

Full SAP Calculation Printout



Property Reference	UNIT 35				Issued on Date	28/06/2023	
Assessment Reference	UNIT 35			Prop Type Ref			
Property	Alexander House, UNIT 35, 205-207 King's Road, RG1 4LS						
SAP Rating	80 C	DER	5.06	TER	13.87		
Environmental	96 A	% DER < TER				63.52	
CO ₂ Emissions (t/year)	0.34	DFEE	42.38	TFEE	45.38		
Compliance Check	See BREL	% DFEE < TFEE				6.61	
% DPER < TPER	26.93	DPER	53.15	TPER	72.74		
Assessor Details	Mr. Ondrej Gajdos				Assessor ID	W452-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	71.2000 (1b)	x 2.5000 (2b)	= 178.0000 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.2000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.0000 (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)

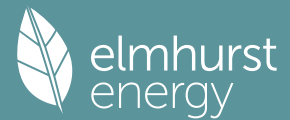
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	4.0000 (17)
Number of sides sheltered	0.2000 (18)
	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - centralised												
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
1 (Uw = 1.30)			6.5000	1.2357	8.0323		(27)
2 (Uw = 1.30)			6.5000	1.2357	8.0323		(27)
3 (Uw = 1.30)			6.5000	1.2357	8.0323		(27)
1			2.1000	1.0000	2.1000		(26)

Full SAP Calculation Printout



top floor exposed new	58.7500	19.5000	39.2500	0.1800	7.0650	18.0000	706.5000 (29a)
corridor new	9.7500	2.1000	7.6500	0.2400	1.8360	60.0000	459.0000 (29a)
stair new	14.2500		14.2500	0.2400	3.4200	9.0000	128.2500 (29a)
flat roof new	39.1000		39.1000	0.1300	5.0830	9.0000	351.9000 (30)
roof terrace new	32.1000		32.1000	0.1300	4.1730	9.0000	288.9000 (30)
Total net area of external elements Aum(A, m2)			153.9500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	47.7740			(33)
pw			16.0000	0.0000	0.0000	20.0000	320.0000 (32)
pf			71.2000			30.0000	2136.0000 (32d)
iw			105.5000			9.0000	949.5000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 5340.0500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 75.0007 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.8000	0.0500	0.4400
E3 Sill	7.8000	0.0500	0.3900
E4 Jamb	19.2000	0.0500	0.9600
E7 Party floor between dwellings (in blocks of flats)	6.6000	0.0700	0.4620
E14 Flat roof	15.8000	0.0800	1.2640
E15 Flat roof with parapet	23.5000	0.1500	3.5250
E16 Corner (normal)	10.0000	0.0900	0.9000
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	5.0000	0.0600	0.3000
E24 Eaves (insulation at ceiling level - inverted)	7.8000	0.2400	1.8720
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.8880 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 57.6620 (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	29.3700	29.3700	29.3700	29.3700	29.3700	29.3700	29.3700	29.3700	29.3700	29.3700	29.3700	29.3700	(38)
Average = Sum(39)m / 12 =	87.0320	87.0320	87.0320	87.0320	87.0320	87.0320	87.0320	87.0320	87.0320	87.0320	87.0320	87.0320	(39)
HLP	1.2224	1.2224	1.2224	1.2224	1.2224	1.2224	1.2224	1.2224	1.2224	1.2224	1.2224	1.2224	(40)
HLP (average)												1.2224	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2749 (42)
Hot water usage for mixer showers													
62.3623	61.4251	60.0594	57.4465	55.5182	53.3678	52.1455	53.5008	54.9865	57.2954	59.9645	62.1233	(42a)	
Hot water usage for baths													
26.9410	26.5409	25.9775	24.9386	24.1607	23.2981	22.8322	23.3917	24.0009	24.9239	25.9842	26.8500	(42b)	
Hot water usage for other uses													
37.9273	36.5481	35.1689	33.7898	32.4106	31.0314	31.0314	32.4106	33.7898	35.1689	36.5481	37.9273	(42c)	
Average daily hot water use (litres/day)													116.9539 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
127.2306	124.5141	121.2059	116.1748	112.0895	107.6973	106.0091	109.3031	112.7772	117.3882	122.4967	126.9006	(44)	
Energy content (annual)	201.5022	177.3065	186.2889	159.0376	150.8940	132.4264	128.2088	135.3401	139.0655	159.2947	174.5191	198.6956	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1942.5793	
30.2253	26.5960	27.9433	23.8556	22.6341	19.8640	19.2313	20.3010	20.8598	23.8942	26.1779	29.8043	(46)	
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.1500 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.6210 (55)
Total storage loss													
19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	(56)	
If cylinder contains dedicated solar storage													
19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month													
244.0156	215.7057	228.8023	200.1796	193.4074	173.5684	170.7222	177.8535	180.2075	201.8081	215.6611	241.2090	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h													
244.0156	215.7057	228.8023	200.1796	193.4074	173.5684	170.7222	177.8535	180.2075	201.8081	215.6611	241.2090	(64)	
									Total per year (kWh/year) = Sum(64)m =		2443.1403	(64)	
12Total per year (kWh/year)											2443	(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													
101.0102	89.6738	95.9518	85.7936	84.1830	76.9454	76.6402	79.0113	79.1529	86.9762	90.9412	100.0770	(65)	

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

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Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	113.7451	113.7451	113.7451	113.7451	113.7451	113.7451	113.7451	113.7451	113.7451	113.7451	113.7451	113.7451	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	100.9181	111.7308	100.9181	104.2820	100.9181	104.2820	100.9181	100.9181	104.2820	100.9181	104.2820	100.9181	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	200.0814	202.1576	196.9256	185.7873	171.7272	158.5126	149.6845	147.6083	152.8403	163.9786	178.0388	191.2533	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3745	34.3745	34.3745	34.3745	34.3745	34.3745	34.3745	34.3745	34.3745	34.3745	34.3745	34.3745	(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)	-90.9961	-90.9961	-90.9961	-90.9961	-90.9961	-90.9961	-90.9961	-90.9961	-90.9961	-90.9961	-90.9961	-90.9961	(71)
Water heating gains (Table 5)	135.7664	133.4431	128.9674	119.1578	113.1492	106.8686	103.0110	106.1980	109.9346	116.9035	126.3072	134.5121	(72)
Total internal gains	493.8894	504.4550	483.9347	466.3506	442.9180	426.7868	410.7371	411.8479	424.1804	438.9238	465.7515	483.8070	(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				6.5000	10.6334	0.6300	0.8000	0.7700	24.1406 (74)			
South				6.5000	46.7521	0.6300	0.8000	0.7700	106.1397 (78)			
North				6.5000	10.6334	0.6300	0.8000	0.7700	24.1406 (74)			
Solar gains	154.4210	266.0975	378.2139	502.1001	600.0375	614.1497	584.2877	507.1488	419.8152	297.3245	185.3730	131.9642 (83)
Total gains	648.3104	770.5525	862.1486	968.4507	1042.9555	1040.9365	995.0248	918.9968	843.9956	736.2482	651.1245	615.7712 (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	17.0437	17.0437	17.0437	17.0437	17.0437	17.0437	17.0437	17.0437	17.0437	17.0437	17.0437	17.0437	
alpha	2.1362	2.1362	2.1362	2.1362	2.1362	2.1362	2.1362	2.1362	2.1362	2.1362	2.1362	2.1362	
util living area	0.8927	0.8518	0.7987	0.7092	0.5917	0.4590	0.3524	0.3907	0.5603	0.7482	0.8565	0.9023	(86)
Living	18.1360	18.5611	19.1225	19.8007	20.3704	20.7405	20.8944	20.8646	20.5821	19.8401	18.8649	18.0316	
Non living	16.6078	17.1324	17.8227	18.6396	19.2990	19.6970	19.8406	19.8188	19.5480	18.7103	17.5224	16.4784	
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	19.5349	18.5611	19.1225	19.8007	20.3704	20.7405	20.8944	20.8646	20.5821	19.8401	18.8649	18.4468	(87)
Th 2	19.9022	19.9022	19.9022	19.9022	19.9022	19.9022	19.9022	19.9022	19.9022	19.9022	19.9022	19.9022	(88)
util rest of house	0.8805	0.8357	0.7767	0.6773	0.5463	0.3962	0.2741	0.3100	0.4981	0.7129	0.8380	0.8910	(89)
MIT 2	18.5839	17.1324	17.8227	18.6396	19.2990	19.6970	19.8406	19.8188	19.5480	18.7103	17.5224	17.0935	(90)
Living area fraction									fLA = Living area / (4) =			0.4537	(91)
MIT	19.0153	17.7806	18.4123	19.1663	19.7851	20.1704	20.3187	20.2933	20.0172	19.2228	18.1314	17.7074	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0153	17.7806	18.4123	19.1663	19.7851	20.1704	20.3187	20.2933	20.0172	19.2228	18.1314	17.7074	(93)

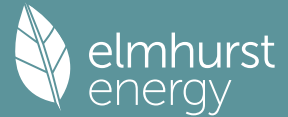
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8692	0.7970	0.7414	0.6533	0.5411	0.4122	0.3047	0.3398	0.5051	0.6876	0.8006	0.8622	(94)
Useful gains	563.5191	614.1308	639.2023	632.7156	564.3486	429.1052	303.2162	312.2940	426.2614	506.2696	521.3085	530.9397	(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	1280.7010	1121.0200	1036.7543	893.4994	703.6588	484.8034	323.6445	338.8384	514.9818	750.4586	960.0865	1175.5787	(97)
Space heating kWh	533.5834	340.6296	295.7787	187.7644	103.6468	0.0000	0.0000	0.0000	0.0000	181.6766	315.9202	479.6114	(98a)
Space heating requirement - total per year (kWh/year)												2438.6109	
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	533.5834	340.6296	295.7787	187.7644	103.6468	0.0000	0.0000	0.0000	0.0000	181.6766	315.9202	479.6114	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2438.6109	
Space heating per m2										(98c) / (4) =		34.2502	(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 %)	243.9991	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

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Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	533.5834	340.6296	295.7787	187.7644	103.6468	0.0000	0.0000	0.0000	0.0000	181.6766	315.9202	479.6114 (98)
Space heating efficiency (main heating system 1)	243.9991	243.9991	243.9991	243.9991	243.9991	0.0000	0.0000	0.0000	0.0000	243.9991	243.9991	243.9991 (210)
Space heating fuel (main heating system)	218.6826	139.6028	121.2212	76.9529	42.4783	0.0000	0.0000	0.0000	0.0000	74.4579	129.4760	196.5628 (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	244.0156	215.7057	228.8023	200.1796	193.4074	173.5684	170.7222	177.8535	180.2075	201.8081	215.6611	241.2090 (64)
Efficiency of water heater												190.3926 (216)
(217)m	190.3926	190.3926	190.3926	190.3926	190.3926	190.3926	190.3926	190.3926	190.3926	190.3926	190.3926	190.3926 (217)
Fuel for water heating, kWh/month	128.1644	113.2952	120.1740	105.1404	101.5835	91.1634	89.6685	93.4141	94.6505	105.9958	113.2718	126.6904 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	20.9688	16.8219	15.1463	11.0968	8.5715	7.0030	7.8192	10.1637	13.2017	17.3213	19.5644	21.5516 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												999.4345 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.3926
Water heating fuel used												1283.2121 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												169.2301 (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												2451.8767 (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	999.4345	0.1549	154.8568 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1283.2121	0.1410	180.9213 (264)
Space and water heating			335.7782 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	169.2301	0.1443	24.4251 (268)
Total CO2, kg/year			360.2033 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.0600 (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	999.4345	1.5736	1572.6899 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1283.2121	1.5213	1952.1993 (278)
Space and water heating			3524.8892 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	169.2301	1.5338	259.5708 (282)
Total Primary energy kWh/year			3784.4600 (286)

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Dwelling Primary energy Rate (DPER)

53.1500 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	71.2000 (1b)	2.5000 (2b)	178.0000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	178.0000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1685 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4185 (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) = 0.3558 (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	0.4536	0.4447	0.4358	0.3913	0.3824	0.3380	0.3380	0.3291	0.3558	0.3824	0.4002	0.4180 (22b)
Effective ac	0.6029	0.5989	0.5950	0.5766	0.5731	0.5571	0.5571	0.5541	0.5633	0.5731	0.5801	0.5874 (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
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.20)			15.6900	1.1450	17.9656		(27)
top floor exposed new	58.7500	15.6900	43.0600	0.1800	7.7508		(29a)
corridor new	9.7500	2.1000	7.6500	0.1800	1.3770		(29a)
stair new	14.2500		14.2500	0.1800	2.5650		(29a)
flat roof new	39.1000		39.1000	0.1100	4.3010		(30)
roof terrace new	32.1000		32.1000	0.1100	3.5310		(30)
Total net area of external elements Aum(A, m ²)			153.9500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.5904		(33)
pw			16.0000	0.0000	0.0000		(32)

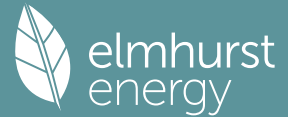
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

75.0007 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.8000	0.0500	0.4400
E3 Sill	7.8000	0.0500	0.3900
E4 Jamb	19.2000	0.0500	0.9600
E7 Party floor between dwellings (in blocks of flats)	6.6000	0.0700	0.4620
E14 Flat roof	15.8000	0.0800	1.2640
E15 Flat roof with parapet	23.5000	0.5600	13.1600
E16 Corner (normal)	10.0000	0.0900	0.9000
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	5.0000	0.0600	0.3000
E24 Eaves (insulation at ceiling level - inverted)	7.8000	0.2400	1.8720
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.5230 (36)

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Point Thermal bridges
Total fabric heat loss (33) + (36) + (36a) = 0.0000
59.1134 (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 35.4128 35.1781 34.9481 33.8678 33.6657 32.7248 32.7248 32.5505 33.0872 33.6657 34.0746 34.5020 (38)
Heat transfer coeff 94.5262 94.2916 94.0616 92.9812 92.7791 91.8382 91.8382 91.6640 92.2006 92.7791 93.1880 93.6155 (39)
Average = Sum(39)m / 12 = 92.9803

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
HLP 1.3276 1.3243 1.3211 1.3059 1.3031 1.2899 1.2899 1.2874 1.2950 1.3031 1.3088 1.3148 (40)
HLP (average) 1.3059
Days in mont 31 28 31 30 31 30 31 31 30 31 30 31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2749 (42)
Hot water usage for mixer showers 62.3623 61.4251 60.0594 57.4465 55.5182 53.3678 52.1455 53.5008 54.9865 57.2954 59.9645 62.1233 (42a)
Hot water usage for baths 26.9410 26.5409 25.9775 24.9386 24.1607 23.2981 22.8322 23.3917 24.0009 24.9239 25.9842 26.8500 (42b)
Hot water usage for other uses 37.9273 36.5481 35.1689 33.7898 32.4106 31.0314 31.0314 32.4106 33.7898 35.1689 36.5481 37.9273 (42c)
Average daily hot water use (litres/day) 116.9539 (43)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Daily hot water use 127.2306 124.5141 121.2059 116.1748 112.0895 107.6973 106.0091 109.3031 112.7772 117.3882 122.4967 126.9006 (44)
Energy conte 201.5022 177.3065 186.2889 159.0376 150.8940 132.4264 128.2088 135.3401 139.0655 159.2947 174.5191 198.6956 (45)
Energy content (annual) Total = Sum(45)m = 1942.5793
Distribution loss (46)m = 0.15 x (45)m 30.2253 26.5960 27.9433 23.8556 22.6341 19.8640 19.2313 20.3010 20.8598 23.8942 26.1779 29.8043 (46)

Water storage loss:
Store volume 150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3938 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7527 (55)
Total storage loss 23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (56)

If cylinder contains dedicated solar storage 23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month 248.0971 219.3922 232.8838 204.1294 197.4889 177.5183 174.8037 181.9350 184.1574 205.8896 219.6109 245.2906 (62)
WWHRS -28.5094 -25.2140 -26.4026 -21.8624 -20.3750 -17.4350 -16.3426 -17.3787 -18.0389 -21.2659 -24.0917 -27.9815 (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 219.5876 194.1782 206.4812 182.2670 177.1139 160.0832 158.4612 164.5563 166.1184 184.6237 195.5192 217.3091 (64)
Total per year (kWh/year) = Sum(64)m = 2226.2990 (64)
2226 (64)

12Total per year (kWh/year)
Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month 104.2754 92.6230 99.2170 88.9535 87.4482 80.1053 79.9054 82.2765 82.3128 90.2414 94.1011 103.3422 (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 113.7451 113.7451 113.7451 113.7451 113.7451 113.7451 113.7451 113.7451 113.7451 113.7451 113.7451 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 100.9477 111.7635 100.9477 104.3126 100.9477 104.3126 100.9477 100.9477 104.3126 100.9477 104.3126 100.9477 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 200.0814 202.1576 196.9256 185.7873 171.7272 158.5126 149.6845 147.6083 152.8403 163.9786 178.0388 191.2533 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 34.3745 34.3745 34.3745 34.3745 34.3745 34.3745 34.3745 34.3745 34.3745 34.3745 34.3745 34.3745 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5) -90.9961 -90.9961 -90.9961 -90.9961 -90.9961 -90.9961 -90.9961 -90.9961 -90.9961 -90.9961 -90.9961 -90.9961 (71)
Water heating gains (Table 5) 140.1551 137.8318 133.3561 123.5465 117.5379 111.2573 107.3997 110.5867 114.3233 121.2922 130.6959 138.9008 (72)
Total internal gains 501.3077 511.8764 491.3530 473.7699 450.3362 431.2061 415.1554 416.2662 428.5997 446.3420 473.1708 491.2253 (73)

6. Solar gains

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

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North	10.4600				10.6334		0.6300		0.7000		0.7700		33.9919 (74)	
South	5.2300				46.7521		0.6300		0.7000		0.7700		74.7264 (78)	
Solar gains	108.7183	187.3429	266.2771	353.4978	422.4495	432.3850	411.3610	357.0523	295.5660	209.3279	130.5097	92.9078	(83)	
Total gains	610.0260	699.2193	757.6301	827.2677	872.7857	863.5910	826.5164	773.3185	724.1657	655.6699	603.6805	584.1332	(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	15.6924	15.7315	15.7700	15.9532	15.9879	16.1517	16.1517	16.1824	16.0883	15.9879	15.9178	15.8451		
alpha	2.0462	2.0488	2.0513	2.0635	2.0659	2.0768	2.0768	2.0788	2.0726	2.0659	2.0612	2.0563		
util living area	0.9072	0.8784	0.8404	0.7700	0.6700	0.5397	0.4253	0.4621	0.6300	0.7922	0.8775	0.9138	(86)	
MIT	17.7777	18.1552	18.7085	19.4530	20.1176	20.6120	20.8325	20.7948	20.4271	19.5864	18.5762	17.7183	(87)	
Th 2	19.8193	19.8218	19.8244	19.8362	19.8384	19.8488	19.8488	19.8507	19.8448	19.8384	19.8339	19.8292	(88)	
util rest of house	0.8958	0.8638	0.8205	0.7401	0.6239	0.4701	0.3319	0.3688	0.5650	0.7588	0.8604	0.9032	(89)	
MIT 2	16.1362	16.6043	17.2900	18.2022	18.9873	19.5393	19.7511	19.7240	19.3559	18.3844	17.1427	16.0656	(90)	
Living area fraction	fLA = Living area / (4) =												0.4537 (91)	
MIT	16.8809	17.3079	17.9335	18.7696	19.5000	20.0259	20.2417	20.2098	19.8419	18.9297	17.7930	16.8154	(92)	
Temperature adjustment													0.0000	
adjusted MIT	16.8809	17.3079	17.9335	18.7696	19.5000	20.0259	20.2417	20.2098	19.8419	18.9297	17.7930	16.8154	(93)	
8. Space heating requirement														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.8570	0.8230	0.7806	0.7078	0.6090	0.4815	0.3654	0.3997	0.5649	0.7274	0.8211	0.8655	(94)	
Useful gains	522.8056	575.4602	591.4172	585.5490	531.5330	415.8439	302.0262	309.0621	409.0571	476.9024	495.6967	505.5853	(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	1189.2232	1169.9592	1075.4557	917.6880	723.6816	498.3083	334.4439	349.2189	529.4065	772.8230	996.4568	1180.9934	(97)	
Space heating kWh	495.8147	399.5033	360.1246	239.1401	142.9586	0.0000	0.0000	0.0000	0.0000	220.1649	360.5473	502.5036	(98a)	
Space heating requirement - total per year (kWh/year)													2720.7570	
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	495.8147	399.5033	360.1246	239.1401	142.9586	0.0000	0.0000	0.0000	0.0000	220.1649	360.5473	502.5036	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)													2720.7570	
Space heating per m2	(98c) / (4) =												38.2129 (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	495.8147	399.5033	360.1246	239.1401	142.9586	0.0000	0.0000	0.0000	0.0000	220.1649	360.5473	502.5036	(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)	537.1773	432.8313	390.1675	259.0900	154.8847	0.0000	0.0000	0.0000	0.0000	238.5319	390.6254	544.4243	(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	219.5876	194.1782	206.4812	182.2670	177.1139	160.0832	158.4612	164.5563	166.1184	184.6237	195.5192	217.3091	(64)	
Efficiency of water heater (217)m	85.8288	85.6409	85.2944	84.6698	83.5837	79.8000	79.8000	79.8000	79.8000	84.4556	85.4129	85.8760	(216)	
Fuel for water heating, kWh/month	255.8437	226.7354	242.0805	215.2681	211.9001	200.6056	198.5729	206.2109	208.1685	218.6044	228.9106	253.0497	(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	20.9749	16.8269	15.1507	11.1001	8.5740	7.0050	7.8215	10.1667	13.2055	17.3264	19.5701	21.5579	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-33.3942	-47.1278	-67.8229	-76.3681	-82.4604	-77.0234	-76.0768	-71.7623	-64.1681	-53.9379	-36.7316	-28.8660	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														

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(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-18.7312	-39.4174	-78.3646	-117.7241	-155.6803	-156.4176	-154.5716	-130.8651	-95.9103	-56.3750	-25.0115	-14.8109	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2947.7324	(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												2665.9504	(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)												169.2797	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1759.6192	(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												4109.3433	(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	2947.7324	0.2100	619.0238	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2665.9504	0.2100	559.8496	(264)
Space and water heating			1178.8734	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	169.2797	0.1443	24.4323	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-715.7394	0.1346	-96.3064	
PV Unit electricity exported	-1043.8798	0.1259	-131.4149	
Total			-227.7213	(269)
Total CO2, kg/year			987.5136	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.8700	(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	2947.7324	1.1300	3330.9376	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2665.9504	1.1300	3012.5239	(278)
Space and water heating			6343.4615	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	169.2797	1.5338	259.6468	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-715.7394	1.4973	-1071.6703	
PV Unit electricity exported	-1043.8798	0.4621	-482.3829	
Total			-1554.0532	(283)
Total Primary energy kWh/year			5179.1559	(286)
Target Primary Energy Rate (TPER)			72.7400	(287)