839	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	609.4082	615.7320	599.7963	565.8712	523.0469	482.7980	455.9093	449.5856	465.5212	499.4463	542.2707	582.5195	582.5195	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	56.3844	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	-122.1967	(71)
Water heating gains (Table 5)	155.8353	153.3204	148.6232	138.5272	132.2981	125.8054	121.9063	125.2631	129.1814	136.3845	146.0730	154.5601	154.5601	(72)
Total internal gains	940.3098	937.6804	907.4963	853.3706	796.3664	745.9586	716.7711	720.2425	749.6476	800.8805	861.3441	913.7463	913.7463	(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
Northeast	3.5200	15.4448	0.7600	0.7000	0.7700	20.0433 (75)
Southeast	18.7400	46.9996	0.7600	0.7000	0.7700	324.7196 (77)
Southwest	1.5800	46.9996	0.7600	0.7000	0.7700	27.3776 (79)
Northwest	18.6000	15.4448	0.7600	0.7000	0.7700	105.9108 (81)
Southeast	1.0800	36.0000	0.6800	0.7000	1.0000	16.6562 (82)
Southwest	2.1500	36.0000	0.6800	0.7000	1.0000	33.1582 (82)
Northwest	3.2300	36.0000	0.6800	0.7000	1.0000	49.8144 (82)

Solar gains	577.6801	898.9960	1381.8959	1999.9833	2305.4325	2553.2428	2160.2938	2023.0638	1617.4889	1055.7338	681.0593	499.7208	499.7208	(83)
Total gains	1517.9899	1836.6763	2289.3922	2853.3539	3101.7989	3299.2014	2877.0649	2743.3064	2367.1365	1856.6143	1542.4034	1413.4671	1413.4671	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.0536	38.3063	38.3913	38.9969	39.0850	39.6219	39.6219	39.7129	39.2623	38.5624	38.4766	38.1374	38.1374
alpha	3.5369	3.5538	3.5594	3.5998	3.6057	3.6415	3.6415	3.6475	3.6175	3.5708	3.5651	3.5425	3.5425
util living area	0.9594	0.9284	0.8538	0.7164	0.5734	0.4040	0.3586	0.3677	0.5447	0.8042	0.9266	0.9642	0.9642 (86)
Living	19.8373	20.0459	20.3642	20.6662	20.8204	20.8943	20.9044	20.9039	20.8581	20.6086	20.2023	19.8340	19.8340
Non living	18.8386	19.1020	19.4918	19.8542	20.0257	20.1090	20.1184	20.1198	20.0717	19.7939	19.3042	18.8365	18.8365
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	10
MIT	20.4052	20.0459	20.3642	20.6662	20.8204	20.8943	20.9044	20.9039	20.8581	20.6086	20.2023	19.9971	19.9971 (87)
Th 2	20.2052	20.2100	20.2117	20.2230	20.2246	20.2343	20.2343	20.2360	20.2278	20.2149	20.2133	20.2068	20.2068 (88)
util rest of house	0.9530	0.9180	0.8348	0.6872	0.5357	0.3618	0.3088	0.3159	0.4929	0.7718	0.9137	0.9582	0.9582 (89)
MIT 2	19.6604	19.1020	19.4918	19.8542	20.0257	20.1090	20.1184	20.1198	20.0717	19.7939	19.3042	19.0834	19.0834 (90)
Living area fraction	19.7498	19.2152	19.5965	19.9516	20.1210	20.2032	20.2127	20.2139	20.1660	19.8917	19.4119	19.1200	19.1200 (91)
MIT	19.7498	19.2152	19.5965	19.9516	20.1210	20.2032	20.2127	20.2139	20.1660	19.8917	19.4119	19.1931	19.1931 (92)
Temperature adjustment												0.0000	0.0000
adjusted MIT	19.7498	19.2152	19.5965	19.9516	20.1210	20.2032	20.2127	20.2139	20.1660	19.8917	19.4119	19.1931	19.1931 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9488	0.9021	0.8182	0.6763	0.5305	0.3601	0.3074	0.3144	0.4886	0.7569	0.8976	0.9488	0.9488 (94)
Useful gains	1440.2327	1656.8975	1873.1171	1929.6851	1645.3528	1187.9004	884.3122	862.3840	1156.5268	1405.1844	1384.4225	1341.0703	1341.0703 (95)
Ext temp.	5.7000	6.0000	7.2000	8.9000	11.4000	14.1000	15.7000	15.8000	14.1000	11.3000	8.5000	6.1000	6.1000 (96)
Heat loss rate W	2894.9911	2705.0683	2531.8606	2222.1270	1749.5724	1207.8053	893.0467	871.5015	1211.4402	1746.9783	2223.7120	2691.9305	2691.9305 (97)
Space heating kWh	1082.3403	704.3708	490.1052	210.5582	77.5394	0.0000	0.0000	0.0000	0.0000	254.2946	604.2884	1005.0399	1005.0399 (98a)
Space heating requirement - total per year (kWh/year)												4428.5368	4428.5368
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	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000	0.0000
Space heating kWh	1082.3403	704.3708	490.1052	210.5582	77.5394	0.0000	0.0000	0.0000	0.0000	254.2946	604.2884	1005.0399	1005.0399 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4428.5368	4428.5368
Space heating per m2										(98c) / (4) =		18.3940	18.3940 (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 %)													338.0833 (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	1082.3403	704.3708	490.1052	210.5582	77.5394	0.0000	0.0000	0.0000	0.0000	254.2946	604.2884	1005.0399	1005.0399 (98)
Space heating efficiency (main heating system 1)	338.0833	338.0833	338.0833	338.0833	338.0833	0.0000	0.0000	0.0000	0.0000	338.0833	338.0833	338.0833	338.0833 (210)
Space heating fuel (main heating system)	320.1401	208.3424	144.9658	62.2800	22.9350	0.0000	0.0000	0.0000	0.0000	75.2166	178.7395	297.2758	297.2758 (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	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	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

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Water heating requirement	267.9740	236.9584	251.8361	221.8505	215.3073	194.3026	192.0546	199.5658	201.6129	224.4509	238.1903	265.1206	(64)
Efficiency of water heater (217)m	188.7435	188.7435	188.7435	188.7435	188.7435	188.7435	188.7435	188.7435	188.7435	188.7435	188.7435	188.7435	(216)
Fuel for water heating, kWh/month	141.9779	125.5452	133.4277	117.5408	114.0740	102.9453	101.7543	105.7339	106.8185	118.9185	126.1979	140.4661	(217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
Pumps and Fa	66.2838	59.8692	66.2838	64.1456	66.2838	64.1456	66.2838	66.2838	64.1456	66.2838	64.1456	66.2838	(221)
Lighting	50.4025	40.4348	36.4070	26.6733	20.6033	16.8330	18.7950	24.4304	31.7327	41.6350	47.0267	51.8033	(222)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-116.7592	-147.3387	-212.4187	-235.8884	-241.5342	-227.8119	-215.2700	-211.8316	-190.0085	-165.2770	-123.0218	-102.2948	(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	-59.6320	-108.2664	-232.6346	-386.0500	-487.8756	-546.5414	-464.6538	-434.5702	-315.1895	-170.8671	-80.2274	-48.6835	(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												1309.8951	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												188.7435	(216)
Water heating fuel used												1435.4003	(217)
Space cooling fuel												0.0000	(219)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.9900) mechanical ventilation fans (SFP = 0.9900)												780.4378	(230a)
Total electricity for the above, kWh/year												780.4378	(231)
Electricity for lighting (calculated in Appendix L)												406.7771	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-5524.6460	(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												-1592.1357	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1309.8951	21.5100	281.7584	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1435.4003	21.5100	308.7546	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	780.4378	21.5100	167.8722	(249)
Energy for lighting	406.7771	21.5100	87.4978	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2189.4546	21.5100	-470.9517	
PV Unit electricity exported	-3335.1914	5.5900	-186.4372	
Total			-657.3889	(252)
Total energy cost			188.4941	(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	1309.8951	0.1567	205.3059	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1435.4003	0.1408	202.1572	(264)
Space and water heating			407.4631	(265)
Pumps, fans and electric keep-hot	780.4378	0.1387	108.2564	(267)
Energy for lighting	406.7771	0.1443	58.7105	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2189.4546	0.1355	-296.5871	
PV Unit electricity exported	-3335.1914	0.1252	-417.4673	
Total			-714.0544	(269)
Total CO2, kg/year			-139.6244	(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	1309.8951	1.5802	2069.8852	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1435.4003	1.5208	2182.8996	(278)
Space and water heating			4252.7848	(279)
Pumps, fans and electric keep-hot	780.4378	1.5128	1180.6464	(281)
Energy for lighting	406.7771	1.5338	623.9283	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2189.4546	1.5007	-3285.6751	
PV Unit electricity exported	-3335.1914	0.4595	-1532.4416	
Total			-4818.1167	(283)

Total Primary energy kWh/year

1239.2427 (286)