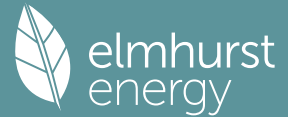


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Property Reference	OP-D320 P5ORCH				Issued on Date	29/11/2024	
Assessment Reference	P5ORCH			Prop Type Ref	P5ORCH		
Property	P5ORCH						
SAP Rating	79 C		DER	4.00		TER	10.17
Environmental	96 A		% DER < TER				60.67
CO ₂ Emissions (t/year)	0.68		DFEE	43.47		TFEE	44.48
Compliance Check	See BREL		% DFEE < TFEE				2.28
% DPER < TPER	21.42		DPER	41.99		TPER	53.44
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	71.8000 (1b)	x 2.7500 (2b)	= 197.4500 (1b) - (3b)
First floor	81.1900 (1c)	x 2.6100 (2c)	= 211.9059 (1c) - (3c)
Second floor	33.8800 (1d)	x 2.5800 (2d)	= 87.4104 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	186.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 496.7663 (5)

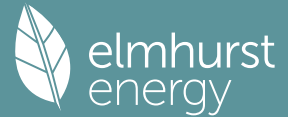
2. Ventilation rate

											m3 per hour		
Number of open chimneys											0 * 80 =	0.0000 (6a)	
Number of open flues											0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)	
Number of blocked chimneys											0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(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)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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			6.4200	1.0000	6.4200		(26)
Windows (Uw = 1.30)			24.0900	1.2357	29.7690		(27)
Ground Floor			71.8000	0.1100	7.8980		(28a)
Exposed Floor			19.3700	0.1400	2.7118		(28b)
External Wall	199.4900	27.0600	172.4300	0.1700	29.3131		(29a)
Dormer Cheeks	3.8900	1.3100	2.5800	0.1900	0.4902		(29a)
Stud Wall	38.1100		38.1100	0.1700	6.4787		(29a)
Garage Wall	25.5800	2.1400	23.4400	0.1700	3.9848		(29a)
Roof - ceiling	84.9500		84.9500	0.1100	9.3445		(30)
Roof - pitch	7.0800		7.0800	0.2000	1.4160		(30)
Dormer Roof	1.6800		1.6800	0.2000	0.3360		(30)
Total net area of external elements Aum(A, m ²)			451.9500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		98.1621		(33)

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

100.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	20.5600	0.0500	1.0280
E3 Sill	15.6900	0.0500	0.7845
E4 Jamb	47.7000	0.0500	2.3850
E5 Ground floor (normal)	42.1800	0.1600	6.7488
E6 Intermediate floor within a dwelling	31.9000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	21.2100	0.0600	1.2726
E12 Gable (insulation at ceiling level)	24.6500	0.0600	1.4790
E16 Corner (normal)	42.2800	0.0900	3.8052
E17 Corner (inverted - internal area greater than external area)	12.1100	-0.0900	-1.0899
E24 Eaves (insulation at ceiling level - inverted)	23.0200	0.2400	5.5248
R1 Head of roof window	1.2500	0.0800	0.1000
R2 Sill of roof window	1.2500	0.0600	0.0750
R3 Jamb of roof window	2.1000	0.0800	0.1680
R6 Flat ceiling	18.8800	0.0600	1.1328
R8 Roof to wall (rafter)	20.2800	0.0600	1.2168
R7 Flat ceiling (inverted)	1.3300	0.0400	0.0532
E20 Exposed floor (normal)	9.3000	0.3200	2.9760
E21 Exposed floor (inverted)	9.3000	0.3200	2.9760
E11 Eaves (insulation at rafter level)	1.9300	0.0400	0.0772

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

Point Thermal bridges

(36a) = 30.7130 (36)

Total fabric heat loss

(33) + (36) + (36a) = 128.8751 (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	
	56.0087	55.3991	54.7894	51.7413	51.1317	48.0836	48.0836	47.4739	49.3028	51.1317	52.3509	53.5702	(38)
Heat transfer coeff	184.8838	184.2742	183.6646	180.6164	180.0068	176.9587	176.9587	176.3490	178.1779	180.0068	181.2261	182.4453	(39)
Average = Sum(39)m / 12 =												180.4640	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9894	0.9861	0.9828	0.9665	0.9633	0.9470	0.9470	0.9437	0.9535	0.9633	0.9698	0.9763	(40)
HLP (average)												0.9657	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

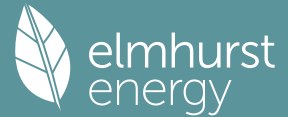
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9848 (42)
Hot water usage for mixer showers													
102.1148	100.5802	98.3440	94.0655	90.9080	87.3868	85.3854	87.6046	90.0374	93.8181	98.1885	101.7235	(42a)	
Hot water usage for baths													
33.7471	33.2459	32.5401	31.2388	30.2643	29.1839	28.6002	29.3011	30.0642	31.2203	32.5485	33.6330	(42b)	
Hot water usage for other uses													
47.5762	45.8462	44.1162	42.3861	40.6561	38.9260	38.9260	40.6561	42.3861	44.1162	45.8462	47.5762	(42c)	
Average daily hot water use (litres/day)												168.6864	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	183.4381	179.6723	175.0003	167.6903	161.8284	155.4967	152.9116	157.5618	162.4877	169.1545	176.5832	182.9328	(44)
Energy conte	290.5211	255.8510	268.9689	229.5597	217.8521	191.2013	184.9334	195.0944	200.3636	229.5411	251.5751	286.4285	(45)
Energy content (annual)										Total = Sum(45)m =		2801.8903	
Distribution loss (46)m = 0.15 x (45)m													
43.5782	38.3776	40.3453	34.4340	32.6778	28.6802	27.7400	29.2642	30.0545	34.4312	37.7363	42.9643	(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													
388.9027	344.7118	367.3505	324.7677	316.2337	255.8333	251.7198	261.8808	264.9956	327.9227	346.7831	384.8101	(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	388.9027	344.7118	367.3505	324.7677	316.2337	255.8333	251.7198	261.8808	264.9956	327.9227	346.7831	384.8101	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3835.9119	(64)
Electric shower(s)												3836	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
140.4844	124.7095	133.3182	118.7990	116.3219	81.5840	80.1003	83.4788	84.6305	120.2085	126.1191	139.1236	(65)	

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

Metabolic gains (Table 5), Watts													
(66)m	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
197.4814	218.6401	197.4814	204.0641	197.4814	204.0641	197.4814	197.4814	204.0641	197.4814	204.0641	197.4814	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
358.3892	362.1082	352.7365	332.7854	307.6006	283.9305	268.1175	264.3985	273.7702	293.7213	318.9060	342.5761	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	(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)													
-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	(71)	
Water heating gains (Table 5)													
188.8231	185.5796	179.1912	164.9986	156.3467	113.3112	107.6617	112.2027	117.5423	161.5706	175.1655	186.9940	(72)	
Total internal gains	812.4658	834.1000	797.1812	769.6202	729.2008	669.0780	641.0326	641.8547	663.1487	720.5454	765.9077	794.8237	(73)

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6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North	6.9300				10.6334	0.6300	0.7000	0.7700	22.5204 (74)			
East	4.7600				19.6403	0.6300	0.7000	0.7700	28.5710 (76)			
South	12.4000				46.7521	0.6300	0.7000	0.7700	177.1717 (78)			
Solar gains	228.2632	389.0903	534.7905	669.4540	758.0738	756.7464	727.8159	660.7128	581.0853	430.5167	273.4155	195.3622 (83)
Total gains	1040.7290	1223.1903	1331.9717	1439.0743	1487.2747	1425.8243	1368.8486	1302.5675	1244.2341	1151.0620	1039.3232	990.1859 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	28.0762	28.1691	28.2626	28.7395	28.8369	29.3336	29.3336	29.4350	29.1329	28.8369	28.6429	28.4514
util living area	2.8717	2.8779	2.8842	2.9160	2.9225	2.9556	2.9556	2.9623	2.9422	2.9225	2.9095	2.8968
util living area	0.9704	0.9526	0.9273	0.8746	0.7873	0.6559	0.5170	0.5546	0.7418	0.8908	0.9539	0.9740 (86)
Living	18.5991	18.9156	19.3459	19.9199	20.4130	20.7684	20.9167	20.8956	20.6412	20.0122	19.2219	18.5609
Non living	17.2537	17.6557	18.2003	18.9234	19.5205	19.9317	20.0752	20.0610	19.7976	19.0493	18.0564	17.2116
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	5	0	0	0	0	0	0	0	0	0	0	0
16 / 9	26	3	0	0	0	0	0	0	0	0	0	31
MIT	19.8595	19.0125	19.3459	19.9199	20.4130	20.7684	20.9167	20.8956	20.6412	20.0122	19.2219	19.6186 (87)
Th 2	20.0922	20.0949	20.0977	20.1113	20.1141	20.1278	20.1278	20.1305	20.1223	20.1141	20.1086	20.1031 (88)
util rest of house	0.9661	0.9459	0.9166	0.8551	0.7518	0.5948	0.4305	0.4697	0.6888	0.8700	0.9462	0.9703 (89)
MIT 2	19.0414	17.8017	18.2003	18.9234	19.5205	19.9317	20.0752	20.0610	19.7976	19.0493	18.0564	18.8269 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.1132	17.9079	18.3008	19.0109	19.5988	20.0051	20.1490	20.1342	19.8717	19.1338	18.1587	18.8964 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.1132	17.9079	18.3008	19.0109	19.5988	20.0051	20.1490	20.1342	19.8717	19.1338	18.1587	18.8964 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9606	0.9237	0.8885	0.8255	0.7281	0.5854	0.4328	0.4700	0.6715	0.8408	0.9228	0.9641 (94)
Ext temp.	999.6743	1129.9159	1183.4900	1188.0080	1082.8310	834.6183	592.4155	612.2551	835.5500	967.8457	959.1130	954.5921 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating requirement	2738.7251	2397.0282	2167.3918	1826.1868	1421.8425	956.4882	628.0311	658.5240	1028.3849	1536.1379	2004.1165	2681.2802 (97)
Space heating requirement - total per year (kWh/year)	1293.8538	851.4995	732.0229	459.4887	252.2245	0.0000	0.0000	0.0000	0.0000	422.8094	752.4025	1284.6560 (98a)
Solar heating contribution - total per year (kWh/year)	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)
Space heating requirement after solar contribution - total per year (kWh/year)	1293.8538	851.4995	732.0229	459.4887	252.2245	0.0000	0.0000	0.0000	0.0000	422.8094	752.4025	1284.6560 (98c)
Space heating per m2	(98c) / (4) =											

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 %)	263.4373 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	1293.8538	851.4995	732.0229	459.4887	252.2245	0.0000	0.0000	0.0000	0.0000	422.8094	752.4025	1284.6560 (98)
Space heating fuel (main heating system)	263.4373	263.4373	263.4373	263.4373	263.4373	0.0000	0.0000	0.0000	0.0000	263.4373	263.4373	263.4373 (210)
Space heating efficiency (main heating system 2)	491.1430	323.2266	277.8737	174.4205	95.7437	0.0000	0.0000	0.0000	0.0000	160.4972	285.6097	487.6515 (211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	388.9027	344.7118	367.3505	324.7677	316.2337	255.8333	251.7198	261.8808	264.9956	327.9227	346.7831	384.8101 (64)
Efficiency of water heater	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122 (216)
Fuel for water heating, kWh/month	139.3357	123.5030	131.6139	116.3574	113.2999	91.6597	90.1859	93.8264	94.9423	117.4878	124.2451	137.8694 (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	91.5193	82.6626	91.5193	88.5670	91.5193	88.5670	91.5193	91.5193	88.5670	91.5193	88.5670	91.5193 (231)
Lighting	41.0327	32.9180	29.6390	21.7148	16.7731	13.7038	15.3010	19.8888	25.8336	33.8951	38.2845	42.1732 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(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												2296.1660	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												279.1122	
Water heating fuel used												1374.3263	(219)
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)												1077.5656	(230a)
Total electricity for the above, kWh/year												1077.5656	(231)
Electricity for lighting (calculated in Appendix L)												331.1576	(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												5079.2156	(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	2296.1660	0.1552	356.3094	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1374.3263	0.1415	194.5172	(264)
Space and water heating			550.8266	(265)
Pumps, fans and electric keep-hot	1077.5656	0.1387	149.4716	(267)
Energy for lighting	331.1576	0.1443	47.7963	(268)
Total CO2, kg/year			748.0945	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.0000	(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	2296.1660	1.5745	3615.2122	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1374.3263	1.5234	2093.6400	(278)
Space and water heating			5708.8522	(279)
Pumps, fans and electric keep-hot	1077.5656	1.5128	1630.1412	(281)
Energy for lighting	331.1576	1.5338	507.9407	(282)
Total Primary energy kWh/year			7846.9341	(286)
Dwelling Primary energy Rate (DPER)			41.9900	(287)

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

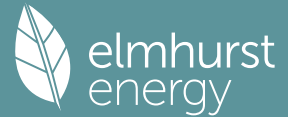
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	71.8000 (1b)	x 2.7500 (2b)	= 197.4500 (1b) - (3b)	
First floor	81.1900 (1c)	x 2.6100 (2c)	= 211.9059 (1c) - (3c)	
Second floor	33.8800 (1d)	x 2.5800 (2d)	= 87.4104 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	186.8700		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e) ... (3n)	= 496.7663 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0805 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3305 (18)

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Number of sides sheltered

2 (19)

Shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.2809 \quad (21)$$

	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													
	0.3582	0.3512	0.3442	0.3090	0.3020	0.2669	0.2669	0.2599	0.2809	0.3020	0.3161	0.3301	(22b)
Effective ac	0.5642	0.5617	0.5592	0.5478	0.5456	0.5356	0.5356	0.5338	0.5395	0.5456	0.5499	0.5545	(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			6.4200	1.0000	6.4200			(26)
TER Opening Type (Uw = 1.20)			24.0900	1.1450	27.5840			(27)
Ground Floor			71.8000	0.1300	9.3340			(28a)
Exposed Floor			19.3700	0.1300	2.5181			(28b)
External Wall	199.4900	27.0600	172.4300	0.1800	31.0374			(29a)
Dormer Cheeks	3.8900	1.3100	2.5800	0.1800	0.4644			(29a)
Stud Wall	38.1100		38.1100	0.1800	6.8598			(29a)
Garage Wall	25.5800	2.1400	23.4400	0.1800	4.2192			(29a)
Roof - ceiling	84.9500		84.9500	0.1100	9.3445			(30)
Roof - pitch	7.0800		7.0800	0.1100	0.7788			(30)
Dormer Roof	1.6800		1.6800	0.1100	0.1848			(31)
Total net area of external elements Aum(A, m2)			451.9500					(31)
Fabric heat loss, W/K = Sum (A x U)								(32)
								(26) ... (30) + (32) = 98.7450 (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)	20.5600	0.0500	1.0280	
E3 Sill	15.6900	0.0500	0.7845	
E4 Jamb	47.7000	0.0500	2.3850	
E5 Ground floor (normal)	42.1800	0.1600	6.7488	
E6 Intermediate floor within a dwelling	31.9000	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	21.2100	0.0600	1.2726	
E12 Gable (insulation at ceiling level)	24.6500	0.0600	1.4790	
E16 Corner (normal)	42.2800	0.0900	3.8052	
E17 Corner (inverted - internal area greater than external area)	12.1100	-0.0900	-1.0899	
E24 Eaves (insulation at ceiling level - inverted)	23.0200	0.2400	5.5248	
R1 Head of roof window	1.2500	0.0800	0.1000	
R2 Sill of roof window	1.2500	0.0600	0.0750	
R3 Jamb of roof window	2.1000	0.0800	0.1680	
R6 Flat ceiling	18.8800	0.0600	1.1328	
R8 Roof to wall (rafter)	20.2800	0.0600	1.2168	
R7 Flat ceiling (inverted)	1.3300	0.0400	0.0532	
E20 Exposed floor (normal)	9.3000	0.3200	2.9760	
E21 Exposed floor (inverted)	9.3000	0.3200	2.9760	
E11 Eaves (insulation at rafter level)	1.9300	0.0400	0.0772	

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

Point Thermal bridges		(36a) =	30.7130 (36)
Total fabric heat loss	(33) + (36) + (36a) =		129.4580 (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	92.4834	92.0750	91.6747	89.7945	89.4428	87.8052	87.8052	87.5019	88.4359	89.4428	90.1544	90.8984	(38)
Heat transfer coeff	221.9414	221.5330	221.1327	219.2525	218.9007	217.2631	217.2631	216.9599	217.8939	218.9007	219.6124	220.3564	(39)
Average = Sum(39)m / 12 =													219.2508

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1877	1.1855	1.1834	1.1733	1.1714	1.1626	1.1626	1.1610	1.1660	1.1714	1.1752	1.1792	(40)
HLP (average)													1.1733
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9848 (42)
Hot water usage for mixer showers													
74.2653	73.1492	71.5229	68.4112	66.1149	63.5540	62.0985	63.7125	65.4817	68.2313	71.4098	73.9808		(42a)
Hot water usage for baths													
32.0597	31.5836	30.9131	29.6768	28.7511	27.7247	27.1702	27.8360	28.5610	29.6593	30.9210	31.9513		(42b)
Hot water usage for other uses													
45.1974	43.5539	41.9103	40.2668	38.6233	36.9797	36.9797	38.6233	40.2668	41.9103	43.5539	45.1974		(42c)
Average daily hot water use (litres/day)													139.2831 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.5225	148.2867	144.3464	138.3549	133.4893	128.2584	126.2484	130.1718	134.3095	139.8010	145.8848	151.1295	(44)
Energy conte	239.9746	211.1583	221.8550	189.4009	179.7023	157.7087	152.6865	161.1798	165.6171	189.7086	207.8396	236.6323	(45)
Energy content (annual)													Total = Sum(45)m = 2313.4637

Distribution loss (46)m = 0.15 x (45)m													
35.9962	31.6737	33.2782	28.4101	26.9553	23.6563	22.9030	24.1770	24.8426	28.4563	31.1759	35.4949		(46)

Water storage loss:													
Store volume													230.0000 (47)

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

Temperature factor from Table 2b													1.7973 (48)
Enter (49) or (54) in (55)													0.5400 (49)
Total storage loss													0.9706 (55)

30.0872	27.1756	30.0872	29.1167	30.0872	29.1167	30.0872	30.0872	29.1167	30.0872	29.1167	30.0872	30.0872	(56)
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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	30.0872	(57)

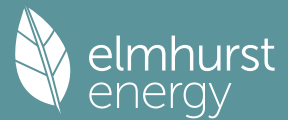
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month													
293.3242	259.3451	275.2046	241.0296	233.0519	209.3374	206.0361	214.5295	217.2457	243.0582	259.4683	289.9820		(62)

WWHRS	-33.9510	-30.0265	-31.4421	-26.0353	-24.2639	-20.7628	-19.4618	-20.6957	-21.4820	-25.3249	-28.6901	-33.3223	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

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Output from w/h	259.3732	229.3185	243.7626	214.9943	208.7879	188.5746	186.5743	193.8338	195.7637	217.7333	230.7782	256.6597 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2626.1540 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	122.4712	108.7595	116.4465	104.2787	102.4307	93.7411	93.4480	96.2720	96.3706	105.7578	110.4096	121.3600 (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	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	197.4814	218.6401	197.4814	204.0641	197.4814	204.0641	197.4814	197.4814	204.0641	197.4814	204.0641	197.4814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	358.3892	362.1082	352.7365	332.7854	307.6006	283.9305	268.1175	264.3985	273.7702	293.7213	318.9060	342.5761	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	(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)	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	(71)
Water heating gains (Table 5)	164.6119	161.8446	156.5141	144.8316	137.6757	130.1959	125.6021	129.3978	133.8481	142.1476	153.3467	163.1182	(72)
Total internal gains	791.2546	813.3650	777.5041	752.4532	713.5298	685.9627	658.9731	659.0499	679.4545	704.1224	747.0889	773.9479	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9300	10.6334	0.6300	0.7000	0.7700	22.5204	(74)
East	4.7600	19.6403	0.6300	0.7000	0.7700	28.5710	(76)
South	12.4000	46.7521	0.6300	0.7000	0.7700	177.1717	(78)

Solar gains	228.2632	389.0903	534.7905	669.4540	758.0738	756.7464	727.8159	660.7128	581.0853	430.5167	273.4155	195.3622	(83)
Total gains	1019.5178	1202.4553	1312.2946	1421.9072	1471.6037	1442.7091	1386.7890	1319.7627	1260.5398	1134.6391	1020.5044	969.3101	(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	23.3883	23.4314	23.4738	23.6751	23.7132	23.8919	23.8919	23.9253	23.8228	23.7132	23.6363	23.5565
alpha	2.5592	2.5621	2.5649	2.5783	2.5809	2.5928	2.5928	2.5950	2.5882	2.5809	2.5758	2.5704
util living area	0.9731	0.9582	0.9377	0.8959	0.8255	0.7082	0.5786	0.6154	0.7815	0.9094	0.9596	0.9762 (86)
MIT	18.0761	18.3972	18.8684	19.5071	20.1107	20.5994	20.8332	20.7979	20.4375	19.6516	18.7571	18.0229 (87)
Th 2	19.9299	19.9316	19.9333	19.9414	19.9429	19.9500	19.9500	19.9513	19.9473	19.9429	19.9399	19.9367 (88)
util rest of house	0.9688	0.9517	0.9274	0.8770	0.7897	0.6401	0.4728	0.5135	0.7252	0.8893	0.9522	0.9725 (89)
MIT 2	16.5003	16.9084	17.5059	18.3109	19.0502	19.6169	19.8495	19.8219	19.4460	18.5027	17.3745	16.4364 (90)
Living area fraction	16.6386	17.0390	17.6255	18.4159	19.1432	19.7031	19.9358	19.9076	19.5330	18.6035	17.4958	16.5756 (91)
MIT	16.6386	17.0390	17.6255	18.4159	19.1432	19.7031	19.9358	19.9076	19.5330	18.6035	17.4958	16.5756 (92)
Temperature adjustment												0.0000
adjusted MIT	16.6386	17.0390	17.6255	18.4159	19.1432	19.7031	19.9358	19.9076	19.5330	18.6035	17.4958	16.5756 (93)

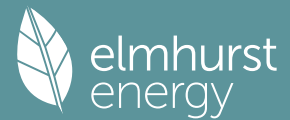
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9484	0.9254	0.8958	0.8412	0.7564	0.6216	0.4712	0.5087	0.6983	0.8544	0.9264	0.9537	(94)	
Useful gains	966.9096	1112.8117	1175.5980	1196.1608	1113.0732	896.7317	653.5027	671.4279	880.2370	969.4920	945.3570	924.4401	(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	2738.4528	2689.1964	2460.2142	2086.3906	1629.3276	1108.7230	724.7440	761.0061	1183.8123	1751.9720	2283.0460	2727.0423	(97)	
Space heating kWh	1318.0281	1059.3305	955.7544	640.9655	384.0933	0.0000	0.0000	0.0000	0.0000	582.1651	963.1361	1341.1360	(98a)	
Space heating requirement - total per year (kWh/year)	7244.6090													
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	1318.0281	1059.3305	955.7544	640.9655	384.0933	0.0000	0.0000	0.0000	0.0000	582.1651	963.1361	1341.1360	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)	7244.6090													
Space heating per m2											(98c) / (4) =		38.7682	(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	1318.0281	1059.3305	955.7544	640.9655	384.0933	0.0000	0.0000	0.0000	0.0000	582.1651	963.1361	1341.1360	(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)

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Space heating fuel (main heating system)	1427.9828	1147.7037	1035.4869	694.4371	416.1357	0.0000	0.0000	0.0000	0.0000	630.7315	1043.4844	1453.0184	(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	259.3732	229.3185	243.7626	214.9943	208.7879	188.5746	186.5743	193.8338	195.7637	217.7333	230.7782	256.6597	(64)
Efficiency of water heater	87.1832	87.0529	86.8104	86.3538	85.4078	79.8000	79.8000	79.8000	79.8000	86.1551	86.9054	87.2199	(216)
Fuel for water heating, kWh/month	297.5036	263.4245	280.7989	248.9692	244.4599	236.3090	233.8024	242.8994	245.3179	252.7225	265.5509	294.2674	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	41.0327	32.9180	29.6390	21.7148	16.7731	13.7038	15.3010	19.8888	25.8336	33.8951	38.2845	42.1732	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-65.0251	-90.5718	-128.5657	-142.5791	-151.9436	-141.0057	-139.1085	-132.1346	-119.6677	-102.5056	-71.0358	-56.3348	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-40.1043	-83.9772	-166.2731	-248.8766	-328.3513	-329.8107	-326.0757	-276.5353	-203.1871	-119.9794	-53.4910	-31.7552	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												7848.9805	(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												3106.0256	(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)												331.1576	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3548.8949	(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												7823.2689	(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	7848.9805	0.2100	1648.2859 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3106.0256	0.2100	652.2654 (264)
Space and water heating			2300.5513 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	331.1576	0.1443	47.7963 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1340.4780	0.1349	-180.8165
PV Unit electricity exported	-2208.4169	0.1260	-278.2295
Total			-459.0460 (269)
Total CO2, kg/year			1901.2308 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.1700 (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	7848.9805	1.1300	8869.3480 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3106.0256	1.1300	3509.8090 (278)
Space and water heating			12379.1569 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	331.1576	1.5338	507.9407 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1340.4780	1.4985	-2008.7683
PV Unit electricity exported	-2208.4169	0.4625	-1021.3003
Total			-3030.0687 (283)
Total Primary energy kWh/year			9987.1297 (286)
Target Primary Energy Rate (TPER)			53.4400 (287)

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Property Reference	OP-D320 P5ORCH				Issued on Date	29/11/2024
Assessment Reference	P5ORCH		Prop Type Ref	P5ORCH		
Property	P5ORCH					
SAP Rating	79 C	DER	4.00	TER	10.17	
Environmental	96 A	% DER < TER				60.67
CO ₂ Emissions (t/year)	0.68	DFEE	43.47	TFEE	44.48	
Compliance Check	See BREL	% DFEE < TFEE				2.28
% DPER < TPER	21.42	DPER	41.99	TPER	53.44	
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	71.8000 (1b)	x 2.7500 (2b)	= 197.4500 (1b) - (3b)
First floor	81.1900 (1c)	x 2.6100 (2c)	= 211.9059 (1c) - (3c)
Second floor	33.8800 (1d)	x 2.5800 (2d)	= 87.4104 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	186.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	496.7663 (5)

2. Ventilation rate

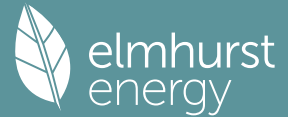
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.0805 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.5000 (17)
Infiltration rate	0.2555 (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) = 0.2172 (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	0.2769	0.2715	0.2661	0.2389	0.2335	0.2063	0.2063	0.2009	0.2172	0.2335	0.2443	0.2552 (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	0.5383	0.5369	0.5354	0.5285	0.5273	0.5213	0.5213	0.5202	0.5236	0.5273	0.5299	0.5326 (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			6.4200	1.0000	6.4200		(26)
Windows (Uw = 1.30)			24.0900	1.2357	29.7690		(27)
Ground Floor			71.8000	0.1100	7.8980		(28a)
Exposed Floor			19.3700	0.1400	2.7118		(28b)
External Wall	199.4900	27.0600	172.4300	0.1700	29.3131		(29a)
Dormer Cheeks	3.8900	1.3100	2.5800	0.1900	0.4902		(29a)
Stud Wall	38.1100		38.1100	0.1700	6.4787		(29a)
Garage Wall	25.5800	2.1400	23.4400	0.1700	3.9848		(29a)
Roof - ceiling	84.9500		84.9500	0.1100	9.3445		(30)
Roof - pitch	7.0800		7.0800	0.2000	1.4160		(30)
Dormer Roof	1.6800		1.6800	0.2000	0.3360		(30)
Total net area of external elements Aum(A, m ²)			451.9500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	98.1621	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
List of Thermal Bridges							

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K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	20.5600	0.0500	1.0280
E3 Sill	15.6900	0.0500	0.7845
E4 Jamb	47.7000	0.0500	2.3850
E5 Ground floor (normal)	42.1800	0.1600	6.7488
E6 Intermediate floor within a dwelling	31.9000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	21.2100	0.0600	1.2726
E12 Gable (insulation at ceiling level)	24.6500	0.0600	1.4790
E16 Corner (normal)	42.2800	0.0900	3.8052
E17 Corner (inverted - internal area greater than external area)	12.1100	-0.0900	-1.0899
E24 Eaves (insulation at ceiling level - inverted)	23.0200	0.2400	5.5248
R1 Head of roof window	1.2500	0.0800	0.1000
R2 Sill of roof window	1.2500	0.0600	0.0750
R3 Jamb of roof window	2.1000	0.0800	0.1680
R6 Flat ceiling	18.8800	0.0600	1.1328
R8 Roof to wall (rafter)	20.2800	0.0600	1.2168
R7 Flat ceiling (inverted)	1.3300	0.0400	0.0532
E20 Exposed floor (normal)	9.3000	0.3200	2.9760
E21 Exposed floor (inverted)	9.3000	0.3200	2.9760
E11 Eaves (insulation at rafter level)	1.9300	0.0400	0.0772
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			30.7130 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	128.8751 (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	88.2520	88.0080	87.7687	86.6450	86.4347	85.4560	85.4560	85.2748	85.8330	86.4347	86.8601	87.3047 (38)
Average = Sum(39)m / 12 =	217.1271	216.8831	216.6438	215.5201	215.3099	214.3311	214.3311	214.1499	214.7081	215.3099	215.7352	216.1798 (39)
												215.5191
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1619	1.1606	1.1593	1.1533	1.1522	1.1470	1.1470	1.1460	1.1490	1.1522	1.1545	1.1568 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9848 (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	32.0597	31.5836	30.9131	29.6768	28.7511	27.7247	27.1702	27.8360	28.5610	29.6593	30.9210	31.9513 (42b)
Hot water usage for other uses	45.1974	43.5539	41.9103	40.2668	38.6233	36.9797	36.9797	38.6233	40.2668	41.9103	43.5539	45.1974 (42c)
Average daily hot water use (litres/day)												70.8130 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	77.2572	75.1375	72.8235	69.9436	67.3744	64.7044	64.1499	66.4593	68.8278	71.5697	74.4749	77.1488 (44)
Energy content (annual)	122.3565	106.9948	111.9269	95.7493	90.6989	79.5616	77.5838	82.2905	84.8715	97.1194	106.1032	120.7963 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	104.0030	90.9456	95.1379	81.3869	77.0941	67.6274	65.9462	69.9469	72.1408	82.5515	90.1877	102.6769 (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	104.0030	90.9456	95.1379	81.3869	77.0941	67.6274	65.9462	69.9469	72.1408	82.5515	90.1877	102.6769 (64)
12Total per year (kWh/year)												999.6449 (64)
Electric shower(s)	59.4741	52.9919	57.8652	55.2200	56.2562	53.6630	55.4517	56.2562	55.2200	57.8652	56.7771	59.4741 (64a)
Heat gains from water heating, kWh/month	40.8693	35.9844	38.2508	34.1517	33.3376	30.3226	30.3495	31.5508	31.8402	35.1042	36.7412	40.5378 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 676.5148 (64a)												

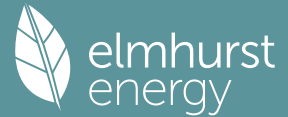
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.4814	218.6401	197.4814	204.0641	197.4814	204.0641	197.4814	197.4814	204.0641	197.4814	204.0641	197.4814 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	358.3892	362.1082	352.7365	332.7854	307.6006	283.9305	268.1175	264.3985	273.7702	293.7213	318.9060	342.5761 (68)
Pumps, fans	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924 (71)
Total internal gains	54.9318	53.5482	51.4123	47.4330	44.8086	42.1147	40.7923	42.4070	44.2225	47.1830	51.0294	54.4862 (72)
	678.5746	702.0686	669.4024	652.0546	617.6627	597.8815	574.1633	572.0590	589.8289	606.1578	641.7717	662.3159 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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North	6.9300	10.6334	0.6300	0.7000	0.7700	22.5204 (74)
East	4.7600	19.6403	0.6300	0.7000	0.7700	28.5710 (76)
South	12.4000	46.7521	0.6300	0.7000	0.7700	177.1717 (78)

Solar gains	228.2632	389.0903	534.7905	669.4540	758.0738	756.7464	727.8159	660.7128	581.0853	430.5167	273.4155	195.3622 (83)
Total gains	906.8377	1091.1589	1204.1929	1321.5086	1375.7366	1354.6278	1301.9792	1232.7718	1170.9142	1036.6745	915.1872	857.6781 (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	23.9069	23.9338	23.9602	24.0851	24.1087	24.2188	24.2188	24.2393	24.1762	24.1087	24.0611	24.0116
alpha	2.5938	2.5956	2.5973	2.6057	2.6072	2.6146	2.6146	2.6160	2.6117	2.6072	2.6041	2.6008
util living area	0.9793	0.9659	0.9472	0.9082	0.8414	0.7279	0.5995	0.6384	0.8019	0.9231	0.9680	0.9820 (86)
MIT	18.0244	18.3494	18.8238	19.4657	20.0788	20.5786	20.8225	20.7835	20.4078	19.6018	18.6979	17.9631 (87)
Th 2	19.9506	19.9516	19.9527	19.9575	19.9584	19.9627	19.9627	19.9635	19.9610	19.9584	19.9566	19.9547 (88)
util rest of house	0.9760	0.9605	0.9383	0.8912	0.8080	0.6617	0.4939	0.5374	0.7486	0.9056	0.9620	0.9791 (89)
MIT 2	17.2194	17.5419	18.0116	18.6436	19.2316	19.6862	19.8778	19.8534	19.5442	18.7849	17.8938	17.1611 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	17.2901	17.6127	18.0829	18.7158	19.3060	19.7645	19.9607	19.9351	19.6200	18.8566	17.9644	17.2315 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.2901	17.6127	18.0829	18.7158	19.3060	19.7645	19.9607	19.9351	19.6200	18.8566	17.9644	17.2315 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9636	0.9435	0.9168	0.8651	0.7824	0.6470	0.4936	0.5342	0.7275	0.8808	0.9455	0.9680 (94)
Useful gains	873.8555	1029.5048	1104.0312	1143.2829	1076.4268	876.4881	642.7126	658.5560	851.8334	913.1004	865.3142	830.2350 (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	2820.4954	2757.1787	2509.3641	2115.4930	1637.6365	1106.9192	720.2983	757.0322	1185.1945	1777.7346	2343.8243	2817.1413 (97)
Space heating kWh	1448.3001	1160.9968	1045.5676	699.9913	417.5400	0.0000	0.0000	0.0000	0.0000	643.2878	1064.5273	1478.2583 (98a)
Space heating requirement - total per year (kWh/year)	7958.4693											
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	1448.3001	1160.9968	1045.5676	699.9913	417.5400	0.0000	0.0000	0.0000	0.0000	643.2878	1064.5273	1478.2583 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	7958.4693											
Space heating per m2	(98c) / (4) = 42.5883 (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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	2014.7127	1586.0504	1627.5391	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.6060	0.6838	0.6527	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1220.8184	1084.6165	1062.3255	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1483.2690	1425.9218	1349.1516	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	188.9645	253.9311	213.3986	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	fC = cooled area / (4) =											1.0000 (105)
Space cooling kWh	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 requirement	0.0000	0.0000	0.0000	0.0000	0.0000	47.2411	63.4828	53.3497	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												164.0736 (107)
Energy for space cooling												42.5883 (99)
Total												0.8780 (108)
Fabric Energy Efficiency (DFEE)												43.4663 (109)
												43.5 (109)

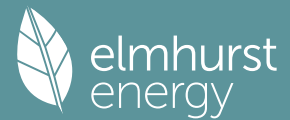
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	71.8000 (1b)	x 2.7500 (2b)	= 197.4500 (1b) - (3b)
First floor	81.1900 (1c)	x 2.6100 (2c)	= 211.9059 (1c) - (3c)
Second floor	33.8800 (1d)	x 2.5800 (2d)	= 87.4104 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	186.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	496.7663 (5)

2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	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) =	Air changes per hour	0.0805	(8)
Pressure test			Yes		
Pressure Test Method			Blower Door		
Measured/design AP50				5.0000	(17)
Infiltration rate				0.3305	(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) =		0.2809	(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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	0.3582	0.3512	0.3442	0.3090	0.3020	0.2669	0.2669	0.2599	0.2809	0.3020	0.3161	0.3301	(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	0.5642	0.5617	0.5592	0.5478	0.5456	0.5356	0.5356	0.5338	0.5395	0.5456	0.5499	0.5545	(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			6.4200	1.0000	6.4200			(26)
TER Opening Type (Uw = 1.20)			24.0900	1.1450	27.5840			(27)
Ground Floor			71.8000	0.1300	9.3340			(28a)
Exposed Floor			19.3700	0.1300	2.5181			(28b)
External Wall	199.4900	27.0600	172.4300	0.1800	31.0374			(29a)
Dormer Cheeks	3.8900	1.3100	2.5800	0.1800	0.4644			(29a)
Stud Wall	38.1100		38.1100	0.1800	6.8598			(29a)
Garage Wall	25.5800	2.1400	23.4400	0.1800	4.2192			(29a)
Roof - ceiling	84.9500		84.9500	0.1100	9.3445			(30)
Roof - pitch	7.0800		7.0800	0.1100	0.7788			(30)
Dormer Roof	1.6800		1.6800	0.1100	0.1848			(30)
Total net area of external elements Aum(A, m2)			451.9500					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	98.7450		(33)

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

List of Thermal Bridges 100.0000 (35)

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	20.5600	0.0500	1.0280	
E3 Sill	15.6900	0.0500	0.7845	
E4 Jamb	47.7000	0.0500	2.3850	
E5 Ground floor (normal)	42.1800	0.1600	6.7488	
E6 Intermediate floor within a dwelling	31.9000	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	21.2100	0.0600	1.2726	
E12 Gable (insulation at ceiling level)	24.6500	0.0600	1.4790	
E16 Corner (normal)	42.2800	0.0900	3.8052	
E17 Corner (inverted - internal area greater than external area)	12.1100	-0.0900	-1.0899	
E24 Eaves (insulation at ceiling level - inverted)	23.0200	0.2400	5.5248	
R1 Head of roof window	1.2500	0.0800	0.1000	
R2 Sill of roof window	1.2500	0.0600	0.0750	
R3 Jamb of roof window	2.1000	0.0800	0.1680	
R6 Flat ceiling	18.8800	0.0600	1.1328	
R8 Roof to wall (rafter)	20.2800	0.0600	1.2168	
R7 Flat ceiling (inverted)	1.3300	0.0400	0.0532	
E20 Exposed floor (normal)	9.3000	0.3200	2.9760	
E21 Exposed floor (inverted)	9.3000	0.3200	2.9760	
E11 Eaves (insulation at rafter level)	1.9300	0.0400	0.0772	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 30.7130 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 129.4580 (37)

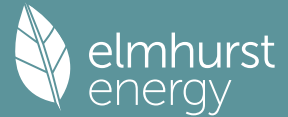
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	92.4834	92.0750	91.6747	89.7945	89.4428	87.8052	87.8052	87.5019	88.4359	89.4428	90.1544	90.8984	(38)
Average = Sum(39)m / 12 =	221.9414	221.5330	221.1327	219.2525	218.9007	217.2631	217.2631	216.9599	217.8939	218.9007	219.6124	220.3564	(39)
													219.2508

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1877	1.1855	1.1834	1.1733	1.1714	1.1626	1.1626	1.1610	1.1660	1.1714	1.1752	1.1792	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9848 (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	32.0597	31.5836	30.9131	29.6768	28.7511	27.7247	27.1702	27.8360	28.5610	29.6593	30.9210	31.9513	(42b)
Hot water usage for other uses	45.1974	43.5539	41.9103	40.2668	38.6233	36.9797	36.9797	38.6233	40.2668	41.9103	43.5539	45.1974	(42c)
Average daily hot water use (litres/day)													70.8130 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	77.2572	75.1375	72.8235	69.9436	67.3744	64.7044	64.1499	66.4593	68.8278	71.5697	74.4749	77.1488	(44)
	122.3565	106.9948	111.9269	95.7493	90.6989	79.5616	77.5838	82.2905	84.8715	97.1194	106.1032	120.7963	(45)

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Energy content (annual)	Total = Sum(45)m =										1176.0528
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	(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	(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	(57)
Primary loss	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	(61)
Total heat required for water heating calculated for each month	104.0030	90.9456	95.1379	81.3869	77.0941	67.6274	65.9462	69.9469	72.1408	82.5515	102.6769 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	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 (63d)
Output from w/h	104.0030	90.9456	95.1379	81.3869	77.0941	67.6274	65.9462	69.9469	72.1408	82.5515	102.6769 (64)
Total per year (kWh/year) = Sum(64)m =										999.6449	(64)
12Total per year (kWh/year)										1000	(64)
Electric shower(s)	59.4741	52.9919	57.8652	55.2200	56.2562	53.6630	55.4517	56.2562	55.2200	57.8652	56.7771 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =										676.5148	(64a)
Heat gains from water heating, kWh/month	40.8693	35.9844	38.2508	34.1517	33.3376	30.3226	30.3495	31.5508	31.8402	35.1042	40.5378 (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	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	197.4814	218.6401	197.4814	204.0641	197.4814	204.0641	197.4814	197.4814	204.0641	197.4814	204.0641	197.4814 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	358.3892	362.1082	352.7365	332.7854	307.6006	283.9305	268.1175	264.3985	273.7702	293.7213	318.9060	342.5761 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240 (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)	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924 (71)
Water heating gains (Table 5)	54.9318	53.5482	51.4123	47.4330	44.8086	42.1147	40.7923	42.4070	44.2225	47.1830	51.0294	54.4862 (72)
Total internal gains	678.5746	702.0686	669.4024	652.0546	617.6627	597.8815	574.1633	572.0590	589.8289	606.1578	641.7717	662.3159 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
North					6.9300	10.6334	0.6300	0.7000		0.7700	22.5204 (74)	
East					4.7600	19.6403	0.6300	0.7000		0.7700	28.5710 (76)	
South					12.4000	46.7521	0.6300	0.7000		0.7700	177.1717 (78)	
Solar gains	228.2632	389.0903	534.7905	669.4540	758.0738	756.7464	727.8159	660.7128	581.0853	430.5167	273.4155	195.3622 (83)
Total gains	906.8377	1091.1589	1204.1929	1321.5086	1375.7366	1354.6278	1301.9792	1232.7718	1170.9142	1036.6745	915.1872	857.6781 (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	23.3883	23.4314	23.4738	23.6751	23.7132	23.8919	23.8919	23.9253	23.8228	23.7132	23.6363	23.5565
alpha	2.5592	2.5621	2.5649	2.5783	2.5809	2.5928	2.5928	2.5950	2.5882	2.5809	2.5758	2.5704
util living area	0.9793	0.9661	0.9478	0.9093	0.8437	0.7310	0.6036	0.6421	0.8044	0.9239	0.9681	0.9820 (86)
MIT	17.9641	18.2915	18.7722	19.4289	20.0520	20.5652	20.8152	20.7756	20.3906	19.5715	18.6562	17.9105 (87)
Th 2	19.9299	19.9316	19.9333	19.9414	19.9429	19.9500	19.9500	19.9513	19.9473	19.9429	19.9399	19.9367 (88)
util rest of house	0.9760	0.9607	0.9389	0.8923	0.8102	0.6645	0.4967	0.5401	0.7510	0.9064	0.9621	0.9791 (89)
MIT 2	17.1465	17.4719	17.9484	18.5973	19.1957	19.6651	19.8619	19.8375	19.5190	18.7454	17.8420	17.0977 (90)
Living area fraction	17.2183	17.5439	18.0207	18.6703	19.2709	19.7441	19.9456	19.9199	19.5955	fLA = Living area / (4) =		0.0878 (91)
MIT	17.2183	17.5439	18.0207	18.6703	19.2709	19.7441	19.9456	19.9199	19.5955	18.8179	17.9134	17.1690 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2183	17.5439	18.0207	18.6703	19.2709	19.7441	19.9456	19.9199	19.5955	18.8179	17.9134	17.1690 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9635	0.9435	0.9171	0.8659	0.7841	0.6493	0.4962	0.5366	0.7293	0.8813	0.9455	0.9678 (94)
Useful gains	873.7024	1029.5113	1104.3819	1144.3430	1078.6948	879.5837	646.0838	661.5467	853.9869	913.6711	865.2908	830.0908 (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	2867.1050	2801.0355	2547.6080	2142.1594	1657.2681	1117.6190	726.8672	763.6705	1197.4257	1798.9076	2374.7584	2857.8055 (97)
Space heating kWh	1483.0915	1190.4643	1073.7602	718.4279	430.4585	0.0000	0.0000	0.0000	0.0000	658.6159	1086.8167	1508.6197 (98a)
Space heating requirement - total per year (kWh/year)											8150.2547	
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	1483.0915	1190.4643	1073.7602	718.4279	430.4585	0.0000	0.0000	0.0000	0.0000	658.6159	1086.8167	1508.6197 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											8150.2547	
Space heating per m2											(98c) / (4) =	43.6146 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	2042.2735	1607.7473	1648.8951	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5993	0.6771	0.6462	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1223.8861	1088.6393	1065.5824	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1483.2690	1425.9218	1349.1516	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	186.7557	250.9382	210.9755	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	46.6889	62.7345	52.7439	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												162.1674 (107)
Energy for space heating												43.6146 (99)
Energy for space cooling												0.8678 (108)
Total												44.4824 (109)
Fabric Energy Efficiency (TFEE)												44.5 (109)

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Property Reference	OP-D320 P5ORCH			Issued on Date	29/11/2024
Assessment Reference	P5ORCH	Prop Type Ref	P5ORCH		
Property	P5ORCH				
SAP Rating	79 C	DER	4.00	TER	10.17
Environmental	96 A	% DER < TER			60.67
CO ₂ Emissions (t/year)	0.68	DFEE	43.47	TFEE	44.48
Compliance Check	See BREL	% DFEE < TFEE			2.28
% DPER < TPER	21.42	DPER	41.99	TPER	53.44
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	71.8000 (1b)	x 2.7500 (2b)	= 197.4500 (1b) - (3b)
First floor	81.1900 (1c)	x 2.6100 (2c)	= 211.9059 (1c) - (3c)
Second floor	33.8800 (1d)	x 2.5800 (2d)	= 87.4104 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	186.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 496.7663 (5)

2. Ventilation rate

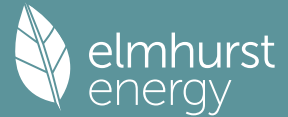
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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			6.4200	1.0000	6.4200		(26)
Windows (Uw = 1.30)			24.0900	1.2357	29.7690		(27)
Ground Floor			71.8000	0.1100	7.8980		(28a)
Exposed Floor			19.3700	0.1400	2.7118		(28b)
External Wall	199.4900	27.0600	172.4300	0.1700	29.3131		(29a)
Dormer Cheeks	3.8900	1.3100	2.5800	0.1900	0.4902		(29a)
Stud Wall	38.1100		38.1100	0.1700	6.4787		(29a)
Garage Wall	25.5800	2.1400	23.4400	0.1700	3.9848		(29a)
Roof - ceiling	84.9500		84.9500	0.1100	9.3445		(30)
Roof - pitch	7.0800		7.0800	0.2000	1.4160		(30)
Dormer Roof	1.6800		1.6800	0.2000	0.3360		(30)
Total net area of external elements Aum(A, m ²)			451.9500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	98.1621	(33)

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

100.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	20.5600	0.0500	1.0280
E3 Sill	15.6900	0.0500	0.7845
E4 Jamb	47.7000	0.0500	2.3850
E5 Ground floor (normal)	42.1800	0.1600	6.7488
E6 Intermediate floor within a dwelling	31.9000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	21.2100	0.0600	1.2726
E12 Gable (insulation at ceiling level)	24.6500	0.0600	1.4790
E16 Corner (normal)	42.2800	0.0900	3.8052
E17 Corner (inverted - internal area greater than external area)	12.1100	-0.0900	-1.0899
E24 Eaves (insulation at ceiling level - inverted)	23.0200	0.2400	5.5248
R1 Head of roof window	1.2500	0.0800	0.1000
R2 Sill of roof window	1.2500	0.0600	0.0750
R3 Jamb of roof window	2.1000	0.0800	0.1680
R6 Flat ceiling	18.8800	0.0600	1.1328
R8 Roof to wall (rafter)	20.2800	0.0600	1.2168
R7 Flat ceiling (inverted)	1.3300	0.0400	0.0532
E20 Exposed floor (normal)	9.3000	0.3200	2.9760
E21 Exposed floor (inverted)	9.3000	0.3200	2.9760
E11 Eaves (insulation at rafter level)	1.9300	0.0400	0.0772

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

Point Thermal bridges

(36a) = 30.7130 (36)

Total fabric heat loss

(33) + (36) + (36a) = 128.8751 (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	56.0087	55.3991	54.7894	51.7413	51.1317	48.0836	48.0836	47.4739	49.3028	51.1317	52.3509	53.5702	(38)
Heat transfer coeff	184.8838	184.2742	183.6646	180.6164	180.0068	176.9587	176.9587	176.3490	178.1779	180.0068	181.2261	182.4453	(39)
Average = Sum(39)m / 12 =												180.4640	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9894	0.9861	0.9828	0.9665	0.9633	0.9470	0.9470	0.9437	0.9535	0.9633	0.9698	0.9763	(40)
HLP (average)												0.9657	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

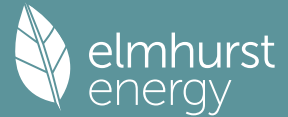
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9848 (42)
Hot water usage for mixer showers													
102.1148	100.5802	98.3440	94.0655	90.9080	87.3868	85.3854	87.6046	90.0374	93.8181	98.1885	101.7235	(42a)	
Hot water usage for baths													
33.7471	33.2459	32.5401	31.2388	30.2643	29.1839	28.6002	29.3011	30.0642	31.2203	32.5485	33.6330	(42b)	
Hot water usage for other uses													
47.5762	45.8462	44.1162	42.3861	40.6561	38.9260	38.9260	40.6561	42.3861	44.1162	45.8462	47.5762	(42c)	
Average daily hot water use (litres/day)												168.6864	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	183.4381	179.6723	175.0003	167.6903	161.8284	155.4967	152.9116	157.5618	162.4877	169.1545	176.5832	182.9328	(44)
Energy conte	290.5211	255.8510	268.9689	229.5597	217.8521	191.2013	184.9334	195.0944	200.3636	229.5411	251.5751	286.4285	(45)
Energy content (annual)										Total = Sum(45)m =		2801.8903	
Distribution loss (46)m = 0.15 x (45)m													
43.5782	38.3776	40.3453	34.4340	32.6778	28.6802	27.7400	29.2642	30.0545	34.4312	37.7363	42.9643	(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													
388.9027	344.7118	367.3505	324.7677	316.2337	255.8333	251.7198	261.8808	264.9956	327.9227	346.7831	384.8101	(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	388.9027	344.7118	367.3505	324.7677	316.2337	255.8333	251.7198	261.8808	264.9956	327.9227	346.7831	384.8101	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3835.9119	(64)
Electric shower(s)												3836	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
140.4844	124.7095	133.3182	118.7990	116.3219	81.5840	80.1003	83.4788	84.6305	120.2085	126.1191	139.1236	(65)	

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

Metabolic gains (Table 5), Watts													
(66)m	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
197.4814	218.6401	197.4814	204.0641	197.4814	204.0641	197.4814	197.4814	204.0641	197.4814	204.0641	197.4814	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
358.3892	362.1082	352.7365	332.7854	307.6006	283.9305	268.1175	264.3985	273.7702	293.7213	318.9060	342.5761	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	(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)													
-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	(71)	
Water heating gains (Table 5)													
188.8231	185.5796	179.1912	164.9986	156.3467	113.3112	107.6617	112.2027	117.5423	161.5706	175.1655	186.9940	(72)	
Total internal gains	812.4658	834.1000	797.1812	769.6202	729.2008	669.0780	641.0326	641.8547	663.1487	720.5454	765.9077	794.8237	(73)

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6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North	6.9300				10.6334	0.6300	0.7000	0.7700	22.5204 (74)			
East	4.7600				19.6403	0.6300	0.7000	0.7700	28.5710 (76)			
South	12.4000				46.7521	0.6300	0.7000	0.7700	177.1717 (78)			
Solar gains	228.2632	389.0903	534.7905	669.4540	758.0738	756.7464	727.8159	660.7128	581.0853	430.5167	273.4155	195.3622 (83)
Total gains	1040.7290	1223.1903	1331.9717	1439.0743	1487.2747	1425.8243	1368.8486	1302.5675	1244.2341	1151.0620	1039.3232	990.1859 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	28.0762	28.1691	28.2626	28.7395	28.8369	29.3336	29.3336	29.4350	29.1329	28.8369	28.6429	28.4514
util living area	2.8717	2.8779	2.8842	2.9160	2.9225	2.9556	2.9556	2.9623	2.9422	2.9225	2.9095	2.8968
util living area	0.9704	0.9526	0.9273	0.8746	0.7873	0.6559	0.5170	0.5546	0.7418	0.8908	0.9539	0.9740 (86)
Living	18.5991	18.9156	19.3459	19.9199	20.4130	20.7684	20.9167	20.8956	20.6412	20.0122	19.2219	18.5609
Non living	17.2537	17.6557	18.2003	18.9234	19.5205	19.9317	20.0752	20.0610	19.7976	19.0493	18.0564	17.2116
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	5	0	0	0	0	0	0	0	0	0	0	0
16 / 9	26	3	0	0	0	0	0	0	0	0	0	31
MIT	19.8595	19.0125	19.3459	19.9199	20.4130	20.7684	20.9167	20.8956	20.6412	20.0122	19.2219	19.6186 (87)
Th 2	20.0922	20.0949	20.0977	20.1113	20.1141	20.1278	20.1278	20.1305	20.1223	20.1141	20.1086	20.1031 (88)
util rest of house	0.9661	0.9459	0.9166	0.8551	0.7518	0.5948	0.4305	0.4697	0.6888	0.8700	0.9462	0.9703 (89)
MIT 2	19.0414	17.8017	18.2003	18.9234	19.5205	19.9317	20.0752	20.0610	19.7976	19.0493	18.0564	18.8269 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.1132	17.9079	18.3008	19.0109	19.5988	20.0051	20.1490	20.1342	19.8717	19.1338	18.1587	18.8964 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.1132	17.9079	18.3008	19.0109	19.5988	20.0051	20.1490	20.1342	19.8717	19.1338	18.1587	18.8964 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9606	0.9237	0.8885	0.8255	0.7281	0.5854	0.4328	0.4700	0.6715	0.8408	0.9228	0.9641 (94)
Ext temp.	999.6743	1129.9159	1183.4900	1188.0080	1082.8310	834.6183	592.4155	612.2551	835.5500	967.8457	959.1130	954.5921 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating requirement	2738.7251	2397.0282	2167.3918	1826.1868	1421.8425	956.4882	628.0311	658.5240	1028.3849	1536.1379	2004.1165	2681.2802 (97)
Space heating requirement - total per year (kWh/year)	1293.8538	851.4995	732.0229	459.4887	252.2245	0.0000	0.0000	0.0000	0.0000	422.8094	752.4025	1284.6560 (98a)
Solar heating contribution - total per year (kWh/year)	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)
Space heating requirement after solar contribution - total per year (kWh/year)	1293.8538	851.4995	732.0229	459.4887	252.2245	0.0000	0.0000	0.0000	0.0000	422.8094	752.4025	1284.6560 (98c)
Space heating per m2	(98c) / (4) =											

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 %)	263.4373 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	1293.8538	851.4995	732.0229	459.4887	252.2245	0.0000	0.0000	0.0000	0.0000	422.8094	752.4025	1284.6560 (98)
Space heating fuel (main heating system)	263.4373	263.4373	263.4373	263.4373	263.4373	0.0000	0.0000	0.0000	0.0000	263.4373	263.4373	263.4373 (210)
Space heating efficiency (main heating system 2)	491.1430	323.2266	277.8737	174.4205	95.7437	0.0000	0.0000	0.0000	0.0000	160.4972	285.6097	487.6515 (211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	388.9027	344.7118	367.3505	324.7677	316.2337	255.8333	251.7198	261.8808	264.9956	327.9227	346.7831	384.8101 (64)
Efficiency of water heater	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122	279.1122 (216)
Fuel for water heating, kWh/month	139.3357	123.5030	131.6139	116.3574	113.2999	91.6597	90.1859	93.8264	94.9423	117.4878	124.2451	137.8694 (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	91.5193	82.6626	91.5193	88.5670	91.5193	88.5670	91.5193	91.5193	88.5670	91.5193	88.5670	91.5193 (231)
Lighting	41.0327	32.9180	29.6390	21.7148	16.7731	13.7038	15.3010	19.8888	25.8336	33.8951	38.2845	42.1732 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(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												2296.1660	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												279.1122	
Water heating fuel used												1374.3263	(219)
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)												1077.5656	(230a)
Total electricity for the above, kWh/year												1077.5656	(231)
Electricity for lighting (calculated in Appendix L)												331.1576	(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												5079.2156	(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	2296.1660	0.1552	356.3094	(261)
Total CO2 associated with community systems			0.0000	(273)
Water heating (other fuel)	1374.3263	0.1415	194.5172	(264)
Space and water heating			550.8266	(265)
Pumps, fans and electric keep-hot	1077.5656	0.1387	149.4716	(267)
Energy for lighting	331.1576	0.1443	47.7963	(268)
Total CO2, kg/year			748.0945	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.0000	(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	2296.1660	1.5745	3615.2122	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1374.3263	1.5234	2093.6400	(278)
Space and water heating			5708.8522	(279)
Pumps, fans and electric keep-hot	1077.5656	1.5128	1630.1412	(281)
Energy for lighting	331.1576	1.5338	507.9407	(282)
Total Primary energy kWh/year			7846.9341	(286)
Dwelling Primary energy Rate (DPER)			41.9900	(287)

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

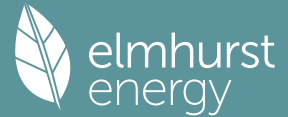
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	71.8000 (1b)	x 2.7500 (2b)	= 197.4500 (1b) - (3b)	
First floor	81.1900 (1c)	x 2.6100 (2c)	= 211.9059 (1c) - (3c)	
Second floor	33.8800 (1d)	x 2.5800 (2d)	= 87.4104 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	186.8700			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e) ... (3n) =	496.7663	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0805 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3305 (18)

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Number of sides sheltered

2 (19)

Shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.2809 \quad (21)$$

	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													
	0.3582	0.3512	0.3442	0.3090	0.3020	0.2669	0.2669	0.2599	0.2809	0.3020	0.3161	0.3301	(22b)
Effective ac	0.5642	0.5617	0.5592	0.5478	0.5456	0.5356	0.5356	0.5338	0.5395	0.5456	0.5499	0.5545	(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			6.4200	1.0000	6.4200			(26)
TER Opening Type (Uw = 1.20)			24.0900	1.1450	27.5840			(27)
Ground Floor			71.8000	0.1300	9.3340			(28a)
Exposed Floor			19.3700	0.1300	2.5181			(28b)
External Wall	199.4900	27.0600	172.4300	0.1800	31.0374			(29a)
Dormer Cheeks	3.8900	1.3100	2.5800	0.1800	0.4644			(29a)
Stud Wall	38.1100		38.1100	0.1800	6.8598			(29a)
Garage Wall	25.5800	2.1400	23.4400	0.1800	4.2192			(29a)
Roof - ceiling	84.9500		84.9500	0.1100	9.3445			(30)
Roof - pitch	7.0800		7.0800	0.1100	0.7788			(30)
Dormer Roof	1.6800		1.6800	0.1100	0.1848			(31)
Total net area of external elements Aum(A, m2)			451.9500					(31)
Fabric heat loss, W/K = Sum (A x U)								(32)
								(26) ... (30) + (32) = 98.7450 (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)	20.5600	0.0500	1.0280	
E3 Sill	15.6900	0.0500	0.7845	
E4 Jamb	47.7000	0.0500	2.3850	
E5 Ground floor (normal)	42.1800	0.1600	6.7488	
E6 Intermediate floor within a dwelling	31.9000	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	21.2100	0.0600	1.2726	
E12 Gable (insulation at ceiling level)	24.6500	0.0600	1.4790	
E16 Corner (normal)	42.2800	0.0900	3.8052	
E17 Corner (inverted - internal area greater than external area)	12.1100	-0.0900	-1.0899	
E24 Eaves (insulation at ceiling level - inverted)	23.0200	0.2400	5.5248	
R1 Head of roof window	1.2500	0.0800	0.1000	
R2 Sill of roof window	1.2500	0.0600	0.0750	
R3 Jamb of roof window	2.1000	0.0800	0.1680	
R6 Flat ceiling	18.8800	0.0600	1.1328	
R8 Roof to wall (rafter)	20.2800	0.0600	1.2168	
R7 Flat ceiling (inverted)	1.3300	0.0400	0.0532	
E20 Exposed floor (normal)	9.3000	0.3200	2.9760	
E21 Exposed floor (inverted)	9.3000	0.3200	2.9760	
E11 Eaves (insulation at rafter level)	1.9300	0.0400	0.0772	

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

Point Thermal bridges		(36a) =	30.7130 (36)
Total fabric heat loss		(33) + (36) + (36a) =	129.4580 (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	92.4834	92.0750	91.6747	89.7945	89.4428	87.8052	87.8052	87.5019	88.4359	89.4428	90.1544	90.8984	(38)
Heat transfer coeff	221.9414	221.5330	221.1327	219.2525	218.9007	217.2631	217.2631	216.9599	217.8939	218.9007	219.6124	220.3564	(39)
Average = Sum(39)m / 12 =												219.2508	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1877	1.1855	1.1834	1.1733	1.1714	1.1626	1.1626	1.1610	1.1660	1.1714	1.1752	1.1792	(40)
HLP (average)												1.1733	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9848 (42)
Hot water usage for mixer showers													
74.2653	73.1492	71.5229	68.4112	66.1149	63.5540	62.0985	63.7125	65.4817	68.2313	71.4098	73.9808		(42a)
Hot water usage for baths													
32.0597	31.5836	30.9131	29.6768	28.7511	27.7247	27.1702	27.8360	28.5610	29.6593	30.9210	31.9513		(42b)
Hot water usage for other uses													
45.1974	43.5539	41.9103	40.2668	38.6233	36.9797	36.9797	38.6233	40.2668	41.9103	43.5539	45.1974		(42c)
Average daily hot water use (litres/day)												139.2831	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.5225	148.2867	144.3464	138.3549	133.4893	128.2584	126.2484	130.1718	134.3095	139.8010	145.8848	151.1295	(44)
Energy conte	239.9746	211.1583	221.8550	189.4009	179.7023	157.7087	152.6865	161.1798	165.6171	189.7086	207.8396	236.6323	(45)
Energy content (annual)										Total = Sum(45)m =		2313.4637	

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)
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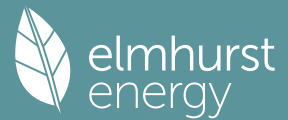
If cylinder contains dedicated solar storage	30.0872	27.1756	30.0872	29.1167	30.0872	29.1167	30.0872	30.0872	29.1167	30.0872	29.1167	30.0872	(57)
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Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(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

Total heat required for water heating calculated for each month												
	293.3242	259.3451	275.2046	241.0296	233.0519	209.3374	206.0361	214.5295	217.2457	243.0582	259.4683	289.9820 (62)
WWHRS	-33.9510	-30.0265	-31.4421	-26.0353	-24.2639	-20.7628	-19.4618	-20.6957	-21.4820	-25.3249	-28.6901	-33.3223 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

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Output from w/h	259.3732	229.3185	243.7626	214.9943	208.7879	188.5746	186.5743	193.8338	195.7637	217.7333	230.7782	256.6597 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2626.1540 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	122.4712	108.7595	116.4465	104.2787	102.4307	93.7411	93.4480	96.2720	96.3706	105.7578	110.4096	121.3600 (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	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	149.2405	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	197.4814	218.6401	197.4814	204.0641	197.4814	204.0641	197.4814	197.4814	204.0641	197.4814	204.0641	197.4814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	358.3892	362.1082	352.7365	332.7854	307.6006	283.9305	268.1175	264.3985	273.7702	293.7213	318.9060	342.5761	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	37.9240	(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)	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	-119.3924	(71)
Water heating gains (Table 5)	164.6119	161.8446	156.5141	144.8316	137.6757	130.1959	125.6021	129.3978	133.8481	142.1476	153.3467	163.1182	(72)
Total internal gains	791.2546	813.3650	777.5041	752.4532	713.5298	685.9627	658.9731	659.0499	679.4545	704.1224	747.0889	773.9479	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.9300	10.6334	0.6300	0.7000	0.7700	22.5204 (74)
East	4.7600	19.6403	0.6300	0.7000	0.7700	28.5710 (76)
South	12.4000	46.7521	0.6300	0.7000	0.7700	177.1717 (78)

Solar gains	228.2632	389.0903	534.7905	669.4540	758.0738	756.7464	727.8159	660.7128	581.0853	430.5167	273.4155	195.3622 (83)
Total gains	1019.5178	1202.4553	1312.2946	1421.9072	1471.6037	1442.7091	1386.7890	1319.7627	1260.5398	1134.6391	1020.5044	969.3101 (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	23.3883	23.4314	23.4738	23.6751	23.7132	23.8919	23.8919	23.9253	23.8228	23.7132	23.6363	23.5565
alpha	2.5592	2.5621	2.5649	2.5783	2.5809	2.5928	2.5928	2.5950	2.5882	2.5809	2.5758	2.5704
util living area	0.9731	0.9582	0.9377	0.8959	0.8255	0.7082	0.5786	0.6154	0.7815	0.9094	0.9596	0.9762 (86)
MIT	18.0761	18.3972	18.8684	19.5071	20.1107	20.5994	20.8332	20.7979	20.4375	19.6516	18.7571	18.0229 (87)
Th 2	19.9299	19.9316	19.9333	19.9414	19.9429	19.9500	19.9500	19.9513	19.9473	19.9429	19.9399	19.9367 (88)
util rest of house	0.9688	0.9517	0.9274	0.8770	0.7897	0.6401	0.4728	0.5135	0.7252	0.8893	0.9522	0.9725 (89)
MIT 2	16.5003	16.9084	17.5059	18.3109	19.0502	19.6169	19.8495	19.8219	19.4460	18.5027	17.3745	16.4364 (90)
Living area fraction	16.6386	17.0390	17.6255	18.4159	19.1432	19.7031	19.9358	19.9076	19.5330	18.6035	17.4958	16.5756 (92)
MIT	16.6386	17.0390	17.6255	18.4159	19.1432	19.7031	19.9358	19.9076	19.5330	18.6035	17.4958	16.5756 (93)
Temperature adjustment												0.0000
adjusted MIT	16.6386	17.0390	17.6255	18.4159	19.1432	19.7031	19.9358	19.9076	19.5330	18.6035	17.4958	16.5756 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9484	0.9254	0.8958	0.8412	0.7564	0.6216	0.4712	0.5087	0.6983	0.8544	0.9264	0.9537	(94)	
Useful gains	966.9096	1112.8117	1175.5980	1196.1608	1113.0732	896.7317	653.5027	671.4279	880.2370	969.4920	945.3570	924.4401	(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	2738.4528	2689.1964	2460.2142	2086.3906	1629.3276	1108.7230	724.7440	761.0061	1183.8123	1751.9720	2283.0460	2727.0423	(97)	
Space heating kWh	1318.0281	1059.3305	955.7544	640.9655	384.0933	0.0000	0.0000	0.0000	0.0000	582.1651	963.1361	1341.1360	(98a)	
Space heating requirement - total per year (kWh/year)												7244.6090		
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	1318.0281	1059.3305	955.7544	640.9655	384.0933	0.0000	0.0000	0.0000	0.0000	582.1651	963.1361	1341.1360	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												7244.6090		
Space heating per m2												(98c) / (4) =	38.7682	(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)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1318.0281	1059.3305	955.7544	640.9655	384.0933	0.0000	0.0000	0.0000	0.0000	582.1651	963.1361	1341.1360 (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)

Full SAP Calculation Printout



Space heating fuel (main heating system)	1427.9828	1147.7037	1035.4869	694.4371	416.1357	0.0000	0.0000	0.0000	0.0000	630.7315	1043.4844	1453.0184	(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	259.3732	229.3185	243.7626	214.9943	208.7879	188.5746	186.5743	193.8338	195.7637	217.7333	230.7782	256.6597	(64)
Efficiency of water heater	87.1832	87.0529	86.8104	86.3538	85.4078	79.8000	79.8000	79.8000	79.8000	86.1551	86.9054	79.8000	(216)
Fuel for water heating, kWh/month	297.5036	263.4245	280.7989	248.9692	244.4599	236.3090	233.8024	242.8994	245.3179	252.7225	265.5509	294.2674	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	41.0327	32.9180	29.6390	21.7148	16.7731	13.7038	15.3010	19.8888	25.8336	33.8951	38.2845	42.1732	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-65.0251	-90.5718	-128.5657	-142.5791	-151.9436	-141.0057	-139.1085	-132.1346	-119.6677	-102.5056	-71.0358	-56.3348	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-40.1043	-83.9772	-166.2731	-248.8766	-328.3513	-329.8107	-326.0757	-276.5353	-203.1871	-119.9794	-53.4910	-31.7552	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												7848.9805	(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												3106.0256	(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)												331.1576	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3548.8949	(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												7823.2689	(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	7848.9805	0.2100	1648.2859 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3106.0256	0.2100	652.2654 (264)
Space and water heating			2300.5513 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	331.1576	0.1443	47.7963 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1340.4780	0.1349	-180.8165
PV Unit electricity exported	-2208.4169	0.1260	-278.2295
Total			-459.0460 (269)
Total CO2, kg/year			1901.2308 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.1700 (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	7848.9805	1.1300	8869.3480 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3106.0256	1.1300	3509.8090 (278)
Space and water heating			12379.1569 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	331.1576	1.5338	507.9407 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1340.4780	1.4985	-2008.7683
PV Unit electricity exported	-2208.4169	0.4625	-1021.3003
Total			-3030.0687 (283)
Total Primary energy kWh/year			9987.1297 (286)
Target Primary Energy Rate (TPER)			53.4400 (287)