

Full SAP Calculation Printout



Property Reference	OP-D320 P4CHAR				Issued on Date	29/11/2024
Assessment Reference	P4CHAR		Prop Type Ref	P4CHAR		
Property	P4CHAR					
SAP Rating	80 C	DER	3.70	TER	9.31	
Environmental	96 A	% DER < TER				60.26
CO ₂ Emissions (t/year)	0.69	DFEE	41.10	TFEE	41.95	
Compliance Check	See BREL	% DFEE < TFEE				2.01
% DPER < TPER	20.40	DPER	38.81	TPER	48.76	
Assessor Details	Mr. Matthew Stainrod				Assessor ID	AU83-0001
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)
Ground floor	75.6900 (1b)	x 2.4600 (2b)	= 186.1974 (1b) - (3b)
First floor	81.5200 (1c)	x 2.6200 (2c)	= 213.5824 (1c) - (3c)
Second floor	48.1900 (1d)	x 2.6100 (2d)	= 125.7759 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	205.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 525.5557 (5)

2. Ventilation rate

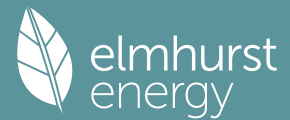
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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	3.5000 (17)
Infiltration rate	0.1750 (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) = 0.1487 (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	0.1897	0.1859	0.1822	0.1636	0.1599	0.1413	0.1413	0.1376	0.1487	0.1599	0.1673	0.1748 (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) =												69.6000 (23c)
Effective ac	0.3417	0.3379	0.3342	0.3156	0.3119	0.2933	0.2933	0.2896	0.3007	0.3119	0.3193	0.3268 (25)

3. Heat losses and heat loss parameter

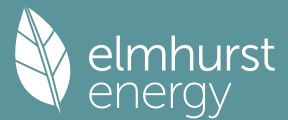
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2800	1.0000	4.2800		(26)
Windows (Uw = 1.30)			42.7300	1.2357	52.8032		(27)
Ground Floor			75.6900	0.1100	8.3259		(28a)
External Wall	288.8600	47.0100	241.8500	0.1700	41.1145		(29a)
Roof - ceiling	70.8100		70.8100	0.1100	7.7891		(30)
Bay Roof	4.8800		4.8800	0.1100	0.5368		(30)
Total net area of external elements Aum (A, m ²)			440.2400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 114.8495		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				36.9100	0.0500	1.8455	

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E3 Sill						31.1900		0.0500		1.5595		
E4 Jamb						84.6000		0.0500		4.2300		
E5 Ground floor (normal)						42.3200		0.1600		6.7712		
E6 Intermediate floor within a dwelling						32.9200		0.0000		0.0000		
E10 Eaves (insulation at ceiling level)						35.5600		0.0600		2.1336		
E12 Gable (insulation at ceiling level)						16.1100		0.0600		0.9666		
E16 Corner (normal)						56.2100		0.0900		5.0589		
E24 Eaves (insulation at ceiling level - inverted)						9.3500		0.2400		2.2440		
E17 Corner (inverted - internal area greater than external area)						25.4200		-0.0900		-2.2878		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											22.5215	(36)
Point Thermal Bridges											0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	137.3710 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	59.2546	58.6096	57.9647	54.7399	54.0950	50.8702	50.8702	50.2252	52.1601	54.0950	55.3849	56.6748 (38)
Average = Sum(39)m / 12 =	196.6256	195.9807	195.3357	192.1109	191.4660	188.2412	188.2412	187.5963	189.5311	191.4660	192.7559	194.0458 (39)
												191.9497
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9573	0.9541	0.9510	0.9353	0.9322	0.9165	0.9165	0.9133	0.9227	0.9322	0.9384	0.9447 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
												0.9345
												31
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												3.0089 (42)
Hot water usage for mixer showers												
	102.6712	101.1283	98.8799	94.5780	91.4034	87.8630	85.8507	88.0820	90.5280	94.3293	98.7235	102.2779 (42a)
Hot water usage for baths												
	33.9303	33.4264	32.7167	31.4083	30.4286	29.3423	28.7555	29.4601	30.2274	31.3898	32.7251	33.8156 (42b)
Hot water usage for other uses												
	47.8364	46.0969	44.3574	42.6179	40.8784	39.1389	39.1389	40.8784	42.6179	44.3574	46.0969	47.8364 (42c)
Average daily hot water use (litres/day)												169.6058 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	184.4379	180.6516	175.9541	168.6043	162.7104	156.3442	153.7450	158.4206	163.3733	170.0765	177.5456	183.9298 (44)
Energy conte	292.1046	257.2454	270.4348	230.8108	219.0395	192.2434	185.9413	196.1577	201.4556	230.7922	252.9463	287.9897 (45)
Energy content (annual)												Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m												2817.1613
	43.8157	38.5868	40.5652	34.6216	32.8559	28.8365	27.8912	29.4237	30.2183	34.6188	37.9419	43.1985 (46)
Water storage loss:												
Store volume												230.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.4040 (55)
Total storage loss												
	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240 (56)
If cylinder contains dedicated solar storage												
	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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												
	390.4862	346.1062	368.8164	326.0188	317.4211	256.8754	252.7277	262.9441	266.0876	329.1738	348.1543	386.3713 (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	390.4862	346.1062	368.8164	326.0188	317.4211	256.8754	252.7277	262.9441	266.0876	329.1738	348.1543	386.3713 (64)
												Total per year (kWh/year) = Sum(64)m =
												3851.1829 (64)
12Total per year (kWh/year)												3851 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =
												0.0000 (64a)
Heat gains from water heating, kWh/month												
	141.0109	125.1731	133.8057	119.2150	116.7167	81.9305	80.4354	83.8324	84.9936	120.6245	126.5750	139.6426 (65)
5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	190.3763	210.7737	190.3763	196.7222	190.3763	196.7222	190.3763	190.3763	196.7222	190.3763	196.7222	190.3763 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	376.1489	380.0522	370.2161	349.2763	322.8435	298.0005	281.4038	277.5005	287.3366	308.2764	334.7092	359.5522 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578 (71)
Water heating gains (Table 5)												
	189.5307	186.2696	179.8463	165.5764	156.8773	113.7924	108.1121	112.6779	118.0466	162.1297	175.7987	187.6917 (72)
Total internal gains	824.1901	845.2296	808.5729	779.7090	738.2313	676.6492	648.0264	648.6889	670.2396	728.9166	775.3642	805.7544 (73)
6. Solar gains												
[Jan]												
	Area											
	m2											
	Solar flux											
	Table 6a											
	W/m2											
	Specific data											
	or Table 6b											
	g											
	Specific data											
	or Table 6c											
	FF											
	Access											
	factor											
	Table 6d											
	Gains											
	W											
North	14.4300											46.8932 (74)
East	15.7600											94.5966 (76)
South	9.4500											135.0220 (78)
West	3.0900											18.5472 (80)

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Solar gains	295.0589	532.0797	798.4644	1094.5674	1312.7536	1338.9333	1276.2123	1109.6251	901.2713	607.8165	358.9728	248.8078 (83)
Total gains	1119.2490	1377.3093	1607.0373	1874.2764	2050.9849	2015.5825	1924.2386	1758.3140	1571.5109	1336.7331	1134.3370	1054.5622 (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	29.0174	29.1128	29.2090	29.6993	29.7993	30.3098	30.3098	30.4140	30.1035	29.7993	29.5999	29.4031	
alpha	2.9345	2.9409	2.9473	2.9800	2.9866	3.0207	3.0207	3.0276	3.0069	2.9866	2.9733	2.9602	
util living area	0.9716	0.9488	0.9089	0.8228	0.6940	0.5396	0.4106	0.4601	0.6779	0.8744	0.9537	0.9758 (86)	
Living	18.6636	19.0312	19.5372	20.1608	20.6164	20.8734	20.9587	20.9416	20.7387	20.1168	19.2886	18.6155	
Non living	17.3513	17.8174	18.4537	19.2273	19.7624	20.0501	20.1283	20.1185	19.9167	19.1921	18.1563	17.2965	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	7	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	24	19	0	0	0	0	0	0	0	0	0	31	
MIT	19.9755	19.6105	19.5372	20.1608	20.6164	20.8734	20.9587	20.9416	20.7387	20.1168	19.2886	19.6495 (87)	
Th 2	20.1191	20.1217	20.1244	20.1376	20.1402	20.1535	20.1535	20.1562	20.1482	20.1402	20.1349	20.1297 (88)	
util rest of house	0.9675	0.9418	0.8963	0.7990	0.6542	0.4817	0.3382	0.3853	0.6229	0.8518	0.9462	0.9723 (89)	
MIT 2	19.1733	18.6909	18.4537	19.2273	19.7624	20.0501	20.1283	20.1185	19.9167	19.1921	18.1563	18.8792 (90)	
Living area fraction									fLA = Living area / (4) =				0.1018 (91)
MIT	19.2549	18.7845	18.5639	19.3223	19.8493	20.1339	20.2128	20.2022	20.0004	19.2862	18.2715	18.9575 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.2549	18.7845	18.5639	19.3223	19.8493	20.1339	20.2128	20.2022	20.0004	19.2862	18.2715	18.9575 (93)	

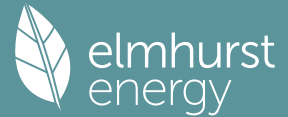
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9628	0.9284	0.8679	0.7729	0.6396	0.4802	0.3434	0.3895	0.6125	0.8242	0.9237	0.9665 (94)
Useful gains	1077.5921	1278.7464	1394.7907	1448.6272	1311.8098	967.9772	660.7834	684.9295	962.5002	1101.7803	1047.7349	1019.2660 (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	2940.5204	2721.0868	2356.5142	2002.2319	1560.3149	1041.7104	680.0777	713.2827	1118.3016	1663.1162	2153.3758	2863.6390 (97)
Space heating kWh	1386.0187	969.2527	715.5223	398.5954	184.8877	0.0000	0.0000	0.0000	0.0000	417.6339	796.0615	1372.2135 (98a)
Space heating requirement - total per year (kWh/year)												6240.1857
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	1386.0187	969.2527	715.5223	398.5954	184.8877	0.0000	0.0000	0.0000	0.0000	417.6339	796.0615	1372.2135 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6240.1857
Space heating per m2										(98c) / (4) =		30.3807 (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 %)												269.8070 (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	1386.0187	969.2527	715.5223	398.5954	184.8877	0.0000	0.0000	0.0000	0.0000	417.6339	796.0615	1372.2135 (98)
Space heating efficiency (main heating system 1)	269.8070	269.8070	269.8070	269.8070	269.8070	0.0000	0.0000	0.0000	0.0000	269.8070	269.8070	269.8070 (210)
Space heating fuel (main heating system)	513.7075	359.2393	265.1978	147.7335	68.5259	0.0000	0.0000	0.0000	0.0000	154.7899	295.0485	508.5908 (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	390.4862	346.1062	368.8164	326.0188	317.4211	256.8754	252.7277	262.9441	266.0876	329.1738	348.1543	386.3713 (64)
Efficiency of water heater (217)m	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159 (216)
Fuel for water heating, kWh/month	140.4546	124.4915	132.6602	117.2663	114.1737	92.3959	90.9040	94.5788	95.7095	118.4011	125.2282	138.9745 (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	96.8231	87.4532	96.8231	93.6998	96.8231	93.6998	96.8231	96.8231	93.6998	96.8231	93.6998	96.8231 (231)
Lighting	39.5564	31.7336	28.5726	20.9335	16.1697	13.2108	14.7505	19.1733	24.9042	32.6756	36.9070	40.6558 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)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 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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												2312.8331 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												278.0159
Water heating fuel used												1385.2384 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7780)	
mechanical ventilation fans (SFP = 1.7780)	1140.0144 (230a)
Total electricity for the above, kWh/year	1140.0144 (231)
Electricity for lighting (calculated in Appendix L)	319.2431 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	5157.3290 (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	2312.8331	0.1559	360.4632 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1385.2384	0.1415	196.0619 (264)
Space and water heating			556.5251 (265)
Pumps, fans and electric keep-hot	1140.0144	0.1387	158.1341 (267)
Energy for lighting	319.2431	0.1443	46.0766 (268)
Total CO2, kg/year			760.7358 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.7000 (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	2312.8331	1.5770	3647.2572 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1385.2384	1.5234	2110.2642 (278)
Space and water heating			5757.5213 (279)
Pumps, fans and electric keep-hot	1140.0144	1.5128	1724.6138 (281)
Energy for lighting	319.2431	1.5338	489.6657 (282)
Total Primary energy kWh/year			7971.8008 (286)
Dwelling Primary energy Rate (DPER)			38.8100 (287)

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

1. Overall dwelling characteristics

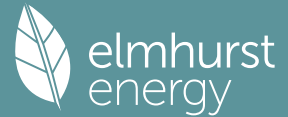
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	75.6900 (1b)	x 2.4600 (2b)	= 186.1974 (1b) - (3b)
First floor	81.5200 (1c)	x 2.6200 (2c)	= 213.5824 (1c) - (3c)
Second floor	48.1900 (1d)	x 2.6100 (2d)	= 125.7759 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	205.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	525.5557 (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) = 0.0761 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3261 (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) = 0.2772 (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	0.3534	0.3465	0.3396	0.3049	0.2980	0.2633	0.2633	0.2564	0.2772	0.2980	0.3118	0.3257 (22b)
Effective ac	0.5625	0.5600	0.5577	0.5465	0.5444	0.5347	0.5347	0.5329	0.5384	0.5444	0.5486	0.5530 (25)

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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 Opaque door				4.2800	1.0000	4.2800		(26)					
TER Opening Type (Uw = 1.20)				42.7300	1.1450	48.9275		(27)					
Ground Floor				75.6900	0.1300	9.8397		(28a)					
External Wall	288.8600		47.0100	241.8500	0.1800	43.5330		(29a)					
Roof - ceiling	70.8100			70.8100	0.1100	7.7891		(30)					
Bay Roof	4.8800			4.8800	0.1100	0.5368		(30)					
Total net area of external elements Aum(A, m2)				440.2400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =			114.9061	(33)					

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												100.0000 (35)	
List of Thermal Bridges													
						Length	Psi-value	Total					
K1 Element							36.9100	0.0500	1.8455				
E2 Other lintels (including other steel lintels)							31.1900	0.0500	1.5595				
E3 Sill							84.6000	0.0500	4.2300				
E4 Jamb							42.3200	0.1600	6.7712				
E5 Ground floor (normal)							32.9200	0.0000	0.0000				
E6 Intermediate floor within a dwelling							35.5600	0.0600	2.1336				
E10 Eaves (insulation at ceiling level)							16.1100	0.0600	0.9666				
E12 Gable (insulation at ceiling level)							56.2100	0.0900	5.0589				
E16 Corner (normal)							9.3500	0.2400	2.2440				
E24 Eaves (insulation at ceiling level - inverted)							25.4200	-0.0900	-2.2878				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								22.5215 (36)					
Point Thermal bridges								(36a) = 0.0000					
Total fabric heat loss								(33) + (36) + (36a) = 137.4276 (37)					

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	97.5482	97.1276	96.7153	94.7789	94.4166	92.7300	92.7300	92.4177	93.3797	94.4166	95.1495	95.9158	(38)
Average = Sum(39)m / 12 =	234.9758	234.5552	234.1429	232.2065	231.8442	230.1576	230.1576	229.8453	230.8073	231.8442	232.5771	233.3433	(39)
	232.2047												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	1.1440	1.1419	1.1399	1.1305	1.1287	1.1205	1.1205	1.1190	1.1237	1.1287	1.1323	1.1360	(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	3.0089 (42)												
Hot water usage for mixer showers													
	74.6700	73.5478	71.9127	68.7840	66.4752	63.9004	62.4368	64.0596	65.8385	68.6031	71.7989	74.3839	(42a)
Hot water usage for baths													
	32.2338	31.7550	31.0809	29.8379	28.9072	27.8752	27.3177	27.9871	28.7160	29.8203	31.0889	32.1248	(42b)
Hot water usage for other uses													
	45.4446	43.7921	42.1395	40.4870	38.8345	37.1820	37.1820	38.8345	40.4870	42.1395	43.7921	45.4446	(42c)
Average daily hot water use (litres/day)	140.0423 (43)												
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	152.3483	149.0950	145.1331	139.1090	134.2168	128.9575	126.9365	130.8813	135.0416	140.5630	146.6799	151.9533	(44)
Energy conte	241.2825	212.3092	223.0642	190.4332	180.6817	158.5683	153.5187	162.0583	166.5198	190.7426	208.9724	237.9221	(45)
Energy content (annual)	Total = Sum(45)m = 2326.0731												
Distribution loss (46)m = 0.15 x (45)m													
	36.1924	31.8464	33.4596	28.5650	27.1023	23.7852	23.0278	24.3088	24.9780	28.6114	31.3459	35.6883	(46)
Water storage loss:													
Store volume	230.0000 (47)												
a) If manufacturer declared loss factor is known (kWh/day):	1.7973 (48)												
Temperature factor from Table 2b	0.5400 (49)												
Enter (49) or (54) in (55)	0.9706 (55)												
Total storage loss	30.0872	27.1756	30.0872	29.1167	30.0872	29.1167	30.0872	30.0872	29.1167	30.0872	29.1167	30.0872	(56)
If cylinder contains dedicated solar storage	30.0872	27.1756	30.0872	29.1167	30.0872	29.1167	30.0872	30.0872	29.1167	30.0872	29.1167	30.0872	(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	294.6322	260.4960	276.4138	242.0619	234.0313	210.1969	206.8683	215.4080	218.1484	244.0922	260.6011	291.2717	(62)
WWHRS	-34.1360	-30.1902	-31.6134	-26.1771	-24.3962	-20.8760	-19.5679	-20.8085	-21.5991	-25.4629	-28.8464	-33.5038	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	260.4962	230.3058	244.8004	215.8847	209.6351	189.3210	187.3004	194.5995	196.5494	218.6293	231.7547	257.7679	(64)
								Total per year (kWh/year) = Sum(64)m = 2637.0444 (64)					
2637 (64)													
12Total per year (kWh/year)													
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	122.9061	109.1422	116.8485	104.6220	102.7564	94.0269	93.7247	96.5641	96.6708	106.1016	110.7863	121.7888	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	190.3763	210.7737	190.3763	196.7222	190.3763	196.7222	190.3763	190.3763	196.7222	190.3763	196.7222	190.3763	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.1489	380.0522	370.2161	349.2763	322.8435	298.0005	281.4038	277.5005	287.3366	308.2764	334.7092	359.5522	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	(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)													
	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	(71)

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Water heating gains (Table 5)	165.1964	162.4140	157.0545	145.3083	138.1134	130.5929	125.9740	129.7905	134.2649	142.6097	153.8698	163.6946 (72)
Total internal gains	802.8558	824.3741	788.7810	762.4409	722.4674	693.4497	665.8883	665.8015	686.4579	712.3966	756.4353	784.7573 (73)

6. Solar gains

[Jan]													Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	

North						14.4300						10.6334				0.6300		0.7000		0.7700		46.8932 (74)		
East						15.7600						19.6403				0.6300		0.7000		0.7700		94.5966 (76)		
South						9.4500						46.7521				0.6300		0.7000		0.7700		135.0220 (78)		
West						3.0900						19.6403				0.6300		0.7000		0.7700		18.5472 (80)		

Solar gains		295.0589	532.0797	798.4644	1094.5674	1312.7536	1338.9333	1276.2123	1109.6251	901.2713	607.8165	358.9728	248.8078	(83)										
Total gains		1097.9147	1356.4538	1587.2454	1857.0083	2035.2210	2032.3830	1942.1005	1775.4266	1587.7292	1320.2131	1115.4081	1033.5651	(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, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.2815	24.3250	24.3678	24.5710	24.6094	24.7898	24.7898	24.8235	24.7200	24.6094	24.5319	24.4513
alpha	2.6188	2.6217	2.6245	2.6381	2.6406	2.6527	2.6527	2.6549	2.6480	2.6406	2.6355	2.6301
util living area	0.9741	0.9552	0.9227	0.8539	0.7459	0.6019	0.4726	0.5239	0.7270	0.8962	0.9595	0.9777 (86)
MIT	18.1600	18.5302	19.0767	19.7765	20.3618	20.7496	20.9048	20.8724	20.5608	19.7718	18.8397	18.0973 (87)
Th 2	19.9651	19.9667	19.9684	19.9760	19.9774	19.9841	19.9841	19.9853	19.9815	19.9774	19.9745	19.9715 (88)
util rest of house	0.9701	0.9483	0.9106	0.8304	0.7037	0.5331	0.3790	0.4297	0.6669	0.8743	0.9522	0.9743 (89)
MIT 2	16.6257	17.0954	17.7847	18.6551	19.3525	19.7836	19.9289	19.9065	19.5976	18.6686	17.4978	16.5494 (90)
Living area fraction	f _{LA} = Living area / (4) =											0.1018 (91)
MIT	16.7818	17.2414	17.9161	18.7692	19.4552	19.8819	20.0282	20.0047	19.6956	18.7809	17.6343	16.7069 (92)
Temperature adjustment												0.0000
adjusted MIT	16.7818	17.2414	17.9161	18.7692	19.4552	19.8819	20.0282	20.0047	19.6956	18.7809	17.6343	16.7069 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9509	0.9222	0.8781	0.7963	0.6790	0.5255	0.3833	0.4316	0.6474	0.8406	0.9274	0.9569 (94)
Useful gains	1043.9660	1250.8691	1393.8258	1478.8161	1381.9446	1068.1164	744.4159	766.2730	1027.9579	1109.8136	1034.3913	989.0046 (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	2932.9188	2894.7313	2673.0031	2291.7026	1798.0017	1215.6777	789.0342	828.5336	1291.5015	1896.6914	2450.0417	2918.4041 (97)
Space heating kWh	1405.3808	1104.6754	951.7080	585.2783	309.5464	0.0000	0.0000	0.0000	0.0000	585.4371	1019.2683	1435.4733 (98a)
Space heating requirement - total per year (kWh/year)												7396.7676
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	1405.3808	1104.6754	951.7080	585.2783	309.5464	0.0000	0.0000	0.0000	0.0000	585.4371	1019.2683	1435.4733 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7396.7676
Space heating per m ²												(98c) / (4) = 36.0115 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1405.3808	1104.6754	951.7080	585.2783	309.5464	0.0000	0.0000	0.0000	0.0000	585.4371	1019.2683	1435.4733 (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)	1522.6228	1196.8314	1031.1029	634.1044	335.3699	0.0000	0.0000	0.0000	0.0000	634.2764	1104.2994	1555.2256 (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	260.4962	230.3058	244.8004	215.8847	209.6351	189.3210	187.3004	194.5995	196.5494	218.6293	231.7547	257.7679 (64)
Efficiency of water heater (217)m	87.2611	87.1052	86.7972	86.1809	84.9323	79.8000	79.8000	79.8000	79.8000	86.1579	86.9827	79.8000 (216)
Fuel for water heating, kWh/month	298.5251	264.3996	282.0373	250.5018	246.8263	237.2443	234.7123	243.8590	246.3024	253.7543	266.4378	295.2630 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	39.5564	31.7336	28.5726	20.9335	16.1697	13.2108	14.7505	19.1733	24.9042	32.6756	36.9070	40.6558 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-68.3092	-95.0505	-134.8145	-149.4028	-159.1362	-147.6404	-145.5988	-138.2753	-125.2656	-107.4316	-74.5630	-59.1866 (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)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-42.5159	-88.9553	-175.9982	-263.2613	-347.1803	-348.6841	-344.7882	-292.5356	-215.0809	-127.1072	-56.7105	-33.6759	(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													8013.8327	(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													3119.8632	(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)													319.2431	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-3741.1679	(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													7797.7711	(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	8013.8327	0.2100	1682.9049	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3119.8632	0.2100	655.1713	(264)
Space and water heating			2338.0761	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	319.2431	0.1443	46.0766	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1404.6745	0.1349	-189.5044	
PV Unit electricity exported	-2336.4933	0.1260	-294.4043	
Total			-483.9087	(269)
Total CO2, kg/year			1912.1734	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.3100	(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	8013.8327	1.1300	9055.6310	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3119.8632	1.1300	3525.4454	(278)
Space and water heating			12581.0764	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	319.2431	1.5338	489.6657	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1404.6745	1.4986	-2105.0764	
PV Unit electricity exported	-2336.4933	0.4625	-1080.6747	
Total			-3185.7511	(283)
Total Primary energy kWh/year			10015.0918	(286)
Target Primary Energy Rate (TPER)			48.7600	(287)

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Property Reference	OP-D320 P4CHAR				Issued on Date	29/11/2024	
Assessment Reference	P4CHAR			Prop Type Ref	P4CHAR		
Property	P4CHAR						
SAP Rating	80 C		DER	3.70	TER	9.31	
Environmental	96 A		% DER < TER				60.26
CO ₂ Emissions (t/year)	0.69		DFEE	41.10	TFEE	41.95	
Compliance Check	See BREL		% DFEE < TFEE				2.01
% DPER < TPER	20.40		DPER	38.81	TPER	48.76	
Assessor Details	Mr. Matthew Stainrod				Assessor ID	AU83-0001	
Client							

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	75.6900 (1b)	x	2.4600 (2b)	=	186.1974 (1b)	- (3b)
First floor	81.5200 (1c)	x	2.6200 (2c)	=	213.5824 (1c)	- (3c)
Second floor	48.1900 (1d)	x	2.6100 (2d)	=	125.7759 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	205.4000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	525.5557	(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) = 0.0761 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.5000 (17)
Infiltration rate			0.2511 (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) =		0.2134 (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	0.2721	0.2668	0.2615	0.2348	0.2295	0.2028	0.2028	0.1974	0.2134	0.2295	0.2401	0.2508	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													(23c)
Effective ac	0.5370	0.5356	0.5342	0.5276	0.5263	0.5206	0.5206	0.5195	0.5228	0.5263	0.5288	0.5314	(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	
Front Door			4.2800	1.0000	4.2800			(26)
Windows (Uw = 1.30)			42.7300	1.2357	52.8032			(27)
Ground Floor			75.6900	0.1100	8.3259			(28a)
External Wall	288.8600	47.0100	241.8500	0.1700	41.1145			(29a)
Roof - ceiling	70.8100		70.8100	0.1100	7.7891			(30)
Bay Roof	4.8800		4.8800	0.1100	0.5368			(30)
Total net area of external elements Aum(A, m2)			440.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		114.8495			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				36.9100	0.0500		1.8455	
E3 Sill				31.1900	0.0500		1.5595	
E4 Jamb				84.6000	0.0500		4.2300	
E5 Ground floor (normal)				42.3200	0.1600		6.7712	

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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	24.7519	24.7787	24.8050	24.9295	24.9529	25.0625	25.0625	25.0829	25.0202	24.9529	24.9055	24.8563
alpha	2.6501	2.6519	2.6537	2.6620	2.6635	2.6708	2.6708	2.6722	2.6680	2.6635	2.6604	2.6571
util living area	0.9798	0.9625	0.9322	0.8658	0.7596	0.6164	0.4861	0.5405	0.7450	0.9096	0.9673	0.9829 (86)
MIT	18.1085	18.4838	19.0370	19.7449	20.3429	20.7394	20.9003	20.8651	20.5395	19.7264	18.7818	18.0375 (87)
Th 2	19.9827	19.9837	19.9847	19.9892	19.9901	19.9940	19.9940	19.9948	19.9925	19.9901	19.9883	19.9865 (88)
util rest of house	0.9766	0.9568	0.9215	0.8438	0.7187	0.5479	0.3917	0.4456	0.6868	0.8900	0.9613	0.9802 (89)
MIT 2	17.3231	17.6950	18.2400	18.9278	19.4854	19.8301	19.9485	19.9289	19.6754	18.9247	17.9969	17.2552 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.4030	17.7753	18.3211	19.0110	19.5727	19.9226	20.0454	20.0242	19.7633	19.0063	18.0768	17.3348 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.4030	17.7753	18.3211	19.0110	19.5727	19.9226	20.0454	20.0242	19.7633	19.0063	18.0768	17.3348 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9648	0.9394	0.8984	0.8180	0.6995	0.5426	0.3969	0.4487	0.6715	0.8654	0.9452	0.9698 (94)
Useful gains	950.3028	1169.3855	1328.6337	1436.8020	1356.3771	1054.9374	737.0183	757.4507	1005.8427	1057.5224	954.5315	893.8434 (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	3020.3773	2964.6689	2719.0392	2314.0735	1800.1077	1211.7132	784.3489	824.3888	1291.4579	1922.1186	2514.6454	3014.9826 (97)
Space heating kWh	1540.1354	1206.4305	1034.4617	631.6355	330.1356	0.0000	0.0000	0.0000	0.0000	643.2595	1123.2821	1578.1276 (98a)
Space heating requirement - total per year (kWh/year)	8087.4679											
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	1540.1354	1206.4305	1034.4617	631.6355	330.1356	0.0000	0.0000	0.0000	0.0000	643.2595	1123.2821	1578.1276 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	8087.4679											
Space heating per m2	(98c) / (4) = 39.3742 (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	2139.9399	1684.6335	1728.7568	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7351	0.8001	0.7599	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1573.1112	1347.9313	1313.6622	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2185.0068	2086.9372	1893.4193	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	440.5648	549.8204	431.3393	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
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	110.1412	137.4551	107.8348	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	355.4311 (107)											
Energy for space heating	39.3742 (99)											
Energy for space cooling	1.7304 (108)											
Total	41.1047 (109)											
Fabric Energy Efficiency (DFEE)	41.1 (109)											

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

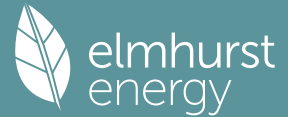
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	75.6900 (1b)	x	2.4600 (2b) = 186.1974 (1b) - (3b)
First floor	81.5200 (1c)	x	2.6200 (2c) = 213.5824 (1c) - (3c)
Second floor	48.1900 (1d)	x	2.6100 (2d) = 125.7759 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	205.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	525.5557 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	

Full SAP Calculation Printout



Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0761 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3261 (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) = 0.2772 (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	0.3534	0.3465	0.3396	0.3049	0.2980	0.2633	0.2633	0.2564	0.2772	0.2980	0.3118	0.3257	(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	0.5625	0.5600	0.5577	0.5465	0.5444	0.5347	0.5347	0.5329	0.5384	0.5444	0.5486	0.5530	(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 Opaque door			4.2800	1.0000	4.2800			(26)
TER Opening Type (Uw = 1.20)			42.7300	1.1450	48.9275			(27)
Ground Floor			75.6900	0.1300	9.8397			(28a)
External Wall	288.8600	47.0100	241.8500	0.1800	43.5330			(29a)
Roof - ceiling	70.8100		70.8100	0.1100	7.7891			(30)
Bay Roof	4.8800		4.8800	0.1100	0.5368			(30)
Total net area of external elements Aum(A, m2)			440.2400					(31)
Fabric heat loss, W/K = Sum (A x U)					114.9061			(33)
					(26)...(30) + (32) =			

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	36.9100	0.0500	1.8455	
E3 Sill	31.1900	0.0500	1.5595	
E4 Jamb	84.6000	0.0500	4.2300	
E5 Ground floor (normal)	42.3200	0.1600	6.7712	
E6 Intermediate floor within a dwelling	32.9200	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	35.5600	0.0600	2.1336	
E12 Gable (insulation at ceiling level)	16.1100	0.0600	0.9666	
E16 Corner (normal)	56.2100	0.0900	5.0589	
E24 Eaves (insulation at ceiling level - inverted)	9.3500	0.2400	2.2440	
E17 Corner (inverted - internal area greater than external area)	25.4200	-0.0900	-2.2878	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			22.5215	(36)
Point Thermal bridges			0.0000	(36a) =
Total fabric heat loss			137.4276	(33) + (36) + (36a) = (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	97.5482	97.1276	96.7153	94.7789	94.4166	92.7300	92.7300	92.4177	93.3797	94.4166	95.1495	95.9158	(38)
Heat transfer coeff	234.9758	234.5552	234.1429	232.2065	231.8442	230.1576	230.1576	229.8453	230.8073	231.8442	232.5771	233.3433	(39)
Average = Sum(39)m / 12 =												232.2047	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1440	1.1419	1.1399	1.1305	1.1287	1.1205	1.1205	1.1190	1.1237	1.1287	1.1323	1.1360	(40)
HLP (average)												1.1305	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

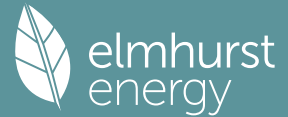
Assumed occupancy 3.0089 (42)
Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)
Hot water usage for baths 32.2338 31.7550 31.0809 29.8379 28.9072 27.8752 27.3177 27.9871 28.7160 29.8203 31.0889 32.1248 (42b)
Hot water usage for other uses 45.4446 43.7921 42.1395 40.4870 38.8345 37.1820 37.1820 38.8345 40.4870 42.1395 43.7921 45.4446 (42c)
Average daily hot water use (litres/day) 71.1991 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	77.6784	75.5471	73.2205	70.3249	67.7417	65.0571	64.4997	66.8216	69.2030	71.9599	74.8810	77.5694	(44)
Energy conte	123.0235	107.5781	112.5371	96.2713	91.1933	79.9953	78.0068	82.7391	85.3342	97.6488	106.6817	121.4549	(45)
Energy content (annual)										Total = Sum(45)m =		1182.4642	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:
Total storage loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month 104.5700 91.4414 95.6565 81.8306 77.5143 67.9960 66.3057 70.3282 72.5341 83.0015 90.6794 103.2367 (62)
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)
PV diverter 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)
Output from w/h 104.5700 91.4414 95.6565 81.8306 77.5143 67.9960 66.3057 70.3282 72.5341 83.0015 90.6794 103.2367 (64)
Total per year (kWh/year) = Sum(64)m = 1005.0946 (64a)
Electric shower(s) 59.7982 53.2807 58.1805 55.5209 56.5628 53.9554 55.7539 56.5628 55.5209 58.1805 57.0865 59.7982 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 680.2012 (64a)

Heat gains from water heating, kWh/month 41.0921 36.1805 38.4593 34.3379 33.5193 30.4878 30.5149 31.7228 32.0138 35.2955 36.9415 40.7587 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	190.3763	210.7737	190.3763	196.7222	190.3763	196.7222	190.3763	190.3763	196.7222	190.3763	196.7222	190.3763	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	376.1489	380.0522	370.2161	349.2763	322.8435	298.0005	281.4038	277.5005	287.3366	308.2764	334.7092	359.5522	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	(71)
Water heating gains (Table 5)	55.2313	53.8401	51.6925	47.6915	45.0528	42.3442	41.0147	42.6381	44.4636	47.4402	51.3076	54.7832	(72)
Total internal gains	689.8906	712.8001	680.4191	661.8241	626.4068	605.2011	580.9289	578.6491	596.6565	614.2271	650.8731	672.8459	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d				Gains W
North					14.4300	10.6334	0.6300	0.7000	0.7700				46.8932 (74)
East					15.7600	19.6403	0.6300	0.7000	0.7700				94.5966 (76)
South					9.4500	46.7521	0.6300	0.7000	0.7700				135.0220 (78)
West					3.0900	19.6403	0.6300	0.7000	0.7700				18.5472 (80)
Solar gains	295.0589	532.0797	798.4644	1094.5674	1312.7536	1338.9333	1276.2123	1109.6251	901.2713	607.8165	358.9728		248.8078 (83)
Total gains	984.9495	1244.8798	1478.8835	1756.3915	1939.1604	1944.1344	1857.1412	1688.2742	1497.9278	1222.0436	1009.8459		921.6537 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	24.2815	24.3250	24.3678	24.5710	24.6094	24.7898	24.7898	24.8235	24.7200	24.6094	24.5319	24.4513	21.0000 (85)
alpha	2.6188	2.6217	2.6245	2.6381	2.6406	2.6527	2.6527	2.6549	2.6480	2.6406	2.6355	2.6301	
util living area	0.9798	0.9628	0.9330	0.8675	0.7626	0.6196	0.4896	0.5438	0.7477	0.9105	0.9675	0.9829	(86)
MIT	18.0561	18.4336	18.9922	19.7145	20.3225	20.7308	20.8962	20.8603	20.5265	19.7013	18.7466	17.9929	(87)
Th 2	19.9651	19.9667	19.9684	19.9760	19.9774	19.9841	19.9841	19.9853	19.9815	19.9774	19.9745	19.9715	(88)
util rest of house	0.9766	0.9570	0.9222	0.8455	0.7215	0.5507	0.3940	0.4480	0.6893	0.8910	0.9615	0.9802	(89)
MIT 2	17.2600	17.6344	18.1853	18.8896	19.4574	19.8150	19.9369	19.9173	19.6559	18.8919	17.9533	17.2013	(90)
Living area fraction	17.3410	17.7158	18.2674	18.9735	19.5455	19.9082	20.0345	20.0133	19.7445	18.9743	18.0340	17.2819	(91)
MIT	17.3410	17.7158	18.2674	18.9735	19.5455	19.9082	20.0345	20.0133	19.7445	18.9743	18.0340	17.2819	(92)
Temperature adjustment	17.3410	17.7158	18.2674	18.9735	19.5455	19.9082	20.0345	20.0133	19.7445	18.9743	18.0340	17.2819	(93)
adjusted MIT	17.3410	17.7158	18.2674	18.9735	19.5455	19.9082	20.0345	20.0133	19.7445	18.9743	18.0340	17.2819	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9647	0.9394	0.8989	0.8193	0.7017	0.5450	0.3991	0.4508	0.6735	0.8660	0.9452	0.9697	(94)
Useful gains	950.1659	1169.4750	1329.3873	1438.9844	1360.7545	1059.6253	741.1945	761.1453	1008.8630	1058.3301	954.5333	893.7140	(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	3064.3203	3006.0029	2755.2639	2339.1305	1818.9244	1221.7158	790.4739	830.4949	1302.7825	1941.5275	2543.0087	3052.5703	(97)
Space heating kWh	1572.9309	1234.1467	1060.8521	648.1052	340.8784	0.0000	0.0000	0.0000	0.0000	657.0988	1143.7023	1606.1891	(98a)
Space heating requirement - total per year (kWh/year)												8263.9036	
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	1572.9309	1234.1467	1060.8521	648.1052	340.8784	0.0000	0.0000	0.0000	0.0000	657.0988	1143.7023	1606.1891	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8263.9036	
Space heating per m2												40.2332	(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	2163.4815	1703.1663	1746.8242	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7298	0.7953	0.7550	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1578.9333	1354.4917	1318.8029	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2185.0068	2086.9372	1893.4193	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	436.3729	544.9394	427.5146	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	109.0932	136.2349	106.8787	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												352.2067	(107)
Energy for space heating												40.2332	(99)
Energy for space cooling												1.7147	(108)
Total												41.9480	(109)
Fabric Energy Efficiency (TFEE)												41.9	(109)

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Property Reference	OP-D320 P4CHAR				Issued on Date	29/11/2024
Assessment Reference	P4CHAR		Prop Type Ref	P4CHAR		
Property	P4CHAR					
SAP Rating	80 C	DER	3.70	TER	9.31	
Environmental	96 A	% DER < TER				60.26
CO ₂ Emissions (t/year)	0.69	DFEE	41.10	TFEE	41.95	
Compliance Check	See BREL	% DFEE < TFEE				2.01
% DPER < TPER	20.40	DPER	38.81	TPER	48.76	
Assessor Details	Mr. Matthew Stainrod				Assessor ID	AU83-0001
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)
Ground floor	75.6900 (1b)	x 2.4600 (2b)	= 186.1974 (1b) - (3b)
First floor	81.5200 (1c)	x 2.6200 (2c)	= 213.5824 (1c) - (3c)
Second floor	48.1900 (1d)	x 2.6100 (2d)	= 125.7759 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	205.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 525.5557 (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	3.5000 (17)
Infiltration rate	0.1750 (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) = 0.1487 (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	0.1897	0.1859	0.1822	0.1636	0.1599	0.1413	0.1413	0.1376	0.1487	0.1599	0.1673	0.1748 (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) =												69.6000 (23c)
Effective ac	0.3417	0.3379	0.3342	0.3156	0.3119	0.2933	0.2933	0.2896	0.3007	0.3119	0.3193	0.3268 (25)

3. Heat losses and heat loss parameter

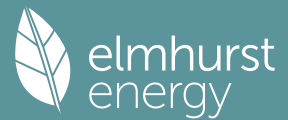
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			4.2800	1.0000	4.2800		(26)
Windows (Uw = 1.30)			42.7300	1.2357	52.8032		(27)
Ground Floor			75.6900	0.1100	8.3259		(28a)
External Wall	288.8600	47.0100	241.8500	0.1700	41.1145		(29a)
Roof - ceiling	70.8100		70.8100	0.1100	7.7891		(30)
Bay Roof	4.8800		4.8800	0.1100	0.5368		(30)
Total net area of external elements Aum (A, m ²)			440.2400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 114.8495		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				36.9100	0.0500	1.8455	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	190.3763	210.7737	190.3763	196.7222	190.3763	196.7222	190.3763	190.3763	196.7222	190.3763	196.7222	190.3763	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	376.1489	380.0522	370.2161	349.2763	322.8435	298.0005	281.4038	277.5005	287.3366	308.2764	334.7092	359.5522	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	(71)
Water heating gains (Table 5)	189.5307	186.2696	179.8463	165.5764	156.8773	113.7924	108.1121	112.6779	118.0466	162.1297	175.7987	187.6917	(72)
Total internal gains	824.1901	845.2296	808.5729	779.7090	738.2313	676.6492	648.0264	648.6889	670.2396	728.9166	775.3642	805.7544	(73)

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	14.4300	10.6334	0.6300	0.7000	0.7700	46.8932 (74)
East	15.7600	19.6403	0.6300	0.7000	0.7700	94.5966 (76)
South	9.4500	46.7521	0.6300	0.7000	0.7700	135.0220 (78)
West	3.0900	19.6403	0.6300	0.7000	0.7700	18.5472 (80)

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Solar gains	295.0589	532.0797	798.4644	1094.5674	1312.7536	1338.9333	1276.2123	1109.6251	901.2713	607.8165	358.9728	248.8078 (83)
Total gains	1119.2490	1377.3093	1607.0373	1874.2764	2050.9849	2015.5825	1924.2386	1758.3140	1571.5109	1336.7331	1134.3370	1054.5622 (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	29.0174	29.1128	29.2090	29.6993	29.7993	30.3098	30.3098	30.4140	30.1035	29.7993	29.5999	29.4031	
alpha	2.9345	2.9409	2.9473	2.9800	2.9866	3.0207	3.0207	3.0276	3.0069	2.9866	2.9733	2.9602	
util living area	0.9716	0.9488	0.9089	0.8228	0.6940	0.5396	0.4106	0.4601	0.6779	0.8744	0.9537	0.9758 (86)	
Living	18.6636	19.0312	19.5372	20.1608	20.6164	20.8734	20.9587	20.9416	20.7387	20.1168	19.2886	18.6155	
Non living	17.3513	17.8174	18.4537	19.2273	19.7624	20.0501	20.1283	20.1185	19.9167	19.1921	18.1563	17.2965	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	7	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	24	19	0	0	0	0	0	0	0	0	0	31	
MIT	19.9755	19.6105	19.5372	20.1608	20.6164	20.8734	20.9587	20.9416	20.7387	20.1168	19.2886	19.6495 (87)	
Th 2	20.1191	20.1217	20.1244	20.1376	20.1402	20.1535	20.1535	20.1562	20.1482	20.1402	20.1349	20.1297 (88)	
util rest of house	0.9675	0.9418	0.8963	0.7990	0.6542	0.4817	0.3382	0.3853	0.6229	0.8518	0.9462	0.9723 (89)	
MIT 2	19.1733	18.6909	18.4537	19.2273	19.7624	20.0501	20.1283	20.1185	19.9167	19.1921	18.1563	18.8792 (90)	
Living area fraction									fLA = Living area / (4) =				0.1018 (91)
MIT	19.2549	18.7845	18.5639	19.3223	19.8493	20.1339	20.2128	20.2022	20.0004	19.2862	18.2715	18.9575 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.2549	18.7845	18.5639	19.3223	19.8493	20.1339	20.2128	20.2022	20.0004	19.2862	18.2715	18.9575 (93)	

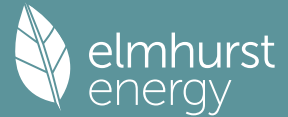
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9628	0.9284	0.8679	0.7729	0.6396	0.4802	0.3434	0.3895	0.6125	0.8242	0.9237	0.9665 (94)
Useful gains	1077.5921	1278.7464	1394.7907	1448.6272	1311.8098	967.9772	660.7834	684.9295	962.5002	1101.7803	1047.7349	1019.2660 (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	2940.5204	2721.0868	2356.5142	2002.2319	1560.3149	1041.7104	680.0777	713.2827	1118.3016	1663.1162	2153.3758	2863.6390 (97)
Space heating kWh	1386.0187	969.2527	715.5223	398.5954	184.8877	0.0000	0.0000	0.0000	0.0000	417.6339	796.0615	1372.2135 (98a)
Space heating requirement - total per year (kWh/year)												6240.1857
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	1386.0187	969.2527	715.5223	398.5954	184.8877	0.0000	0.0000	0.0000	0.0000	417.6339	796.0615	1372.2135 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6240.1857
Space heating per m2										(98c) / (4) =		30.3807 (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 %)												269.8070 (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	1386.0187	969.2527	715.5223	398.5954	184.8877	0.0000	0.0000	0.0000	0.0000	417.6339	796.0615	1372.2135 (98)
Space heating efficiency (main heating system 1)	269.8070	269.8070	269.8070	269.8070	269.8070	0.0000	0.0000	0.0000	0.0000	269.8070	269.8070	269.8070 (210)
Space heating fuel (main heating system)	513.7075	359.2393	265.1978	147.7335	68.5259	0.0000	0.0000	0.0000	0.0000	154.7899	295.0485	508.5908 (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	390.4862	346.1062	368.8164	326.0188	317.4211	256.8754	252.7277	262.9441	266.0876	329.1738	348.1543	386.3713 (64)
Efficiency of water heater (217)m	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159	278.0159 (216)
Fuel for water heating, kWh/month	140.4546	124.4915	132.6602	117.2663	114.1737	92.3959	90.9040	94.5788	95.7095	118.4011	125.2282	138.9745 (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	96.8231	87.4532	96.8231	93.6998	96.8231	93.6998	96.8231	96.8231	93.6998	96.8231	93.6998	96.8231 (231)
Lighting	39.5564	31.7336	28.5726	20.9335	16.1697	13.2108	14.7505	19.1733	24.9042	32.6756	36.9070	40.6558 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)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 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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												2312.8331 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												278.0159
Water heating fuel used												1385.2384 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7780)	
mechanical ventilation fans (SFP = 1.7780)	1140.0144 (230a)
Total electricity for the above, kWh/year	1140.0144 (231)
Electricity for lighting (calculated in Appendix L)	319.2431 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	5157.3290 (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	2312.8331	0.1559	360.4632 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1385.2384	0.1415	196.0619 (264)
Space and water heating			556.5251 (265)
Pumps, fans and electric keep-hot	1140.0144	0.1387	158.1341 (267)
Energy for lighting	319.2431	0.1443	46.0766 (268)
Total CO2, kg/year			760.7358 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.7000 (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	2312.8331	1.5770	3647.2572 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1385.2384	1.5234	2110.2642 (278)
Space and water heating			5757.5213 (279)
Pumps, fans and electric keep-hot	1140.0144	1.5128	1724.6138 (281)
Energy for lighting	319.2431	1.5338	489.6657 (282)
Total Primary energy kWh/year			7971.8008 (286)
Dwelling Primary energy Rate (DPER)			38.8100 (287)

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

1. Overall dwelling characteristics

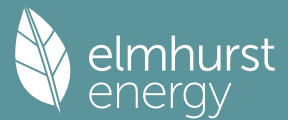
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	75.6900 (1b)	x 2.4600 (2b)	= 186.1974 (1b) - (3b)
First floor	81.5200 (1c)	x 2.6200 (2c)	= 213.5824 (1c) - (3c)
Second floor	48.1900 (1d)	x 2.6100 (2d)	= 125.7759 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	205.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	525.5557 (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) = 0.0761 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3261 (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) = 0.2772 (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	0.3534	0.3465	0.3396	0.3049	0.2980	0.2633	0.2633	0.2564	0.2772	0.2980	0.3118	0.3257 (22b)
Effective ac	0.5625	0.5600	0.5577	0.5465	0.5444	0.5347	0.5347	0.5329	0.5384	0.5444	0.5486	0.5530 (25)

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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 Opaque door			4.2800	1.0000	4.2800			(26)
TER Opening Type (Uw = 1.20)			42.7300	1.1450	48.9275			(27)
Ground Floor			75.6900	0.1300	9.8397			(28a)
External Wall	288.8600	47.0100	241.8500	0.1800	43.5330			(29a)
Roof - ceiling	70.8100		70.8100	0.1100	7.7891			(30)
Bay Roof	4.8800		4.8800	0.1100	0.5368			(30)
Total net area of external elements Aum(A, m2)			440.2400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	114.9061		(33)

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

100.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	36.9100	0.0500	1.8455
E3 Sill	31.1900	0.0500	1.5595
E4 Jamb	84.6000	0.0500	4.2300
E5 Ground floor (normal)	42.3200	0.1600	6.7712
E6 Intermediate floor within a dwelling	32.9200	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	35.5600	0.0600	2.1336
E12 Gable (insulation at ceiling level)	16.1100	0.0600	0.9666
E16 Corner (normal)	56.2100	0.0900	5.0589
E24 Eaves (insulation at ceiling level - inverted)	9.3500	0.2400	2.2440
E17 Corner (inverted - internal area greater than external area)	25.4200	-0.0900	-2.2878

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

22.5215 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 137.4276 (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	97.5482	97.1276	96.7153	94.7789	94.4166	92.7300	92.7300	92.4177	93.3797	94.4166	95.1495	95.9158
Heat transfer coeff	234.9758	234.5552	234.1429	232.2065	231.8442	230.1576	230.1576	229.8453	230.8073	231.8442	232.5771	233.3433
Average = Sum(39)m / 12 =												232.2047

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1440	1.1419	1.1399	1.1305	1.1287	1.1205	1.1205	1.1190	1.1237	1.1287	1.1323	1.1360
HLP (average)												1.1305
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

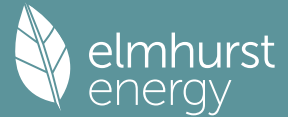
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0089 (42)
Hot water usage for mixer showers	74.6700	73.5478	71.9127	68.7840	66.4752	63.9004	62.4368	64.0596	65.8385	68.6031	71.7989	74.3839	(42a)
Hot water usage for baths	32.2338	31.7550	31.0809	29.8379	28.9072	27.8752	27.3177	27.9871	28.7160	29.8203	31.0889	32.1248	(42b)
Hot water usage for other uses	45.4446	43.7921	42.1395	40.4870	38.8345	37.1820	37.1820	38.8345	40.4870	42.1395	43.7921	45.4446	(42c)
Average daily hot water use (litres/day)													140.0423 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.3483	149.0950	145.1331	139.1090	134.2168	128.9575	126.9365	130.8813	135.0416	140.5630	146.6799	151.9533	(44)
Energy content (annual)	241.2825	212.3092	223.0642	190.4332	180.6817	158.5683	153.5187	162.0583	166.5198	190.7426	208.9724	237.9221	(45)
Distribution loss (46)m = 0.15 x (45)m	36.1924	31.8464	33.4596	28.5650	27.1023	23.7852	23.0278	24.3088	24.9780	28.6114	31.3459	35.6883	(46)
Water storage loss:													
Store volume													230.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7973 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9706 (55)
Total storage loss	30.0872	27.1756	30.0872	29.1167	30.0872	29.1167	30.0872	30.0872	29.1167	30.0872	29.1167	30.0872	(56)
If cylinder contains dedicated solar storage	30.0872	27.1756	30.0872	29.1167	30.0872	29.1167	30.0872	30.0872	29.1167	30.0872	29.1167	30.0872	(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													
	294.6322	260.4960	276.4138	242.0619	234.0313	210.1969	206.8683	215.4080	218.1484	244.0922	260.6011	291.2717	(62)
WWHRS	-34.1360	-30.1902	-31.6134	-26.1771	-24.3962	-20.8760	-19.5679	-20.8085	-21.5991	-25.4629	-28.8464	-33.5038	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	260.4962	230.3058	244.8004	215.8847	209.6351	189.3210	187.3004	194.5995	196.5494	218.6293	231.7547	257.7679	(64)
12Total per year (kWh/year)													2637.0444 (64)
Electric shower(s)													2637 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													0.0000 (64a)
Heat gains from water heating, kWh/month													
	122.9061	109.1422	116.8485	104.6220	102.7564	94.0269	93.7247	96.5641	96.6708	106.1016	110.7863	121.7888	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	150.4473	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	190.3763	210.7737	190.3763	196.7222	190.3763	196.7222	190.3763	190.3763	196.7222	190.3763	196.7222	190.3763	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.1489	380.0522	370.2161	349.2763	322.8435	298.0005	281.4038	277.5005	287.3366	308.2764	334.7092	359.5522	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	38.0447	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	-120.3578	(71)

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Water heating gains (Table 5)	165.1964	162.4140	157.0545	145.3083	138.1134	130.5929	125.9740	129.7905	134.2649	142.6097	153.8698	163.6946 (72)
Total internal gains	802.8558	824.3741	788.7810	762.4409	722.4674	693.4497	665.8883	665.8015	686.4579	712.3966	756.4353	784.7573 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				14.4300	10.6334		0.6300		0.7000		0.7700		46.8932 (74)
East				15.7600	19.6403		0.6300		0.7000		0.7700		94.5966 (76)
South				9.4500	46.7521		0.6300		0.7000		0.7700		135.0220 (78)
West				3.0900	19.6403		0.6300		0.7000		0.7700		18.5472 (80)

Solar gains	295.0589	532.0797	798.4644	1094.5674	1312.7536	1338.9333	1276.2123	1109.6251	901.2713	607.8165	358.9728	248.8078	(83)
Total gains	1097.9147	1356.4538	1587.2454	1857.0083	2035.2210	2032.3830	1942.1005	1775.4266	1587.7292	1320.2131	1115.4081	1033.5651	(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, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.2815	24.3250	24.3678	24.5710	24.6094	24.7898	24.7898	24.8235	24.7200	24.6094	24.5319	24.4513
alpha	2.6188	2.6217	2.6245	2.6381	2.6406	2.6527	2.6527	2.6549	2.6480	2.6406	2.6355	2.6301
util living area	0.9741	0.9552	0.9227	0.8539	0.7459	0.6019	0.4726	0.5239	0.7270	0.8962	0.9595	0.9777 (86)
MIT	18.1600	18.5302	19.0767	19.7765	20.3618	20.7496	20.9048	20.8724	20.5608	19.7718	18.8397	18.0973 (87)
Th 2	19.9651	19.9667	19.9684	19.9760	19.9774	19.9841	19.9841	19.9853	19.9815	19.9774	19.9745	19.9715 (88)
util rest of house	0.9701	0.9483	0.9106	0.8304	0.7037	0.5331	0.3790	0.4297	0.6669	0.8743	0.9522	0.9743 (89)
MIT 2	16.6257	17.0954	17.7847	18.6551	19.3525	19.7836	19.9289	19.9065	19.5976	18.6686	17.4978	16.5494 (90)
Living area fraction	f _{LA} = Living area / (4) =											0.1018 (91)
MIT	16.7818	17.2414	17.9161	18.7692	19.4552	19.8819	20.0282	20.0047	19.6956	18.7809	17.6343	16.7069 (92)
Temperature adjustment												0.0000
adjusted MIT	16.7818	17.2414	17.9161	18.7692	19.4552	19.8819	20.0282	20.0047	19.6956	18.7809	17.6343	16.7069 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9509	0.9222	0.8781	0.7963	0.6790	0.5255	0.3833	0.4316	0.6474	0.8406	0.9274	0.9569 (94)
Useful gains	1043.9660	1250.8691	1393.8258	1478.8161	1381.9446	1068.1164	744.4159	766.2730	1027.9579	1109.8136	1034.3913	989.0046 (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	2932.9188	2894.7313	2673.0031	2291.7026	1798.0017	1215.6777	789.0342	828.5336	1291.5015	1896.6914	2450.0417	2918.4041 (97)
Space heating kWh	1405.3808	1104.6754	951.7080	585.2783	309.5464	0.0000	0.0000	0.0000	0.0000	585.4371	1019.2683	1435.4733 (98a)
Space heating requirement - total per year (kWh/year)												7396.7676
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	1405.3808	1104.6754	951.7080	585.2783	309.5464	0.0000	0.0000	0.0000	0.0000	585.4371	1019.2683	1435.4733 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7396.7676
Space heating per m ²												(98c) / (4) = 36.0115 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1405.3808	1104.6754	951.7080	585.2783	309.5464	0.0000	0.0000	0.0000	0.0000	585.4371	1019.2683	1435.4733 (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)	1522.6228	1196.8314	1031.1029	634.1044	335.3699	0.0000	0.0000	0.0000	0.0000	634.2764	1104.2994	1555.2256 (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	260.4962	230.3058	244.8004	215.8847	209.6351	189.3210	187.3004	194.5995	196.5494	218.6293	231.7547	257.7679 (64)
Efficiency of water heater (217)m	87.2611	87.1052	86.7972	86.1809	84.9323	79.8000	79.8000	79.8000	79.8000	86.1579	86.9827	79.8000 (216)
Fuel for water heating, kWh/month	298.5251	264.3996	282.0373	250.5018	246.8263	237.2443	234.7123	243.8590	246.3024	253.7543	266.4378	295.2630 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	39.5564	31.7336	28.5726	20.9335	16.1697	13.2108	14.7505	19.1733	24.9042	32.6756	36.9070	40.6558 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-68.3092	-95.0505	-134.8145	-149.4028	-159.1362	-147.6404	-145.5988	-138.2753	-125.2656	-107.4316	-74.5630	-59.1866 (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)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-42.5159	-88.9553	-175.9982	-263.2613	-347.1803	-348.6841	-344.7882	-292.5356	-215.0809	-127.1072	-56.7105	-33.6759	(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													8013.8327	(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													3119.8632	(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)													319.2431	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-3741.1679	(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													7797.7711	(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	8013.8327	0.2100	1682.9049	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3119.8632	0.2100	655.1713	(264)
Space and water heating			2338.0761	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	319.2431	0.1443	46.0766	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1404.6745	0.1349	-189.5044	
PV Unit electricity exported	-2336.4933	0.1260	-294.4043	
Total			-483.9087	(269)
Total CO2, kg/year			1912.1734	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.3100	(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	8013.8327	1.1300	9055.6310	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3119.8632	1.1300	3525.4454	(278)
Space and water heating			12581.0764	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	319.2431	1.5338	489.6657	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1404.6745	1.4986	-2105.0764	
PV Unit electricity exported	-2336.4933	0.4625	-1080.6747	
Total			-3185.7511	(283)
Total Primary energy kWh/year			10015.0918	(286)
Target Primary Energy Rate (TPER)			48.7600	(287)