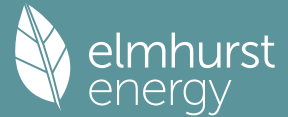


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Property Reference	OP-D320 A4WILL				Issued on Date	29/11/2024
Assessment Reference	A4WILL	Prop Type Ref	A4WILL			
Property	A4WILL					
SAP Rating	82 B	DER	3.85	TER	9.97	
Environmental	96 A	% DER < TER				61.38
CO ₂ Emissions (t/year)	0.39	DFEE	34.76	TFEE	36.06	
Compliance Check	See BREL	% DFEE < TFEE				3.61
% DPER < TPER	21.77	DPER	40.65	TPER	51.96	
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	55.3200 (1b)	x 2.3100 (2b)	= 127.7892 (1b) - (3b)
First floor	55.3200 (1c)	x 2.6100 (2c)	= 144.3852 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 272.1744 (5)

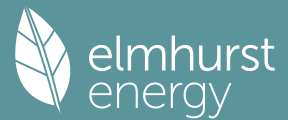
2. Ventilation rate

											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	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (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) =													72.0000 (23c)
Effective ac	0.3297	0.3259	0.3222	0.3036	0.2999	0.2813	0.2813	0.2776	0.2888	0.2999	0.3073	0.3148 (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			2.1400	1.0000	2.1400		(26)
Windows (Uw = 1.30)			17.4300	1.2357	21.5390		(27)
Ground Floor			55.3200	0.1100	6.0852		(28a)
External Wall	117.9800	19.5700	98.4100	0.1700	16.7297		(29a)
Roof - ceiling	55.3200		55.3200	0.1100	6.0852		(30)
Total net area of external elements Aum(A, m ²)			228.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5791		(33)
Party Wall			41.9200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				14.2100	0.0500		0.7105
E3 Sill				11.3800	0.0500		0.5690

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E4 Jamb	32.1000	0.0500	1.6050
E5 Ground floor (normal)	23.9800	0.1600	3.8368
E6 Intermediate floor within a dwelling	23.9800	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	12.4600	0.0600	0.7476
E12 Gable (insulation at ceiling level)	11.5200	0.0600	0.6912
E16 Corner (normal)	14.7600	0.0900	1.3284
E18 Party wall between dwellings	9.8400	0.0600	0.5904
P1 Party wall - Ground floor	8.5200	0.0800	0.6816
P2 Party wall - Intermediate floor within a dwelling	8.5200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.5200	0.1200	1.0224
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0900	-0.4428
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.3401 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	63.9192 (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	29.6089	29.2749	28.9409	27.2709	26.9368	25.2668	25.2668	24.9328	25.9348	26.9368	27.6049	28.2729 (38)
Average = Sum(39)m / 12 =	93.5281	93.1941	92.8601	91.1900	90.8560	89.1860	89.1860	88.8520	89.8540	90.8560	91.5240	92.1921 (39)
												91.1065
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8453	0.8423	0.8393	0.8242	0.8212	0.8061	0.8061	0.8031	0.8121	0.8212	0.8272	0.8333 (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	2.8186 (42)											
Hot water usage for mixer showers	98.2832	96.8062	94.6539	90.5359	87.4969	84.1079	82.1815	84.3175	86.6590	90.2978	94.5042	97.9066 (42a)
Hot water usage for baths	32.4857	32.0032	31.3238	30.0711	29.1331	28.0930	27.5312	28.2059	28.9404	30.0534	31.3319	32.3759 (42b)
Hot water usage for other uses	45.7847	44.1198	42.4549	40.7900	39.1251	37.4602	37.4602	39.1251	40.7900	42.4549	44.1198	45.7847 (42c)
Average daily hot water use (litres/day)												162.3556 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	176.5535	172.9292	168.4326	161.3970	155.7551	149.6611	147.1729	151.6484	156.3894	162.8060	169.9559	176.0671 (44)
Energy content (annual)	279.6176	246.2488	258.8746	220.9444	209.6763	184.0257	177.9929	187.7725	192.8437	220.9262	242.1333	275.6786 (45)
Distribution loss (46)m = 0.15 x (45)m	41.9426	36.9373	38.8312	33.1417	31.4514	27.6039	26.6989	28.1659	28.9266	33.1389	36.3200	41.3518 (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	377.9992	335.1096	357.2562	316.1524	308.0579	248.6577	244.7793	254.5589	257.4757	319.3078	337.3413	374.0602 (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	377.9992	335.1096	357.2562	316.1524	308.0579	248.6577	244.7793	254.5589	257.4757	319.3078	337.3413	374.0602 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 3730.7563 (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	136.8589	121.5168	129.9619	115.9344	113.6034	79.1982	77.7926	81.0443	82.1301	117.3440	122.9797	135.5492 (65)

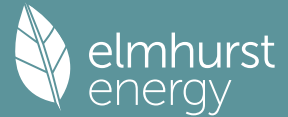
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8222	159.2317	143.8222	148.6163	143.8222	148.6163	143.8222	143.8222	148.6163	143.8222	148.6163	143.8222 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	272.4723	275.2997	268.1748	253.0065	233.8593	215.8637	203.8415	201.0141	208.1390	223.3073	242.4545	260.4501 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931 (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)	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445 (71)
Water heating gains (Table 5)	183.9502	180.8285	174.6800	161.0200	152.6928	109.9974	104.5599	108.9305	114.0696	157.7205	170.8052	182.1898 (72)
Total internal gains	665.5240	680.6392	651.9561	627.9220	595.6536	539.7566	517.5028	519.0460	536.1042	590.1292	627.1551	651.7414 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.6000	10.6334	0.6300	0.7000	0.7700	18.1983 (74)
East	3.7200	19.6403	0.6300	0.7000	0.7700	22.3286 (76)
South	8.1100	46.7521	0.6300	0.7000	0.7700	115.8760 (78)

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Solar gains	156.4030	268.2325	372.7699	473.0535	541.1542	542.5019	520.8188	469.0146	407.2407	297.9182	187.6437	133.6605 (83)
Total gains	821.9269	948.8717	1024.7261	1100.9755	1136.8078	1082.2585	1038.3215	988.0605	943.3449	888.0474	814.7989	785.4019 (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	32.8600	32.9778	33.0964	33.7025	33.8264	34.4598	34.4598	34.5894	34.2036	33.8264	33.5795	33.3362
alpha	3.1907	3.1985	3.2064	3.2468	3.2551	3.2973	3.2973	3.3060	3.2802	3.2551	3.2386	3.2224
util living area	0.9345	0.9006	0.8542	0.7654	0.6420	0.4951	0.3683	0.4003	0.5891	0.7881	0.8999	0.9414 (86)
Living	19.3642	19.6675	20.0269	20.4583	20.7604	20.9269	20.9790	20.9723	20.8658	20.4904	19.8816	19.3242
Non living	18.2923	18.6717	19.1180	19.6487	19.9993	20.1877	20.2349	20.2324	20.1252	19.6986	18.9537	18.2493
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1632	19.6675	20.0269	20.4583	20.7604	20.9269	20.9790	20.9723	20.8658	20.4904	19.8816	19.5586 (87)
Th 2	20.2142	20.2168	20.2194	20.2324	20.2350	20.2481	20.2481	20.2507	20.2428	20.2350	20.2298	20.2246 (88)
util rest of house	0.9266	0.8893	0.8377	0.7398	0.6045	0.4447	0.3086	0.3394	0.5386	0.7595	0.8867	0.9343 (89)
MIT 2	19.4480	18.6717	19.1180	19.6487	19.9993	20.1877	20.2349	20.2324	20.1252	19.6986	18.9537	18.6052 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	19.7693	19.1190	19.5263	20.0124	20.3412	20.5197	20.5692	20.5648	20.4579	20.0543	19.3705	19.0335 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.7693	19.1190	19.5263	20.0124	20.3412	20.5197	20.5692	20.5648	20.4579	20.0543	19.3705	19.0335 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9216	0.8706	0.8212	0.7319	0.6099	0.4633	0.3344	0.3653	0.5534	0.7521	0.8694	0.9211 (94)
Useful gains	757.4656	826.0892	841.5290	805.8038	693.3036	501.3836	347.2136	360.9113	522.0475	667.9032	708.3681	723.4597 (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	1446.8103	1325.1305	1209.6226	1013.3378	785.1060	527.9586	353.9940	370.0476	571.2815	858.9799	1123.0497	1367.5301 (97)
Space heating kWh	512.8724	335.3557	273.8616	149.4245	68.3010	0.0000	0.0000	0.0000	0.0000	142.1611	298.5707	479.1883 (98a)
Space heating requirement - total per year (kWh/year)	2259.7354											
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	512.8724	335.3557	273.8616	149.4245	68.3010	0.0000	0.0000	0.0000	0.0000	142.1611	298.5707	479.1883 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2259.7354											
Space heating per m2	(98c) / (4) = 20.4242 (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 %)	253.3382 (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	512.8724	335.3557	273.8616	149.4245	68.3010	0.0000	0.0000	0.0000	0.0000	142.1611	298.5707	479.1883 (98)
Space heating efficiency (main heating system 1)	253.3382	253.3382	253.3382	253.3382	253.3382	0.0000	0.0000	0.0000	0.0000	253.3382	253.3382	253.3382 (210)
Space heating fuel (main heating system)	202.4458	132.3747	108.1012	58.9822	26.9604	0.0000	0.0000	0.0000	0.0000	56.1151	117.8546	189.1497 (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	377.9992	335.1096	357.2562	316.1524	308.0579	248.6577	244.7793	254.5589	257.4757	319.3078	337.3413	374.0602 (64)
Water heating requirement	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459 (216)
Efficiency of water heater (217)m	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459 (217)
Fuel for water heating, kWh/month	140.2876	124.3699	132.5892	117.3343	114.3302	92.2848	90.8454	94.4749	95.5575	118.5054	125.1982	138.8257 (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)
(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	34.3497	31.0256	34.3497	33.2417	34.3497	33.2417	34.3497	34.3497	33.2417	34.3497	33.2417	34.3497 (231)
Lighting	29.8834	23.9736	21.5856	15.8145	12.2156	9.9802	11.1435	14.4847	18.8142	24.6852	27.8819	30.7140 (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)
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	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)
(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1	891.9837 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	269.4459											

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Water heating fuel used	1384.6032	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.2180) mechanical ventilation fans (SFP = 1.2180)	404.4403	(230a)
Total electricity for the above, kWh/year	404.4403	(231)
Electricity for lighting (calculated in Appendix L)	241.1763	(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	2922.2035	(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	891.9837	0.1558	138.9704	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1384.6032	0.1415	195.9701	(264)
Space and water heating			334.9405	(265)
Pumps, fans and electric keep-hot	404.4403	0.1387	56.1009	(267)
Energy for lighting	241.1763	0.1443	34.8092	(268)
Total CO2, kg/year			425.8506	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8500	(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	891.9837	1.5768	1406.4374	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1384.6032	1.5234	2109.2901	(278)
Space and water heating			3515.7274	(279)
Pumps, fans and electric keep-hot	404.4403	1.5128	611.8372	(281)
Energy for lighting	241.1763	1.5338	369.9243	(282)
Total Primary energy kWh/year			4497.4889	(286)
Dwelling Primary energy Rate (DPER)			40.6500	(287)

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

1. Overall dwelling characteristics

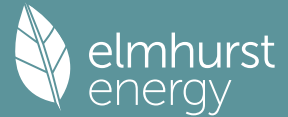
	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.3200	(1b)	x	2.3100	(2b)	= 127.7892 (1b) - (3b)
First floor	55.3200	(1c)	x	2.6100	(2c)	= 144.3852 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.6400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	272.1744 (5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1470 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3970 (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) =	0.3374 (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	0.4302	0.4218	0.4133	0.3712	0.3627	0.3205	0.3205	0.3121	0.3374	0.3627	0.3796	0.3965 (22b)
Effective ac	0.5925	0.5889	0.5854	0.5689	0.5658	0.5514	0.5514	0.5487	0.5569	0.5658	0.5720	0.5786 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1400	1.0000	2.1400			(26)
TER Opening Type (Uw = 1.20)			17.4300	1.1450	19.9580			(27)
Ground Floor			55.3200	0.1300	7.1916			(28a)
External Wall	117.9800	19.5700	98.4100	0.1800	17.7138			(29a)
Roof - ceiling	55.3200		55.3200	0.1100	6.0852			(30)
Total net area of external elements Aum(A, m2)			228.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.0886			(33)
Party Wall			41.9200	0.0000	0.0000			(32)

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

100.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.2100	0.0500	0.7105
E3 Sill	11.3800	0.0500	0.5690
E4 Jamb	32.1000	0.0500	1.6050
E5 Ground floor (normal)	23.9800	0.1600	3.8368
E6 Intermediate floor within a dwelling	23.9800	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	12.4600	0.0600	0.7476
E12 Gable (insulation at ceiling level)	11.5200	0.0600	0.6912
E16 Corner (normal)	14.7600	0.0900	1.3284
E18 Party wall between dwellings	9.8400	0.0600	0.5904
P1 Party wall - Ground floor	8.5200	0.0800	0.6816
P2 Party wall - Intermediate floor within a dwelling	8.5200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.5200	0.1200	1.0224
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0900	-0.4428

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

11.3401 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 64.4287 (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	53.2205	52.8978	52.5814	51.0955	50.8174	49.5232	49.5232	49.2836	50.0217	50.8174	51.3799	51.9679	(38)
Average = Sum(39)m / 12 =	117.6493	117.3265	117.0101	115.5242	115.2462	113.9519	113.9519	113.7123	114.4505	115.2462	115.8086	116.3966	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0634	1.0604	1.0576	1.0441	1.0416	1.0299	1.0299	1.0278	1.0344	1.0416	1.0467	1.0520	(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													2.8186 (42)
Hot water usage for mixer showers	71.4787	70.4045	68.8392	65.8443	63.6341	61.1693	59.7684	61.3218	63.0247	65.6711	68.7304	71.2048	(42a)
Hot water usage for baths	30.8614	30.4031	29.7576	28.5676	27.6765	26.6884	26.1547	26.7956	27.4934	28.5507	29.7653	30.7571	(42b)
Hot water usage for other uses	43.4954	41.9138	40.3321	38.7505	37.1688	35.5872	35.5872	37.1688	38.7505	40.3321	41.9138	43.4954	(42c)
Average daily hot water use (litres/day)													134.0556 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	145.8355	142.7213	138.9290	133.1623	128.4794	123.4449	121.5102	125.2862	129.2686	134.5539	140.4094	145.4573	(44)
Energy content (annual)	230.9678	203.2333	213.5286	182.2926	172.9580	151.7899	146.9560	155.1305	159.4011	182.5884	200.0389	227.7510	(45)
Distribution loss (46)m = 0.15 x (45)m	34.6452	30.4850	32.0293	27.3439	25.9437	22.7685	22.0434	23.2696	23.9102	27.3883	30.0058	34.1626	(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)

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 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 284.3174 251.4200 266.8782 233.9212 226.3076 203.4186 200.3057 208.4801 211.0298 235.9380 251.6676 281.1006 (62)

WWHRS -32.6771 -28.8999 -30.2623 -25.0584 -23.3535 -19.9838 -18.7316 -19.9192 -20.6760 -24.3747 -27.6135 -32.0719 (63a)

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

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

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

Output from w/h 251.6403 222.5202 236.6160 208.8629 202.9541 183.4348 181.5741 188.5610 190.3538 211.5634 224.0541 249.0287 (64)

Total per year (kWh/year) = Sum(64)m = 2551.1632 (64)

12Total per year (kWh/year) 2551 (64)

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

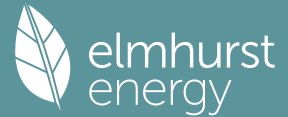
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month 119.4765 106.1245 113.6780 101.9152 100.1882 91.7731 91.5426 94.2606 94.3038 103.3903 107.8159 118.4069 (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	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8222	159.2317	143.8222	148.6163	143.8222	148.6163	143.8222	143.8222	148.6163	143.8222	148.6163	143.8222	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	272.4723	275.2997	268.1748	253.0065	233.8593	215.8637	203.8415	201.0141	208.1390	223.3073	242.4545	260.4501	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	(69)

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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)	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445 (71)
Water heating gains (Table 5)	160.5867	157.9233	152.7930	141.5489	134.6616	127.4626	123.0411	126.6943	130.9775	138.9655	149.7443	159.1491 (72)
Total internal gains	645.1604	660.7340	633.0691	611.4509	580.6223	557.2218	535.9840	536.8098	553.0120	574.3742	609.0943	631.7006 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					5.6000	10.6334	0.6300	0.7000	0.7700		18.1983 (74)	
East					3.7200	19.6403	0.6300	0.7000	0.7700		22.3286 (76)	
South					8.1100	46.7521	0.6300	0.7000	0.7700		115.8760 (78)	
Solar gains	156.4030	268.2325	372.7699	473.0535	541.1542	542.5019	520.8188	469.0146	407.2407	297.9182	187.6437	133.6605 (83)
Total gains	801.5634	928.9665	1005.8391	1084.5044	1121.7766	1099.7237	1056.8028	1005.8244	960.2527	872.2925	796.7380	765.3612 (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	26.1228	26.1947	26.2655	26.6034	26.6676	26.9704	26.9704	27.0273	26.8530	26.6676	26.5380	26.4040
alpha	2.7415	2.7463	2.7510	2.7736	2.7778	2.7980	2.7980	2.8018	2.7902	2.7778	2.7692	2.7603
util living area	0.9475	0.9222	0.8875	0.8201	0.7183	0.5735	0.4415	0.4765	0.6607	0.8389	0.9225	0.9529 (86)
MIT	18.7098	19.0364	19.4693	20.0272	20.4906	20.8105	20.9331	20.9156	20.7019	20.1061	19.3279	18.6607 (87)
Th 2	20.0309	20.0333	20.0356	20.0467	20.0488	20.0585	20.0585	20.0603	20.0547	20.0488	20.0446	20.0402 (88)
util rest of house	0.9402	0.9117	0.8720	0.7945	0.6766	0.5093	0.3578	0.3926	0.6009	0.8107	0.9103	0.9464 (89)
MIT 2	17.3559	17.7668	18.3090	19.0007	19.5496	19.9055	20.0189	20.0076	19.7973	19.1106	18.1466	17.2997 (90)
Living area fraction	17.9641	18.3371	18.8302	19.4618	19.9723	20.3120	20.4296	20.4155	20.2036	19.5578	18.6772	17.9110 (92)
MIT	17.9641	18.3371	18.8302	19.4618	19.9723	20.3120	20.4296	20.4155	20.2036	19.5578	18.6772	17.9110 (93)
Temperature adjustment												0.0000
adjusted MIT	17.9641	18.3371	18.8302	19.4618	19.9723	20.3120	20.4296	20.4155	20.2036	19.5578	18.6772	17.9110 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9197	0.8885	0.8486	0.7767	0.6730	0.5274	0.3918	0.4254	0.6110	0.7938	0.8883	0.9269 (94)
Useful gains	737.1586	825.4115	853.5766	842.2985	754.9515	579.9892	414.0469	427.9048	586.7238	692.4019	707.7228	709.4367 (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	1607.5671	1576.5315	1442.7586	1220.1424	953.3529	650.8986	436.3905	456.6075	698.5635	1032.3479	1340.7442	1595.9192 (97)
Space heating kWh	647.5839	504.7526	438.3514	272.0476	147.6106	0.0000	0.0000	0.0000	0.0000	252.9199	455.7753	659.5430 (98a)
Space heating requirement - total per year (kWh/year)												3378.5844
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	647.5839	504.7526	438.3514	272.0476	147.6106	0.0000	0.0000	0.0000	0.0000	252.9199	455.7753	659.5430 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3378.5844
Space heating per m2										(98c) / (4) =		30.5367 (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	647.5839	504.7526	438.3514	272.0476	147.6106	0.0000	0.0000	0.0000	0.0000	252.9199	455.7753	659.5430 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	701.6077	546.8609	474.9202	294.7428	159.9248	0.0000	0.0000	0.0000	0.0000	274.0194	493.7978	714.5645 (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	251.6403	222.5202	236.6160	208.8629	202.9541	183.4348	181.5741	188.5610	190.3538	211.5634	224.0541	249.0287 (64)
Efficiency of water heater (217)m	86.0831	85.8380	85.4227	84.6535	83.3573	79.8000	79.8000	79.8000	79.8000	84.4612	85.6176	79.8000 (216)
Fuel for water heating, kWh/month	292.3225	259.2328	276.9944	246.7268	243.4748	229.8682	227.5365	236.2919	238.5386	250.4858	261.6916	86.1373 (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	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	29.8834	23.9736	21.5856	15.8145	12.2156	9.9802	11.1435	14.4847	18.8142	24.6852	27.8819	30.7140 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-50.0935	-69.7805	-99.0995	-110.0086	-117.3950	-109.0762	-107.6628	-102.2013	-92.4336	-79.0662	-54.7466	-43.4028 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)

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Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-30.9059	-64.7049	-128.0660	-191.5977	-252.6596	-253.6754	-250.7493	-212.6680	-156.3174	-92.3526	-41.1980	-24.4682 (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	(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	(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	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3660.4381 (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												3052.2705 (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)												241.1763 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2734.3296 (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												4305.5553 (238)

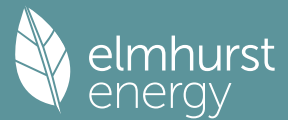
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3660.4381	0.2100	768.6920 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3052.2705	0.2100	640.9768 (264)
Space and water heating			1409.6688 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	241.1763	0.1443	34.8092 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1034.9667	0.1349	-139.5773
PV Unit electricity exported	-1699.3629	0.1260	-214.1295
Total			-353.7068 (269)
Total CO2, kg/year			1102.7005 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.9700 (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	3660.4381	1.1300	4136.2951 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3052.2705	1.1300	3449.0657 (278)
Space and water heating			7585.3608 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	241.1763	1.5338	369.9243 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1034.9667	1.4984	-1550.8368
PV Unit electricity exported	-1699.3629	0.4625	-786.0101
Total			-2336.8469 (283)
Total Primary energy kWh/year			5748.5389 (286)
Target Primary Energy Rate (TPER)			51.9600 (287)

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Property Reference	OP-D320 A4WILL				Issued on Date	29/11/2024
Assessment Reference	A4WILL	Prop Type Ref	A4WILL			
Property	A4WILL					
SAP Rating	82 B	DER	3.85	TER	9.97	
Environmental	96 A	% DER < TER				61.38
CO ₂ Emissions (t/year)	0.39	DFEE	34.76	TFEE	36.06	
Compliance Check	See BREL	% DFEE < TFEE				3.61
% DPER < TPER	21.77	DPER	40.65	TPER	51.96	
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	55.3200 (1b)	x 2.3100 (2b)	= 127.7892 (1b) - (3b)
First floor	55.3200 (1c)	x 2.6100 (2c)	= 144.3852 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 272.1744 (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) =	Air changes per hour 40.0000 / (5) = 0.1470 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.5000 (17)
Infiltration rate	0.3220 (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) = 0.2737 (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	0.3489	0.3421	0.3352	0.3010	0.2942	0.2600	0.2600	0.2531	0.2737	0.2942	0.3079	0.3216 (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	0.5609	0.5585	0.5562	0.5453	0.5433	0.5338	0.5338	0.5320	0.5374	0.5433	0.5474	0.5517 (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			2.1400	1.0000	2.1400		(26)
Windows (Uw = 1.30)			17.4300	1.2357	21.5390		(27)
Ground Floor			55.3200	0.1100	6.0852		(28a)
External Wall	117.9800	19.5700	98.4100	0.1700	16.7297		(29a)
Roof - ceiling	55.3200		55.3200	0.1100	6.0852		(30)
Total net area of external elements Aum(A, m ²)			228.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5791		(33)
Party Wall			41.9200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				14.2100	0.0500	0.7105	
E3 Sill				11.3800	0.0500	0.5690	
E4 Jamb				32.1000	0.0500	1.6050	
E5 Ground floor (normal)				23.9800	0.1600	3.8368	
E6 Intermediate floor within a dwelling				23.9800	0.0000	0.0000	

Ventilation heat loss calculated monthly (39)m = 0.33 x (25)m x (5)												
(39)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	50.3765	50.1642	49.9561	48.9786	48.7957	47.9443	47.9443	47.7866	48.2722	48.7957	49.1656	49.5524 (39)
Heat transfer coeff	114.2957	114.0833	113.8752	112.8977	112.7148	111.8635	111.8635	111.7058	112.1914	112.7148	113.0848	113.4716 (39)
Average = Sum(39)m / 12 =												112.8969
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.0330	1.0311	1.0292	1.0204	1.0188	1.0111	1.0111	1.0096	1.0140	1.0188	1.0221	1.0256 (40)
HLP (average)												1.0204
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

Assumed occupancy												2.8186 (42)
Hot water usage for mixer showers	0.0000	0.0000										0.0000 (42a)
Hot water usage for baths	30.8614	30.4031	29.7576	28.5676	27.6765	26.6884	26.1547	26.7956	27.4934	28.5507	29.7653	30.7571 (42b)
Hot water usage for other uses	43.4954	41.9138	40.3321	38.7505	37.1688	35.5872	35.5872	37.1688	38.7505	40.3321	41.9138	43.4954 (42c)
Average daily hot water use (litres/day)												68.1547 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	74.3568	72.3168	70.0897	67.3180	64.8453	62.2755	61.7418	63.9644	66.2439	68.8828	71.6790	74.2525 (44)
Energy content (annual)	117.7630	102.9782	107.7253	92.1550	87.2942	76.5750	74.6714	79.2013	81.6853	93.4733	102.1199	116.2614 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1131.9035
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss												
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 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	100.0986	87.5315	91.5665	78.3318	74.2001	65.0888	63.4707	67.3211	69.4325	79.4523	86.8019	98.8222 (61)
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 (62a)
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	100.0986	87.5315	91.5665	78.3318	74.2001	65.0888	63.4707	67.3211	69.4325	79.4523	86.8019	98.8222 (64)
12Total per year (kWh/year)									Total per year (kWh/year) = Sum(64)m =			962.1180 (64a)
Electric shower(s)	57.2425	51.0036	55.6939	53.1480	54.1453	51.6494	53.3710	54.1453	53.1480	55.6939	54.6467	57.2425 (64a)
												651.1303 (64a)
Heat gains from water heating, kWh/month	39.3353	34.6338	36.8151	32.8700	32.0864	29.1845	29.2104	30.3666	30.6451	33.7866	35.3622	39.0162 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8222	159.2317	143.8222	148.6163	143.8222	148.6163	143.8222	143.8222	148.6163	143.8222	148.6163	143.8222 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	272.4723	275.2997	268.1748	253.0065	233.8593	215.8637	203.8415	201.0141	208.1390	223.3073	242.4545	260.4501 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931 (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)	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445 (71)
Water heating gains (Table 5)	52.8700	51.5383	49.4827	45.6527	43.1268	40.5341	39.2613	40.8153	42.5627	45.4121	49.1141	52.4411 (72)
Total internal gains	534.4437	551.3490	526.7589	512.5547	486.0876	470.2933	452.2042	450.9308	464.5972	477.8208	505.4641	521.9927 (73)

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					5.6000	10.6334	0.6300	0.7000			0.7700	18.1983 (74)
East					3.7200	19.6403	0.6300	0.7000			0.7700	22.3286 (76)
South					8.1100	46.7521	0.6300	0.7000			0.7700	115.8760 (78)
Solar gains	156.4030	268.2325	372.7699	473.0535	541.1542	542.5019	520.8188	469.0146	407.2407	297.9182	187.6437	133.6605 (83)
Total gains	690.8467	819.5815	899.5288	985.6082	1027.2418	1012.7952	973.0230	919.9454	871.8379	775.7390	693.1078	655.6532 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	26.8893	26.9394	26.9886	27.2223	27.2664	27.4740	27.4740	27.5127	27.3937	27.2664	27.1772	27.0846
alpha	2.7926	2.7960	2.7992	2.8148	2.8178	2.8316	2.8316	2.8342	2.8262	2.8178	2.8118	2.8056
util living area	0.9618	0.9391	0.9077	0.8440	0.7455	0.6014	0.4667	0.5056	0.6933	0.8668	0.9415	0.9666 (86)
MIT	18.6098	18.9489	19.3943	19.9690	20.4546	20.7931	20.9262	20.9055	20.6718	20.0348	19.2270	18.5488 (87)
Th 2	20.0559	20.0575	20.0590	20.0664	20.0677	20.0741	20.0741	20.0753	20.0717	20.0677	20.0650	20.0621 (88)
util rest of house	0.9564	0.9307	0.8945	0.8208	0.7058	0.5373	0.3810	0.4200	0.6353	0.8421	0.9319	0.9618 (89)
MIT 2	17.8658	18.1997	18.6366	19.1947	19.6465	19.9421	20.0395	20.0284	19.8472	19.2685	18.4831	17.8098 (90)
Living area fraction	fLA = Living area / (4) =											0.4492 (91)
MIT	18.2000	18.5362	18.9770	19.5426	20.0095	20.3244	20.4378	20.4224	20.2176	19.6128	18.8173	18.1418 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2000	18.5362	18.9770	19.5426	20.0095	20.3244	20.4378	20.4224	20.2176	19.6128	18.8173	18.1418 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9423	0.9136	0.8761	0.8060	0.7031	0.5555	0.4158	0.4534	0.6452	0.8280	0.9158	0.9487 (94)
Useful gains	650.9977	748.7332	788.1083	794.3672	722.2498	562.6400	404.5866	417.0999	562.4832	642.3273	634.7243	622.0429 (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	1588.7125	1555.6672	1420.8211	1201.5207	936.6058	640.3494	429.3106	449.3288	686.3434	1015.8709	1325.0483	1581.9980 (97)
Space heating kWh	697.6598	542.2597	470.7383	293.1505	159.4809	0.0000	0.0000	0.0000	0.0000	277.9164	497.0332	714.2066 (98a)
Space heating requirement - total per year (kWh/year)												3652.4454
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	697.6598	542.2597	470.7383	293.1505	159.4809	0.0000	0.0000	0.0000	0.0000	277.9164	497.0332	714.2066 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3652.4454
Space heating per m2												(98c) / (4) = 33.0120 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1051.5166	827.7896	848.9641	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7620	0.8271	0.8020	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	801.2700	684.6501	680.9067	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1120.4982	1076.9514	1017.8121	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	229.8443	291.8722	250.6576	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	57.4611	72.9680	62.6644	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												193.0935 (107)
Energy for space heating												33.0120 (99)
Energy for space cooling												1.7452 (108)
Total												34.7572 (109)
Fabric Energy Efficiency (DFEE)												34.8 (109)

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

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

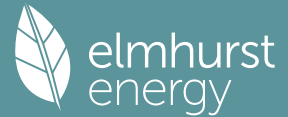
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	55.3200 (1b)	x 2.3100 (2b)	= 127.7892 (1b) - (3b)
First floor	55.3200 (1c)	x 2.6100 (2c)	= 144.3852 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	272.1744 (5)

2. Ventilation rate

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

Full SAP Calculation Printout



Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1470 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 5.0000 (17)
 Infiltration rate 0.3970 (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) = 0.3374 (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	0.4302	0.4218	0.4133	0.3712	0.3627	0.3205	0.3205	0.3121	0.3374	0.3627	0.3796	0.3965	(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	0.5925	0.5889	0.5854	0.5689	0.5658	0.5514	0.5514	0.5487	0.5569	0.5658	0.5720	0.5786	(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			2.1400	1.0000	2.1400			(26)
TER Opening Type (Uw = 1.20)			17.4300	1.1450	19.9580			(27)
Ground Floor			55.3200	0.1300	7.1916			(28a)
External Wall	117.9800	19.5700	98.4100	0.1800	17.7138			(29a)
Roof - ceiling	55.3200		55.3200	0.1100	6.0852			(30)
Total net area of external elements Aum (A, m2)			228.6200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	53.0886		(33)
Party Wall			41.9200	0.0000	0.0000			(32)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	14.2100	0.0500	0.7105	
E3 Sill	11.3800	0.0500	0.5690	
E4 Jamb	32.1000	0.0500	1.6050	
E5 Ground floor (normal)	23.9800	0.1600	3.8368	
E6 Intermediate floor within a dwelling	23.9800	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	12.4600	0.0600	0.7476	
E12 Gable (insulation at ceiling level)	11.5200	0.0600	0.6912	
E16 Corner (normal)	14.7600	0.0900	1.3284	
E18 Party wall between dwellings	9.8400	0.0600	0.5904	
P1 Party wall - Ground floor	8.5200	0.0800	0.6816	
P2 Party wall - Intermediate floor within a dwelling	8.5200	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	8.5200	0.1200	1.0224	
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0900	-0.4428	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.3401 (36)

Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 64.4287 (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	53.2205	52.8978	52.5814	51.0955	50.8174	49.5232	49.5232	49.2836	50.0217	50.8174	51.3799	51.9679	(38)
Heat transfer coeff	117.6493	117.3265	117.0101	115.5242	115.2462	113.9519	113.9519	113.7123	114.4505	115.2462	115.8086	116.3966	(39)
Average = Sum(39)m / 12 =												115.5228	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0634	1.0604	1.0576	1.0441	1.0416	1.0299	1.0299	1.0278	1.0344	1.0416	1.0467	1.0520	(40)
HLP (average)												1.0441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8186 (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	30.8614	30.4031	29.7576	28.5676	27.6765	26.6884	26.1547	26.7956	27.4934	28.5507	29.7653	30.7571	(42b)
Hot water usage for other uses	43.4954	41.9138	40.3321	38.7505	37.1688	35.5872	35.5872	37.1688	38.7505	40.3321	41.9138	43.4954	(42c)
Average daily hot water use (litres/day)												68.1547	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.3568	72.3168	70.0897	67.3180	64.8453	62.2755	61.7418	63.9644	66.2439	68.8828	71.6790	74.2525	(44)
Energy conte	117.7630	102.9782	107.7253	92.1550	87.2942	76.5750	74.6714	79.2013	81.6853	93.4733	102.1199	116.2614	(45)
Energy content (annual)										Total = Sum(45)m =		1131.9035	

Distribution loss (46)m = 0.15 x (45)m 0.0000 (46)

Water storage loss: 0.0000 (56)

Total storage loss 0.0000 (56)

If cylinder contains dedicated solar storage 0.0000 (57)

Primary loss 0.0000 (59)

Combi loss 0.0000 (61)

Total heat required for water heating calculated for each month

WWHRS	100.0986	87.5315	91.5665	78.3318	74.2001	65.0888	63.4707	67.3211	69.4325	79.4523	86.8019	98.8222	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)

Output from w/h 100.0986 (64)

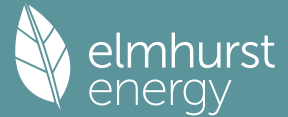
Total per year (kWh/year) = Sum(64)m = 962.1180 (64)

Electric shower(s) 57.2425 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 651.1303 (64a)

Heat gains from water heating, kWh/month

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39.3353 34.6338 36.8151 32.8700 32.0864 29.1845 29.2104 30.3666 30.6451 33.7866 35.3622 39.0162 (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	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8222	159.2317	143.8222	148.6163	143.8222	148.6163	143.8222	143.8222	148.6163	143.8222	148.6163	143.8222	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	272.4723	275.2997	268.1748	253.0065	233.8593	215.8637	203.8415	201.0141	208.1390	223.3073	242.4545	260.4501	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	(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)	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	(71)
Water heating gains (Table 5)	52.8700	51.5383	49.4827	45.6527	43.1268	40.5341	39.2613	40.8153	42.5627	45.4121	49.1141	52.4411	(72)
Total internal gains	534.4437	551.3490	526.7589	512.5547	486.0876	470.2933	452.2042	450.9308	464.5972	477.8208	505.4641	521.9927	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				5.6000	10.6334		0.6300	0.7000	0.7700		18.1983 (74)	
East				3.7200	19.6403		0.6300	0.7000	0.7700		22.3286 (76)	
South				8.1100	46.7521		0.6300	0.7000	0.7700		115.8760 (78)	
Solar gains	156.4030	268.2325	372.7699	473.0535	541.1542	542.5019	520.8188	469.0146	407.2407	297.9182	187.6437	133.6605 (83)
Total gains	690.8467	819.5815	899.5288	985.6082	1027.2418	1012.7952	973.0230	919.9454	871.8379	775.7390	693.1078	655.6532 (84)

7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9623	0.9402	0.9096	0.8472	0.7507	0.6072	0.4728	0.5115	0.6988	0.8694	0.9424	0.9669	(85)
tau	26.1228	26.1947	26.2655	26.6034	26.6676	26.9704	26.9704	27.0273	26.8530	26.6676	26.5380	26.4040	
alpha	2.7415	2.7463	2.7510	2.7736	2.7778	2.7980	2.7980	2.8018	2.7902	2.7778	2.7692	2.7603	
util living area	0.9623	0.9402	0.9096	0.8472	0.7507	0.6072	0.4728	0.5115	0.6988	0.8694	0.9424	0.9669	(86)
MIT	18.5299	18.8727	19.3274	19.9232	20.4243	20.7802	20.9205	20.8989	20.6534	19.9963	19.1715	18.4787	(87)
Th 2	20.0309	20.0333	20.0356	20.0467	20.0488	20.0585	20.0585	20.0603	20.0547	20.0488	20.0446	20.0402	(88)
util rest of house	0.9569	0.9318	0.8965	0.8241	0.7108	0.5423	0.3852	0.4242	0.6403	0.8448	0.9328	0.9621	(89)
MIT 2	17.7703	18.1086	18.5554	19.1370	19.6045	19.9185	20.0213	20.0103	19.8180	19.2184	18.4149	17.7261	(90)
Living area fraction	18.1115	18.4518	18.9022	19.4902	19.9727	20.3056	20.4252	20.4094	20.1933	19.5678	18.7548	18.0642	(91)
MIT	18.1115	18.4518	18.9022	19.4902	19.9727	20.3056	20.4252	20.4094	20.1933	19.5678	18.7548	18.0642	(92)
Temperature adjustment	18.1115	18.4518	18.9022	19.4902	19.9727	20.3056	20.4252	20.4094	20.1933	19.5678	18.7548	18.0642	(93)
adjusted MIT	18.1115	18.4518	18.9022	19.4902	19.9727	20.3056	20.4252	20.4094	20.1933	19.5678	18.7548	18.0642	(93)

8. Space heating requirement

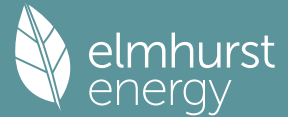
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9426	0.9143	0.8777	0.8086	0.7073	0.5603	0.4205	0.4580	0.6495	0.8301	0.9164	0.9489	(94)
Useful gains	651.1581	749.3712	789.4918	796.9627	726.5715	567.4497	409.1848	421.3542	566.2938	643.9588	635.1557	622.1194	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1624.9154	1589.9910	1451.1831	1223.4214	953.4015	650.1642	435.8909	455.9228	697.3754	1033.5088	1349.7252	1613.7397	(97)
Space heating kWh	724.4754	564.8965	492.2983	307.0502	168.7616	0.0000	0.0000	0.0000	0.0000	289.8252	514.4900	737.7655	(98a)
Space heating requirement - total per year (kWh/year)												3799.5627	
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	724.4754	564.8965	492.2983	307.0502	168.7616	0.0000	0.0000	0.0000	0.0000	289.8252	514.4900	737.7655	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3799.5627	
Space heating per m ²												34.3417	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1071.1482	843.2444	864.2133	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7531	0.8191	0.7939	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	806.6446	690.7225	686.1368	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1120.4982	1076.9514	1017.8121	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	225.9746	287.3543	246.7664	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	56.4937	71.8386	61.6916	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												190.0238	(107)
Energy for space heating												34.3417	(99)
Energy for space cooling												1.7175	(108)
Total												36.0592	(109)

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Property Reference	OP-D320 A4WILL				Issued on Date	29/11/2024
Assessment Reference	A4WILL	Prop Type Ref	A4WILL			
Property	A4WILL					
SAP Rating	82 B	DER	3.85	TER	9.97	
Environmental	96 A	% DER < TER				61.38
CO ₂ Emissions (t/year)	0.39	DFEE	34.76	TFEE	36.06	
Compliance Check	See BREL	% DFEE < TFEE				3.61
% DPER < TPER	21.77	DPER	40.65	TPER	51.96	
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	55.3200 (1b)	x 2.3100 (2b)	= 127.7892 (1b) - (3b)
First floor	55.3200 (1c)	x 2.6100 (2c)	= 144.3852 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 272.1744 (5)

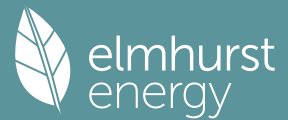
2. Ventilation rate

	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)											
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1897	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) =												72.0000 (23c)
Effective ac	0.3297	0.3259	0.3222	0.3036	0.2999	0.2813	0.2813	0.2776	0.2888	0.2999	0.3073	0.3148 (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			2.1400	1.0000	2.1400		(26)
Windows (Uw = 1.30)			17.4300	1.2357	21.5390		(27)
Ground Floor			55.3200	0.1100	6.0852		(28a)
External Wall	117.9800	19.5700	98.4100	0.1700	16.7297		(29a)
Roof - ceiling	55.3200		55.3200	0.1100	6.0852		(30)
Total net area of external elements Aum(A, m ²)			228.6200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5791		(33)
Party Wall			41.9200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				14.2100	0.0500		0.7105
E3 Sill				11.3800	0.0500		0.5690

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E4 Jamb	32.1000	0.0500	1.6050
E5 Ground floor (normal)	23.9800	0.1600	3.8368
E6 Intermediate floor within a dwelling	23.9800	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	12.4600	0.0600	0.7476
E12 Gable (insulation at ceiling level)	11.5200	0.0600	0.6912
E16 Corner (normal)	14.7600	0.0900	1.3284
E18 Party wall between dwellings	9.8400	0.0600	0.5904
P1 Party wall - Ground floor	8.5200	0.0800	0.6816
P2 Party wall - Intermediate floor within a dwelling	8.5200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.5200	0.1200	1.0224
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0900	-0.4428
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.3401 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	63.9192 (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	29.6089	29.2749	28.9409	27.2709	26.9368	25.2668	25.2668	24.9328	25.9348	26.9368	27.6049	28.2729 (38)
Average = Sum(39)m / 12 =	93.5281	93.1941	92.8601	91.1900	90.8560	89.1860	89.1860	88.8520	89.8540	90.8560	91.5240	92.1921 (39)
												91.1065
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8453	0.8423	0.8393	0.8242	0.8212	0.8061	0.8061	0.8031	0.8121	0.8212	0.8272	0.8333 (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	2.8186 (42)											
Hot water usage for mixer showers	98.2832	96.8062	94.6539	90.5359	87.4969	84.1079	82.1815	84.3175	86.6590	90.2978	94.5042	97.9066 (42a)
Hot water usage for baths	32.4857	32.0032	31.3238	30.0711	29.1331	28.0930	27.5312	28.2059	28.9404	30.0534	31.3319	32.3759 (42b)
Hot water usage for other uses	45.7847	44.1198	42.4549	40.7900	39.1251	37.4602	37.4602	39.1251	40.7900	42.4549	44.1198	45.7847 (42c)
Average daily hot water use (litres/day)												162.3556 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	176.5535	172.9292	168.4326	161.3970	155.7551	149.6611	147.1729	151.6484	156.3894	162.8060	169.9559	176.0671 (44)
Energy content (annual)	279.6176	246.2488	258.8746	220.9444	209.6763	184.0257	177.9929	187.7725	192.8437	220.9262	242.1333	275.6786 (45)
Distribution loss (46)m = 0.15 x (45)m	41.9426	36.9373	38.8312	33.1417	31.4514	27.6039	26.6989	28.1659	28.9266	33.1389	36.3200	41.3518 (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	377.9992	335.1096	357.2562	316.1524	308.0579	248.6577	244.7793	254.5589	257.4757	319.3078	337.3413	374.0602 (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	377.9992	335.1096	357.2562	316.1524	308.0579	248.6577	244.7793	254.5589	257.4757	319.3078	337.3413	374.0602 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 3730.7563 (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	136.8589	121.5168	129.9619	115.9344	113.6034	79.1982	77.7926	81.0443	82.1301	117.3440	122.9797	135.5492 (65)

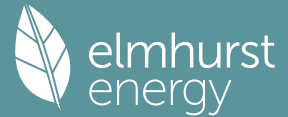
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8222	159.2317	143.8222	148.6163	143.8222	148.6163	143.8222	143.8222	148.6163	143.8222	148.6163	143.8222 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	272.4723	275.2997	268.1748	253.0065	233.8593	215.8637	203.8415	201.0141	208.1390	223.3073	242.4545	260.4501 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931 (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)	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445 (71)
Water heating gains (Table 5)	183.9502	180.8285	174.6800	161.0200	152.6928	109.9974	104.5599	108.9305	114.0696	157.7205	170.8052	182.1898 (72)
Total internal gains	665.5240	680.6392	651.9561	627.9220	595.6536	539.7566	517.5028	519.0460	536.1042	590.1292	627.1551	651.7414 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.6000	10.6334	0.6300	0.7000	0.7700	18.1983 (74)
East	3.7200	19.6403	0.6300	0.7000	0.7700	22.3286 (76)
South	8.1100	46.7521	0.6300	0.7000	0.7700	115.8760 (78)

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Solar gains	156.4030	268.2325	372.7699	473.0535	541.1542	542.5019	520.8188	469.0146	407.2407	297.9182	187.6437	133.6605 (83)
Total gains	821.9269	948.8717	1024.7261	1100.9755	1136.8078	1082.2585	1038.3215	988.0605	943.3449	888.0474	814.7989	785.4019 (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	32.8600	32.9778	33.0964	33.7025	33.8264	34.4598	34.4598	34.5894	34.2036	33.8264	33.5795	33.3362
alpha	3.1907	3.1985	3.2064	3.2468	3.2551	3.2973	3.2973	3.3060	3.2802	3.2551	3.2386	3.2224
util living area	0.9345	0.9006	0.8542	0.7654	0.6420	0.4951	0.3683	0.4003	0.5891	0.7881	0.8999	0.9414 (86)
Living	19.3642	19.6675	20.0269	20.4583	20.7604	20.9269	20.9790	20.9723	20.8658	20.4904	19.8816	19.3242
Non living	18.2923	18.6717	19.1180	19.6487	19.9993	20.1877	20.2349	20.2324	20.1252	19.6986	18.9537	18.2493
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1632	19.6675	20.0269	20.4583	20.7604	20.9269	20.9790	20.9723	20.8658	20.4904	19.8816	19.5586 (87)
Th 2	20.2142	20.2168	20.2194	20.2324	20.2350	20.2481	20.2481	20.2507	20.2428	20.2350	20.2298	20.2246 (88)
util rest of house	0.9266	0.8893	0.8377	0.7398	0.6045	0.4447	0.3086	0.3394	0.5386	0.7595	0.8867	0.9343 (89)
MIT 2	19.4480	18.6717	19.1180	19.6487	19.9993	20.1877	20.2349	20.2324	20.1252	19.6986	18.9537	18.6052 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	19.7693	19.1190	19.5263	20.0124	20.3412	20.5197	20.5692	20.5648	20.4579	20.0543	19.3705	19.0335 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.7693	19.1190	19.5263	20.0124	20.3412	20.5197	20.5692	20.5648	20.4579	20.0543	19.3705	19.0335 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9216	0.8706	0.8212	0.7319	0.6099	0.4633	0.3344	0.3653	0.5534	0.7521	0.8694	0.9211 (94)
Useful gains	757.4656	826.0892	841.5290	805.8038	693.3036	501.3836	347.2136	360.9113	522.0475	667.9032	708.3681	723.4597 (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	1446.8103	1325.1305	1209.6226	1013.3378	785.1060	527.9586	353.9940	370.0476	571.2815	858.9799	1123.0497	1367.5301 (97)
Space heating kWh	512.8724	335.3557	273.8616	149.4245	68.3010	0.0000	0.0000	0.0000	0.0000	142.1611	298.5707	479.1883 (98a)
Space heating requirement - total per year (kWh/year)	2259.7354											
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	512.8724	335.3557	273.8616	149.4245	68.3010	0.0000	0.0000	0.0000	0.0000	142.1611	298.5707	479.1883 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2259.7354											
Space heating per m2	(98c) / (4) = 20.4242 (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 %)	253.3382 (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	512.8724	335.3557	273.8616	149.4245	68.3010	0.0000	0.0000	0.0000	0.0000	142.1611	298.5707	479.1883 (98)
Space heating efficiency (main heating system 1)	253.3382	253.3382	253.3382	253.3382	253.3382	0.0000	0.0000	0.0000	0.0000	253.3382	253.3382	253.3382 (210)
Space heating fuel (main heating system)	202.4458	132.3747	108.1012	58.9822	26.9604	0.0000	0.0000	0.0000	0.0000	56.1151	117.8546	189.1497 (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	377.9992	335.1096	357.2562	316.1524	308.0579	248.6577	244.7793	254.5589	257.4757	319.3078	337.3413	374.0602 (64)
Water heating requirement	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459 (216)
Efficiency of water heater (217)m	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459	269.4459 (217)
Fuel for water heating, kWh/month	140.2876	124.3699	132.5892	117.3343	114.3302	92.2848	90.8454	94.4749	95.5575	118.5054	125.1982	138.8257 (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	34.3497	31.0256	34.3497	33.2417	34.3497	33.2417	34.3497	34.3497	33.2417	34.3497	33.2417	34.3497 (231)
Lighting	29.8834	23.9736	21.5856	15.8145	12.2156	9.9802	11.1435	14.4847	18.8142	24.6852	27.8819	30.7140 (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)	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)	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	891.9837 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	269.4459											

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Water heating fuel used	1384.6032	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.2180) mechanical ventilation fans (SFP = 1.2180)	404.4403	(230a)
Total electricity for the above, kWh/year	404.4403	(231)
Electricity for lighting (calculated in Appendix L)	241.1763	(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	2922.2035	(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	891.9837	0.1558	138.9704	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1384.6032	0.1415	195.9701	(264)
Space and water heating			334.9405	(265)
Pumps, fans and electric keep-hot	404.4403	0.1387	56.1009	(267)
Energy for lighting	241.1763	0.1443	34.8092	(268)
Total CO2, kg/year			425.8506	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8500	(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	891.9837	1.5768	1406.4374	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1384.6032	1.5234	2109.2901	(278)
Space and water heating			3515.7274	(279)
Pumps, fans and electric keep-hot	404.4403	1.5128	611.8372	(281)
Energy for lighting	241.1763	1.5338	369.9243	(282)
Total Primary energy kWh/year			4497.4889	(286)
Dwelling Primary energy Rate (DPER)			40.6500	(287)

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

1. Overall dwelling characteristics

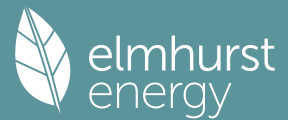
	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	55.3200 (1b)	x 2.3100 (2b)	= 127.7892 (1b) - (3b)	
First floor	55.3200 (1c)	x 2.6100 (2c)	= 144.3852 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	110.6400			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e) ... (3n) =	272.1744	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1470 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3970	(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) =	0.3374 (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	0.4302	0.4218	0.4133	0.3712	0.3627	0.3205	0.3205	0.3121	0.3374	0.3627	0.3796	0.3965 (22b)
Effective ac	0.5925	0.5889	0.5854	0.5689	0.5658	0.5514	0.5514	0.5487	0.5569	0.5658	0.5720	0.5786 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1400	1.0000	2.1400			(26)
TER Opening Type (Uw = 1.20)			17.4300	1.1450	19.9580			(27)
Ground Floor			55.3200	0.1300	7.1916			(28a)
External Wall	117.9800	19.5700	98.4100	0.1800	17.7138			(29a)
Roof - ceiling	55.3200		55.3200	0.1100	6.0852			(30)
Total net area of external elements Aum(A, m2)			228.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.0886			(33)
Party Wall			41.9200	0.0000	0.0000			(32)

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

100.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.2100	0.0500	0.7105
E3 Sill	11.3800	0.0500	0.5690
E4 Jamb	32.1000	0.0500	1.6050
E5 Ground floor (normal)	23.9800	0.1600	3.8368
E6 Intermediate floor within a dwelling	23.9800	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	12.4600	0.0600	0.7476
E12 Gable (insulation at ceiling level)	11.5200	0.0600	0.6912
E16 Corner (normal)	14.7600	0.0900	1.3284
E18 Party wall between dwellings	9.8400	0.0600	0.5904
P1 Party wall - Ground floor	8.5200	0.0800	0.6816
P2 Party wall - Intermediate floor within a dwelling	8.5200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.5200	0.1200	1.0224
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0900	-0.4428

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

11.3401 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 64.4287 (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	53.2205	52.8978	52.5814	51.0955	50.8174	49.5232	49.5232	49.2836	50.0217	50.8174	51.3799	51.9679	(38)
Heat transfer coeff	117.6493	117.3265	117.0101	115.5242	115.2462	113.9519	113.9519	113.7123	114.4505	115.2462	115.8086	116.3966	(39)
Average = Sum(39)m / 12 =												115.5228	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0634	1.0604	1.0576	1.0441	1.0416	1.0299	1.0299	1.0278	1.0344	1.0416	1.0467	1.0520	(40)
HLP (average)												1.0441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8186 (42)
Hot water usage for mixer showers	71.4787	70.4045	68.8392	65.8443	63.6341	61.1693	59.7684	61.3218	63.0247	65.6711	68.7304	71.2048	(42a)
Hot water usage for baths	30.8614	30.4031	29.7576	28.5676	27.6765	26.6884	26.1547	26.7956	27.4934	28.5507	29.7653	30.7571	(42b)
Hot water usage for other uses	43.4954	41.9138	40.3321	38.7505	37.1688	35.5872	35.5872	37.1688	38.7505	40.3321	41.9138	43.4954	(42c)
Average daily hot water use (litres/day)												134.0556	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.8355	142.7213	138.9290	133.1623	128.4794	123.4449	121.5102	125.2862	129.2686	134.5539	140.4094	145.4573	(44)
Energy conte	230.9678	203.2333	213.5286	182.2926	172.9580	151.7899	146.9560	155.1305	159.4011	182.5884	200.0389	227.7510	(45)
Energy content (annual)										Total =	Sum(45)m =	2226.6361	
Distribution loss (46)m = 0.15 x (45)m	34.6452	30.4850	32.0293	27.3439	25.9437	22.7685	22.0434	23.2696	23.9102	27.3883	30.0058	34.1626	(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)

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 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 284.3174 251.4200 266.8782 233.9212 226.3076 203.4186 200.3057 208.4801 211.0298 235.9380 251.6676 281.1006 (62)

WWHRS -32.6771 -28.8999 -30.2623 -25.0584 -23.3535 -19.9838 -18.7316 -19.9192 -20.6760 -24.3747 -27.6135 -32.0719 (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 251.6403 222.5202 236.6160 208.8629 202.9541 183.4348 181.5741 188.5610 190.3538 211.5634 224.0541 249.0287 (64)

Total per year (kWh/year) = Sum(64)m = 2551.1632 (64)

12Total per year (kWh/year) 2551 (64)

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

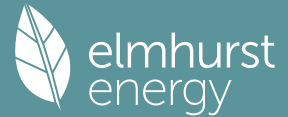
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month 119.4765 106.1245 113.6780 101.9152 100.1882 91.7731 91.5426 94.2606 94.3038 103.3903 107.8159 118.4069 (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	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	140.9307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8222	159.2317	143.8222	148.6163	143.8222	148.6163	143.8222	143.8222	148.6163	143.8222	148.6163	143.8222	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	272.4723	275.2997	268.1748	253.0065	233.8593	215.8637	203.8415	201.0141	208.1390	223.3073	242.4545	260.4501	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	37.0931	(69)

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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)	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445	-112.7445 (71)
Water heating gains (Table 5)	160.5867	157.9233	152.7930	141.5489	134.6616	127.4626	123.0411	126.6943	130.9775	138.9655	149.7443	159.1491 (72)
Total internal gains	645.1604	660.7340	633.0691	611.4509	580.6223	557.2218	535.9840	536.8098	553.0120	574.3742	609.0943	631.7006 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.6000	10.6334	0.6300	0.7000	0.7700	18.1983 (74)
East	3.7200	19.6403	0.6300	0.7000	0.7700	22.3286 (76)
South	8.1100	46.7521	0.6300	0.7000	0.7700	115.8760 (78)

Solar gains	156.4030	268.2325	372.7699	473.0535	541.1542	542.5019	520.8188	469.0146	407.2407	297.9182	187.6437	133.6605 (83)
Total gains	801.5634	928.9665	1005.8391	1084.5044	1121.7766	1099.7237	1056.8028	1005.8244	960.2527	872.2925	796.7380	765.3612 (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	26.1228	26.1947	26.2655	26.6034	26.6676	26.9704	26.9704	27.0273	26.8530	26.6676	26.5380	26.4040	
alpha	2.7415	2.7463	2.7510	2.7736	2.7778	2.7980	2.7980	2.8018	2.7902	2.7778	2.7692	2.7603	
util living area	0.9475	0.9222	0.8875	0.8201	0.7183	0.5735	0.4415	0.4765	0.6607	0.8389	0.9225	0.9529 (86)	
MIT	18.7098	19.0364	19.4693	20.0272	20.4906	20.8105	20.9331	20.9156	20.7019	20.1061	19.3279	18.6607 (87)	
Th 2	20.0309	20.0333	20.0356	20.0467	20.0488	20.0585	20.0585	20.0603	20.0547	20.0488	20.0446	20.0402 (88)	
util rest of house	0.9402	0.9117	0.8720	0.7945	0.6766	0.5093	0.3578	0.3926	0.6009	0.8107	0.9103	0.9464 (89)	
MIT 2	17.3559	17.7668	18.3090	19.0007	19.5496	19.9055	20.0189	20.0076	19.7973	19.1106	18.1466	17.2997 (90)	
Living area fraction	fLA = Living area / (4) =												0.4492 (91)
MIT	17.9641	18.3371	18.8302	19.4618	19.9723	20.3120	20.4296	20.4155	20.2036	19.5578	18.6772	17.9110 (92)	
Temperature adjustment													0.0000
adjusted MIT	17.9641	18.3371	18.8302	19.4618	19.9723	20.3120	20.4296	20.4155	20.2036	19.5578	18.6772	17.9110 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9197	0.8885	0.8486	0.7767	0.6730	0.5274	0.3918	0.4254	0.6110	0.7938	0.8883	0.9269 (94)
Useful gains	737.1586	825.4115	853.5766	842.2985	754.9515	579.9892	414.0469	427.9048	586.7238	692.4019	707.7228	709.4367 (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	1607.5671	1576.5315	1442.7586	1220.1424	953.3529	650.8986	436.3905	456.6075	698.5635	1032.3479	1340.7442	1595.9192 (97)
Space heating kWh	647.5839	504.7526	438.3514	272.0476	147.6106	0.0000	0.0000	0.0000	0.0000	252.9199	455.7753	659.5430 (98a)
Space heating requirement - total per year (kWh/year)												3378.5844
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	647.5839	504.7526	438.3514	272.0476	147.6106	0.0000	0.0000	0.0000	0.0000	252.9199	455.7753	659.5430 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3378.5844
Space heating per m2										(98c) / (4) =		30.5367 (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	647.5839	504.7526	438.3514	272.0476	147.6106	0.0000	0.0000	0.0000	0.0000	252.9199	455.7753	659.5430 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	701.6077	546.8609	474.9202	294.7428	159.9248	0.0000	0.0000	0.0000	0.0000	274.0194	493.7978	714.5645 (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	251.6403	222.5202	236.6160	208.8629	202.9541	183.4348	181.5741	188.5610	190.3538	211.5634	224.0541	249.0287 (64)
Efficiency of water heater (217)m	86.0831	85.8380	85.4227	84.6535	83.3573	79.8000	79.8000	79.8000	79.8000	84.4612	85.6176	79.8000 (216)
Fuel for water heating, kWh/month	292.3225	259.2328	276.9944	246.7268	243.4748	229.8682	227.5365	236.2919	238.5386	250.4858	261.6916	289.1066 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	29.8834	23.9736	21.5856	15.8145	12.2156	9.9802	11.1435	14.4847	18.8142	24.6852	27.8819	30.7140 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-50.0935	-69.7805	-99.0995	-110.0086	-117.3950	-109.0762	-107.6628	-102.2013	-92.4336	-79.0662	-54.7466	-43.4028 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)

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Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-30.9059	-64.7049	-128.0660	-191.5977	-252.6596	-253.6754	-250.7493	-212.6680	-156.3174	-92.3526	-41.1980	-24.4682 (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	(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	(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	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3660.4381 (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												3052.2705 (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)												241.1763 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2734.3296 (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												4305.5553 (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	3660.4381	0.2100	768.6920 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3052.2705	0.2100	640.9768 (264)
Space and water heating			1409.6688 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	241.1763	0.1443	34.8092 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1034.9667	0.1349	-139.5773
PV Unit electricity exported	-1699.3629	0.1260	-214.1295
Total			-353.7068 (269)
Total CO2, kg/year			1102.7005 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.9700 (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	3660.4381	1.1300	4136.2951 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3052.2705	1.1300	3449.0657 (278)
Space and water heating			7585.3608 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	241.1763	1.5338	369.9243 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1034.9667	1.4984	-1550.8368
PV Unit electricity exported	-1699.3629	0.4625	-786.0101
Total			-2336.8469 (283)
Total Primary energy kWh/year			5748.5389 (286)
Target Primary Energy Rate (TPER)			51.9600 (287)