

Full SAP Calculation Printout



Plot Reference	UNIT 07				Issued on Date	08/07/2026	
Assessment Reference	001			Plot Type Ref	UNIT 07		
Plot Address	UNIT 07, Stoney Wood Quarter, 34 The Fairway, LONDON, NW7 3HS				SAP Version	10.2	
SAP Rating	81 B	DER	3.90	TER	16.34		
Environmental	97 A	% DER < TER				76.13	
CO ₂ Emissions (t/year)	0.26	DFEE	37.79	TFEE	43.85		
Compliance Check	See BREL	% DFEE < TFEE				13.81	
% DPER < TPER	52.90	DPER	41.57	TPER	88.26		
Assessor Details	Mr. Ondrej Gajdos				Assessor ID	W452-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Basement floor	39.1000 (1a)	x 2.9000 (2a)	= 113.3900 (1a) - (3a)
Ground floor	32.6000 (1b)	x 2.8000 (2b)	= 91.2800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 204.6700 (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	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1050 (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	0.1339 0.1313 0.1286 0.1155 0.1129 0.0997 0.0997 0.0971 0.1050 0.1129 0.1181 0.1234 (22b)
Balanced mechanical ventilation with heat recovery	
If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000 (23c)
Effective ac	0.2289 0.2262 0.2236 0.2105 0.2079 0.1947 0.1947 0.1921 0.2000 0.2079 0.2131 0.2184 (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
Main dwelling							
dl			1.8900	1.0000	1.8900		(26)
1			30.1500	0.7940	23.9378		(27)
basement floor			39.1000	0.1000	3.9100	110.0000	4300.9998 (28)
exposed wall	79.3500	32.0400	47.3100	0.1500	7.0965	60.0000	2838.5999 (29a)
basement wall	62.0600		62.0600	0.1500	9.3090	9.0000	558.5400 (29a)
Total net area of external elements Aum(A, m ²)			180.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.1433		(33)
Main dwelling							
pw			28.5000	0.0000	0.0000	110.0000	3135.0000 (32)
pc			35.9000			30.0000	1077.0000 (32b)
iw			89.9600			9.0000	809.6400 (32c)
if			32.6000			18.0000	586.8000 (32d)
ic			32.6000			9.0000	293.4000 (32e)

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Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 13599.9797 (34)
189.6789 (35)

	Length	Psi-value	Total
K1 Element	12.3500	0.0500	0.6175
E2 Other lintels (including other steel lintels)	11.4500	0.0500	0.5725
E3 Sill	35.2000	0.0500	1.7600
E4 Jamb	6.7000	0.1600	1.0720
E5 Ground floor (normal)	21.3000	0.0700	1.4910
E22 Basement floor	6.1000	0.0000	0.0000
E6 Intermediate floor within a dwelling	21.5000	0.0700	1.5050
E7 Party floor between dwellings (in blocks of flats)	11.5000	0.0900	1.0350
E16 Corner (normal)	5.7000	-0.0900	-0.5130
E17 Corner (inverted - internal area greater than external area)	11.3000	0.0600	0.6780
E18 Party wall between dwellings	5.7000	0.0600	0.3420
E25 Staggered party wall between dwellings			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.5600 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	54.7033 (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	15.4585	15.2812	15.1039	14.2174	14.0401	13.1536	13.1536	12.9763	13.5082	14.0401	14.3947	14.7493	(38)
Heat transfer coeff	70.1618	69.9845	69.8072	68.9207	68.7434	67.8570	67.8570	67.6797	68.2116	68.7434	69.0980	69.4526	(39)
Average = Sum(39)m / 12 =												68.8764	
HLP	0.9785	0.9761	0.9736	0.9612	0.9588	0.9464	0.9464	0.9439	0.9513	0.9588	0.9637	0.9687	(40)
HLP (average)												0.9606	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2867 (42)
Hot water usage for mixer showers	62.5597	61.6196	60.2496	57.6284	55.6940	53.5368	52.3106	53.6702	55.1606	57.4768	60.1543	62.3201	(42a)
Hot water usage for baths	27.0260	26.6246	26.0594	25.0172	24.2369	23.3716	22.9042	23.4654	24.0766	25.0024	26.0661	26.9346	(42b)
Hot water usage for other uses	38.0479	36.6643	35.2808	33.8972	32.5136	31.1301	31.1301	32.5136	33.8972	35.2808	36.6643	38.0479	(42c)
Average daily hot water use (litres/day)												117.3243	(43)
Daily hot water use	127.6336	124.9085	121.5897	116.5428	112.4445	108.0384	106.3449	109.6493	113.1344	117.7600	122.8847	127.3025	(44)
Energy conte	202.1404	177.8681	186.8789	159.5413	151.3719	132.8459	128.6149	135.7688	139.5060	159.7992	175.0718	199.3250	(45)
Energy content (annual)												1948.7322	
Distribution loss (46)m = 0.15 x (45)m	30.3211	26.6802	28.0318	23.9312	22.7058	19.9269	19.2922	20.3653	20.9259	23.9699	26.2608	29.8988	(46)
Water storage loss (or HIU loss):													
Store volume												110.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152	(51)
Volume factor from Table 2a												1.0294	(52)
Temperature factor from Table 2b												0.6000	(53)
Enter (49) or (54) in (55)												1.0327	(55)
Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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	257.4172	227.7955	242.1557	213.0350	206.6487	186.3395	183.8917	191.0456	192.9997	215.0761	228.5655	254.6018	(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	257.4172	227.7955	242.1557	213.0350	206.6487	186.3395	183.8917	191.0456	192.9997	215.0761	228.5655	254.6018	(64)
12Total per year (kWh/year)												2599.5719	(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	111.4331	99.0831	106.3587	95.8424	94.5526	86.9662	86.9859	89.3646	89.1807	97.3547	101.0063	110.4970	(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	114.3340	114.3340	114.3340	114.3340	114.3340	114.3340	114.3340	114.3340	114.3340	114.3340	114.3340	114.3340	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.4983	112.3731	101.4983	104.8816	101.4983	104.8816	101.4983	101.4983	104.8816	101.4983	104.8816	101.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.2318	203.3199	198.0578	186.8555	172.7145	159.4240	150.5451	148.4570	153.7190	164.9214	179.0624	192.3529	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334	(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)	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	(71)
Water heating gains (Table 5)	149.7757	147.4451	142.9552	133.1145	127.0868	120.7864	116.9165	120.1136	123.8621	130.8531	140.2866	148.5175	(72)
Total internal gains	509.8060	520.4383	499.8115	482.1517	458.5998	442.3922	426.2602	427.3691	439.7629	454.5730	481.5307	499.6689	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W
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					W/m2	or Table 6b		or Table 6c		Table 6d		
Southwest					20.9600	36.7938	0.5300	0.7000	0.7700			198.2775 (79)
Northwest					9.1900	11.2829	0.5300	0.7000	0.7700			26.6591 (81)
Solar gains	224.9366	392.0052	559.8793	733.1418	857.1645	866.7943	829.0952	734.1488	619.5008	439.5911	271.0347	191.4554 (83)
Total gains	734.7425	912.4435	1059.6909	1215.2935	1315.7643	1309.1865	1255.3553	1161.5179	1059.2637	894.1641	752.5655	691.1242 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	53.8437	53.9801	54.1172	54.8133	54.9547	55.6726	55.6726	55.8184	55.3832	54.9547	54.6726	54.3935
alpha	4.5896	4.5987	4.6078	4.6542	4.6636	4.7115	4.7115	4.7212	4.6922	4.6636	4.6448	4.6262
util living area	0.9527	0.8960	0.8023	0.6438	0.4771	0.3305	0.2376	0.2676	0.4388	0.7209	0.9068	0.9618 (86)
MIT	20.0936	20.4055	20.6884	20.9007	20.9777	20.9969	20.9995	20.9991	20.9886	20.8643	20.4638	20.0330 (87)
Th 2	20.1012	20.1033	20.1054	20.1158	20.1178	20.1282	20.1282	20.1303	20.1241	20.1178	20.1137	20.1095 (88)
util rest of house	0.9433	0.8782	0.7739	0.6055	0.4344	0.2860	0.1907	0.2172	0.3851	0.6766	0.8875	0.9540 (89)
MIT 2	19.0765	19.4552	19.7854	20.0238	20.1003	20.1264	20.1280	20.1300	20.1167	19.9957	19.5413	19.0081 (90)
Living area fraction	fLA = Living area / (4) = 0.4086 (91)											
MIT	19.4921	19.8435	20.1544	20.3822	20.4588	20.4821	20.4842	20.4851	20.4730	20.3506	19.9183	19.4269 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.4921	19.8435	20.1544	20.3822	20.4588	20.4821	20.4842	20.4851	20.4730	20.3506	19.9183	19.4269 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9356	0.8725	0.7756	0.6173	0.4511	0.3041	0.2098	0.2378	0.4067	0.6888	0.8827	0.9467 (94)
Useful gains	687.4454	796.1069	821.8896	750.2365	593.4842	398.1121	263.4339	276.2405	430.7640	615.8854	664.2852	654.2980 (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	1065.9061	1045.8169	953.1770	791.3593	602.1119	399.1429	263.5672	276.4807	434.7136	670.2932	885.7167	1057.5516 (97)
Space heating kWh	281.5748	167.8051	97.6778	29.6084	6.4190	0.0000	0.0000	0.0000	0.0000	40.4794	159.4307	300.0207 (98a)
Space heating requirement - total per year (kWh/year)	1083.0160											
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	281.5748	167.8051	97.6778	29.6084	6.4190	0.0000	0.0000	0.0000	0.0000	40.4794	159.4307	300.0207 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1083.0160											
Space heating per m2	(98c) / (4) = 15.1048 (99)											
9b. Energy requirements												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	281.5748	167.8051	97.6778	29.6084	6.4190	0.0000	0.0000	0.0000	0.0000	40.4794	159.4307	300.0207 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50	422.3623	251.7076	146.5168	44.4127	9.6285	0.0000	0.0000	0.0000	0.0000	60.7191	239.1460	450.0311
307a	422.3623	251.7076	146.5168	44.4127	9.6285	0.0000	0.0000	0.0000	0.0000	60.7191	239.1460	450.0311
Space heating requirement	422.3623	251.7076	146.5168	44.4127	9.6285	0.0000	0.0000	0.0000	0.0000	60.7191	239.1460	450.0311 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)											
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	257.4172	227.7955	242.1557	213.0350	206.6487	186.3395	183.8917	191.0456	192.9997	215.0761	228.5655	254.6018 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50	386.1258	341.6932	363.2336	319.5524	309.9731	279.5093	275.8376	286.5683	289.4995	322.6141	342.8483	381.9027
310a	386.1258	341.6932	363.2336	319.5524	309.9731	279.5093	275.8376	286.5683	289.4995	322.6141	342.8483	381.9027
Water heating fuel	386.1258	341.6932	363.2336	319.5524	309.9731	279.5093	275.8376	286.5683	289.4995	322.6141	342.8483	381.9027 (310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)
Space coolin	14.6966	13.2743	14.6966	14.2225	14.6966	14.2225	14.6966	14.6966	14.2225	14.6966	14.2225	14.6966 (315)
Pumps and Fa	21.0893	16.9187	15.2334	11.1606	8.6208	7.0433	7.8642	10.2221	13.2776	17.4209	19.6768	21.6755 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	(333a)m	-3.0541	-5.4543	-10.1336	-14.3736	-18.0786	-17.8717	-17.4912	-14.9935	-11.2003	-7.1395	-2.4904 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)	(333b)m	-0.3504	-0.9324	-2.4370	-4.6344	-7.0627	-7.4723	-7.2572	-5.5647	-3.3725	-1.5028	-0.2594 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating	1624.5240 (307)											
Space heating fuel - secondary	0.0000 (309)											
Water heating fuel - community heating	3899.3579 (310)											
Efficiency of water heater	0.0000 (311)											
Electricity used for heat distribution	16.2452 (313)											
Space cooling fuel	0.0000 (321)											
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.6930)												
mechanical ventilation fans (SFP = 0.6930)												173.0403 (330a)

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Total electricity for the above, kWh/year	173.0403 (331)
Electricity for lighting (calculated in Appendix L)	170.2031 (332)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-167.3084 (333)
Wind generation	0.0000 (334)
Hydro-electric generation (Appendix N)	0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	5699.8168 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Efficiency of heat source Heat pump			330.0000 (367)
Space and Water heating from Heat pump	1673.9036	0.1581	77.8428 (367)
Electrical energy for heat distribution (space & water)	16.2452	0.0000	8.0615 (372)
Overall CO ₂ factor for heat network			0.0457 (386)
Total CO ₂ associated with community systems			252.3485 (373)
Space and water heating			252.3485 (376)
Pumps, fans and electric keep-hot	173.0403	0.1387	24.0028 (378)
Energy for lighting	170.2031	0.1443	24.5656 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-125.9568	0.1304	-16.4266
PV Unit electricity exported	-41.3516	0.1205	-4.9846
Total			-21.4112 (380)
Total CO ₂ , kg/year			279.5057 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9000 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			330.0000 (467a)
Space and Water heating from Heat pump	1673.9036	1.5853	780.4129 (467)
Electrical energy for heat distribution (space & water)	16.2452	0.0000	85.0570 (472)
Overall CO ₂ factor for heat network			0.4820 (486)
Total CO ₂ associated with community systems			2662.5418 (473)
Space and water heating			2662.5418 (476)
Pumps, fans and electric keep-hot	173.0403	1.5128	261.7754 (478)
Energy for lighting	170.2031	1.5338	261.0632 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-125.9568	1.4817	-186.6358
PV Unit electricity exported	-41.3516	0.4422	-18.2854
Total			-204.9212 (480)
Total Primary energy kWh/year			2980.4591 (483)
Dwelling Primary energy Rate (DPER)			41.5700 (484)

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)
Main dwelling			
Basement floor	39.1000 (1a)	x 2.9000 (2a)	= 113.3900 (1a) - (3a)
Ground floor	32.6000 (1b)	x 2.8000 (2b)	= 91.2800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 204.6700 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	30.0000 / (5) = 0.1466 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3966 (18)
Number of sides sheltered	4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2776 (21)

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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												
Effective ac	0.3539	0.3470	0.3401	0.3054	0.2984	0.2637	0.2637	0.2568	0.2776	0.2984	0.3123	0.3262 (22b)
	0.5626	0.5602	0.5578	0.5466	0.5445	0.5348	0.5348	0.5330	0.5385	0.5445	0.5488	0.5532 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type			16.0300	1.1450	18.3550		(27)
basement floor			39.1000	0.1300	5.0830		(28)
exposed wall	79.3500	17.9200	61.4300	0.1800	11.0574		(29a)
basement wall	62.0600		62.0600	0.1800	11.1708		(29a)
Total net area of external elements Aum(A, m2)			180.5100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	47.5562	(33)
Main dwelling							
pw			28.5000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							189.6789 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.3500	0.0500	0.6175
E3 Sill	11.4500	0.0500	0.5725
E4 Jamb	35.2000	0.0500	1.7600
E5 Ground floor (normal)	6.7000	0.1600	1.0720
E22 Basement floor	21.3000	0.0700	1.4910
E6 Intermediate floor within a dwelling	6.1000	0.0000	0.0000
E7 Party floor between dwellings (in blocks of flats)	21.5000	0.0700	1.5050
E16 Corner (normal)	11.5000	0.0900	1.0350
E17 Corner (inverted - internal area greater than external area)	5.7000	-0.0900	-0.5130
E18 Party wall between dwellings	11.3000	0.0600	0.6780
E25 Staggered party wall between dwellings	5.7000	0.0600	0.3420
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.5600 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	56.1162 (37)

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

(38)m	Jan 38.0012	Feb 37.8369	Mar 37.6759	Apr 36.9196	May 36.7781	Jun 36.1193	Jul 36.1193	Aug 35.9973	Sep 36.3730	Oct 36.7781	Nov 37.0643	Dec 37.3636 (38)
Heat transfer coeff	94.1174	93.9531	93.7921	93.0357	92.8942	92.2355	92.2355	92.1135	92.4892	92.8942	93.1805	93.4798 (39)
Average = Sum(39)m / 12 =												93.0351
HLP	Jan 1.3127	Feb 1.3104	Mar 1.3081	Apr 1.2976	May 1.2956	Jun 1.2864	Jul 1.2864	Aug 1.2847	Sep 1.2899	Oct 1.2956	Nov 1.2996	Dec 1.3038 (40)
HLP (average)												1.2976
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2867 (42)
Hot water usage for mixer showers	62.5597	61.6196	60.2496	57.6284	55.6940	53.5368	52.3106	53.6702	55.1606	57.4768	60.1543	62.3201 (42a)	
Hot water usage for baths	27.0260	26.6246	26.0594	25.0172	24.2369	23.3716	22.9042	23.4654	24.0766	25.0024	26.0661	26.9346 (42b)	
Hot water usage for other uses	38.0479	36.6643	35.2808	33.8972	32.5136	31.1301	31.1301	32.5136	33.8972	35.2808	36.6643	38.0479 (42c)	
Average daily hot water use (litres/day)												117.3243 (43)	
Daily hot water use	Jan 127.6336	Feb 124.9085	Mar 121.5897	Apr 116.5428	May 112.4445	Jun 108.0384	Jul 106.3449	Aug 109.6493	Sep 113.1344	Oct 117.7600	Nov 122.8847	Dec 127.3025 (44)	
Energy content (annual)	202.1404	177.8681	186.8789	159.5413	151.3719	132.8459	128.6149	135.7688	139.5060	159.7992	175.0718	199.3250 (45)	
Distribution loss (46)m = 0.15 x (45)m	30.3211	26.6802	28.0318	23.9312	22.7058	19.9269	19.2922	20.3653	20.9259	23.9699	26.2608	29.8988 (46)	
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)	
Total heat required for water heating calculated for each month	253.0993	223.8954	237.8378	208.8563	202.3308	182.1609	179.5738	186.7277	188.8211	210.7582	224.3869	250.2839 (62)	
WWHRS	-28.5997	-25.2938	-26.4862	-21.9316	-20.4395	-17.4902	-16.3943	-17.4337	-18.0961	-21.3333	-24.1680	-28.0701 (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	224.4996	198.6016	211.3516	186.9247	181.8913	164.6707	163.1795	169.2940	170.7250	189.4249	200.2189	222.2138 (64)	
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				2282.9957 (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)	
												0.0000 (64a)	
Heat gains from water heating, kWh/month	79.9514	70.6480	74.8770	65.3762	63.0709	56.5000	55.5042	57.8828	58.7145	65.8730	70.5402	79.0153 (65)	

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

Metabolic gains (Table 5), Watts												
(66)m	Jan 114.3340	Feb 114.3340	Mar 114.3340	Apr 114.3340	May 114.3340	Jun 114.3340	Jul 114.3340	Aug 114.3340	Sep 114.3340	Oct 114.3340	Nov 114.3340	Dec 114.3340 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.4932	112.3674	101.4932	104.8763	101.4932	104.8763	101.4932	101.4932	104.8763	101.4932	104.8763	101.4932 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												

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Cooking gains	201.2318	203.3199	198.0578	186.8555	172.7145	159.4240	150.5451	148.4570	153.7190	164.9214	179.0624	192.3529 (68)
	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334	34.4334 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation	(negative values) (Table 5)											
	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672	-91.4672 (71)
Water heating gains	107.4616	105.1309	100.6411	90.8003	84.7727	78.4722	74.6024	77.7995	81.5479	88.5389	97.9724	106.2033 (72)
Total internal gains	470.4867	481.1184	460.4923	442.8323	419.2805	400.0727	383.9409	385.0498	397.4434	415.2537	442.2112	460.3496 (73)

6. Solar gains

[Jan]												Gains
			Area m2			Solar flux Table 6a W/m2	g Specific data or Table 6b			FF Specific data or Table 6c	Access factor Table 6d	W
Southwest			11.1500			36.7938	0.6300			0.7000	0.7700	125.3781 (79)
Northwest			4.8800			11.2829	0.6300			0.7000	0.7700	16.8273 (81)
Solar gains	142.2054	247.8177	353.9213	463.4103	541.7718	547.8449	524.0232	464.0346	391.5979	277.8943	171.3472	121.0395 (83)
Total gains	612.6921	728.9362	814.4136	906.2426	961.0523	947.9176	907.9640	849.0844	789.0414	693.1480	613.5584	581.3891 (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	40.1389	40.2091	40.2782	40.6056	40.6675	40.9579	40.9579	41.0122	40.8455	40.6675	40.5425	40.4127	
alpha	3.6759	3.6806	3.6852	3.7070	3.7112	3.7305	3.7305	3.7341	3.7230	3.7112	3.7028	3.6942	
util living area	0.9806	0.9635	0.9333	0.8636	0.7439	0.5778	0.4344	0.4797	0.6979	0.8958	0.9659	0.9838 (86)	
MIT	19.2696	19.5551	19.9299	20.3865	20.7335	20.9237	20.9796	20.9705	20.8433	20.3825	19.7443	19.2170 (87)	
Th 2	19.8309	19.8327	19.8345	19.8427	19.8443	19.8515	19.8515	19.8528	19.8487	19.8443	19.8412	19.8379 (88)	
util rest of house	0.9758	0.9547	0.9171	0.8308	0.6853	0.4897	0.3267	0.3685	0.6140	0.8630	0.9561	0.9798 (89)	
MIT 2	17.8554	18.2150	18.6813	19.2343	19.6193	19.8050	19.8440	19.8410	19.7402	19.2462	18.4637	17.7935 (90)	
Living area fraction	18.4333	18.7626	19.1915	19.7052	20.0746	20.2622	20.3081	20.3026	20.1910	19.7105	18.9870	18.3752 (92)	
MIT	18.4333	18.7626	19.1915	19.7052	20.0746	20.2622	20.3081	20.3026	20.1910	19.7105	18.9870	18.3752 (93)	
Temperature adjustment												0.0000	
adjusted MIT	18.4333	18.7626	19.1915	19.7052	20.0746	20.2622	20.3081	20.3026	20.1910	19.7105	18.9870	18.3752 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9679	0.9443	0.9062	0.8264	0.6979	0.5225	0.3705	0.4133	0.6408	0.8585	0.9466	0.9727 (94)	
Useful gains	593.0447	688.3477	737.9929	748.8762	670.6778	495.2709	336.3776	350.9652	505.6297	595.0557	580.8096	565.5002 (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	1330.1875	1302.4378	1190.3620	1005.2660	777.9559	522.2529	342.0170	359.4803	563.3519	846.3160	1107.6372	1325.0984 (97)	
Space heating kWh	548.4342	412.6685	336.5626	184.6007	79.8149	0.0000	0.0000	0.0000	0.0000	186.9377	379.3159	565.1410 (98a)	
Space heating requirement - total per year (kWh/year)												2693.4755	
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	548.4342	412.6685	336.5626	184.6007	79.8149	0.0000	0.0000	0.0000	0.0000	186.9377	379.3159	565.1410 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												2693.4755	
Space heating per m ²												(98c) / (4) =	37.5659 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	548.4342	412.6685	336.5626	184.6007	79.8149	0.0000	0.0000	0.0000	0.0000	186.9377	379.3159	565.1410 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	593.5435	446.6110	364.2452	199.7843	86.3798	0.0000	0.0000	0.0000	0.0000	202.3135	410.5150	611.6245 (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	224.4996	198.6016	211.3516	186.9247	181.8913	164.6707	163.1795	169.2940	170.7250	189.4249	200.2189	222.2138 (64)
Efficiency of water heater	86.2180	85.9106	85.3731	84.3546	82.7411	80.3000	80.3000	80.3000	80.3000	84.3531	85.7280	86.2917 (217)
Fuel for water heating, kWh/month	260.3859	231.1724	247.5624	221.5939	219.8318	205.0694	203.2124	210.8269	212.6090	224.5618	233.5513	257.5146 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	21.0883	16.9178	15.2326	11.1601	8.6203	7.0429	7.8638	10.2216	13.2769	17.4200	19.6758	21.6744 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-9.3307	-14.3766	-22.5603	-27.7679	-32.1259	-30.8004	-30.4271	-27.6192	-23.0981	-17.4396	-10.6822	-7.9310 (233a)

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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	-2.1194	-4.6341	-9.5517	-14.8669	-20.1848	-20.4779	-20.2378	-16.8905	-12.0652	-6.7920	-2.8805	-1.6632	(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												2915.0167	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2727.8917	(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)												170.1944	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-386.5231	(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												5512.5798	(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	2915.0167	0.2100	612.1535	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2727.8917	0.2100	572.8573	(264)
Space and water heating			1185.0108	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	170.1944	0.1443	24.5643	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-254.1591	0.1328	-33.7466	
PV Unit electricity exported	-132.3640	0.1249	-16.5282	
Total			-50.2748	(269)
Total CO2, kg/year			1171.2295	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.3400	(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	2915.0167	1.1300	3293.9689	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2727.8917	1.1300	3082.5177	(278)
Space and water heating			6376.4866	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	170.1944	1.5338	261.0499	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-254.1591	1.4906	-378.8545	
PV Unit electricity exported	-132.3640	0.4583	-60.6631	
Total			-439.5175	(283)
Total Primary energy kWh/year			6328.1198	(286)
Target Primary Energy Rate (TPER)			88.2600	(287)