Full SAP Calculation Printout

Property Reference	Apartment 1	**Issued on Date**	21/12/2023
Assessment Reference	Apartment 1 Be Green	**Prop Type Ref**	Apartment 1
Property	Apartment 1, 95, Avenue Road, London, NW8 6HY		

SAP Rating	71 C	**DER**	28.84	**TER**	18.48
Environmental	74 C	**% DER < TER**			-56.06
CO_2 Emissions (t/year)	2.45	**DFEE**	71.54	**TFEE**	38.79
Compliance Check	See BREL	**% DFEE < TFEE**			-84.43
% DPER < TPER	-61.34	**DPER**	160.40	**TPER**	99.42

Assessor Details	Mr. Graham Suttill	**Assessor ID**	P035-0001
Client	Carnell Warren Associates Ltd, Wendy Warren		

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	100.4400	(1b)	x 2.5100	(2b) =	252.1044	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		252.1044	(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		6.0000	(17)
Infiltration rate		0.3000	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2100	(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	0.2677	0.2625	0.2573	0.2310	0.2257	0.1995	0.1995	0.1943	0.2100	0.2257	0.2362	0.2467	(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) =		79.2000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3717	0.3665	0.3613	0.3350	0.3297	0.3035	0.3035	0.2983	0.3140	0.3297	0.3402	0.3508	(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	
Windows (Uw = 1.40)			13.8700	1.3258	18.3883			(27)
Glazed Doors (Uw = 1.40)			13.6000	1.3258	18.0303			(27)
Basement Floor			100.4400	0.2500	25.1100	110.0000	11048.4000	(28a)
Retaining Walls	37.5500		37.5500	0.3000	11.2650	9.0000	337.9500	(29a)
Wall to Lightwells	44.4400	27.4700	16.9700	0.3000	5.0910	9.0000	152.7300	(29a)
Total net area of external elements Aum(A, m2)			182.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		77.8846			(33)
Wall to Corridor			29.9700	0.0000	0.0000	70.0000	2097.9000	(32)
Party Ceiling 1			100.4400			30.0000	3013.2000	(32b)
Internal Wall 1			173.3900			75.0000	13004.2500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	29654.4300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		295.2452 (35)
Thermal bridges (Default value 0.200 * total exposed area)		36.4860 (36)
Point Thermal bridges	(36a) =	0.0000

Total fabric heat loss (33) + (36) + (36a) = 114.3706 (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	30.9275	30.4908	30.0540	27.8701	27.4334	25.2495	25.2495	24.8127	26.1231	27.4334	28.3069	29.1805	(38)
Heat transfer coeff	145.2981	144.8613	144.4246	142.2407	141.8039	139.6201	139.6201	139.1833	140.4936	141.8039	142.6775	143.5510	(39)
Average = Sum(39)m / 12 =												142.1315	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4466	1.4423	1.4379	1.4162	1.4118	1.3901	1.3901	1.3857	1.3988	1.4118	1.4205	1.4292	(40)
HLP (average)												1.4151	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7436 (42)

Hot water usage for mixer showers	78.9978	77.8107	76.0807	72.7707	70.3281	67.6040	66.0557	67.7725	69.6545	72.5793	75.9604	78.6952	(42a)
Hot water usage for baths	30.3202	29.8700	29.2358	28.0666	27.1912	26.2204	25.6960	26.3257	27.0113	28.0501	29.2433	30.2177	(42b)
Hot water usage for other uses	42.7268	41.1731	39.6194	38.0657	36.5120	34.9583	34.9583	36.5120	38.0657	39.6194	41.1731	42.7268	(42c)
Average daily hot water use (litres/day)												139.7876	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.0449	148.8537	144.9359	138.9031	134.0312	128.7827	126.7100	130.6103	134.7316	140.2488	146.3769	151.6397	(44)
Energy conte	240.8020	211.9657	222.7611	190.1514	180.4318	158.3534	153.2448	161.7228	166.1375	190.3163	208.5407	237.4312	(45)
Energy content (annual)										Total = Sum(45)m =		2321.8586	
Distribution loss (46)m = 0.15 x (45)m	36.1203	31.7949	33.4142	28.5227	27.0648	23.7530	22.9867	24.2584	24.9206	28.5474	31.2811	35.6147	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												1.0800	(55)
Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(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	297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(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	297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(64)
										Total per year (kWh/year) = Sum(64)m =		2989.9546	(64)
12Total per year (kWh/year)												2990	(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	125.4606	111.4796	119.4620	107.1549	105.3875	96.5821	96.3478	99.1667	99.1703	108.6741	113.2694	124.3398	(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	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	129.6766	143.5705	129.6766	133.9991	129.6766	133.9991	129.6766	129.6766	133.9991	129.6766	133.9991	129.6766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.0371	259.7044	252.9830	238.6740	220.6115	203.6353	192.2941	189.6269	196.3482	210.6572	228.7198	245.6960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	(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)	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	(71)
Water heating gains (Table 5)	168.6298	165.8922	160.5672	148.8263	141.6499	134.1418	129.4997	133.2886	137.7366	146.0673	157.3186	167.1234	(72)
Total internal gains	619.4969	633.3205	607.3802	585.6529	556.0914	535.9297	515.6239	516.7455	532.2374	550.5546	584.1909	606.6494	(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	3.3600	10.6334	0.4000	0.7000	0.5400	4.8619	(74)
East	4.9200	19.6403	0.4000	0.7000	0.5400	13.1494	(76)
West	5.5900	19.6403	0.4000	0.7000	0.5400	14.9401	(80)
North	6.8200	10.6334	0.4000	0.7000	0.5400	9.8685	(74)
West	6.7800	19.6403	0.4000	0.7000	0.5400	18.1205	(80)

Solar gains	60.9404	118.5472	196.7051	293.9533	369.5904	383.1909	362.7731	304.8292	230.6552	140.7728	75.7903	50.2809	(83)
Total gains	680.4374	751.8677	804.0853	879.6062	925.6818	919.1205	878.3970	821.5747	762.8926	691.3274	659.9812	656.9302	(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	56.6927	56.8636	57.0356	57.9113	58.0897	58.9983	58.9983	59.1834	58.6314	58.0897	57.7340	57.3827	
alpha	4.7795	4.7909	4.8024	4.8608	4.8726	4.9332	4.9332	4.9456	4.9088	4.8726	4.8489	4.8255	
util living area													
	0.9983	0.9970	0.9938	0.9809	0.9393	0.8195	0.6584	0.7145	0.9132	0.9866	0.9968	0.9986	(86)
MIT	19.4423	19.5881	19.8438	20.2312	20.5973	20.8738	20.9677	20.9521	20.7551	20.2895	19.8137	19.4306	(87)
Th 2	19.7278	19.7311	19.7344	19.7510	19.7543	19.7709	19.7709	19.7743	19.7643	19.7543	19.7476	19.7410	(88)
util rest of house													
	0.9977	0.9957	0.9909	0.9710	0.9040	0.7182	0.4954	0.5557	0.8478	0.9778	0.9952	0.9981	(89)
MIT 2	17.9399	18.1286	18.4575	18.9586	19.4031	19.6996	19.7622	19.7591	19.5925	19.0387	18.4293	17.9341	(90)
Living area fraction									fLA = Living area / (4) =			0.2903	(91)
MIT	18.3761	18.5523	18.8600	19.3281	19.7498	20.0405	20.1121	20.1055	19.9301	19.4018	18.8312	18.3686	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3761	18.5523	18.8600	19.3281	19.7498	20.0405	20.1121	20.1055	19.9301	19.4018	18.8312	18.3686	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9940	0.9880	0.9663	0.9038	0.7438	0.5439	0.6028	0.8589	0.9741	0.9933	0.9971	(94)
Useful gains	678.0743	747.3204	794.3972	849.9867	836.6346	683.5972	477.7587	495.2580	655.2173	673.4358	655.5768	655.0235	(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													
	2045.2298	1977.6947	1785.0896	1483.2974	1141.4927	759.6034	490.3665	515.7386	819.0850	1248.1368	1673.7842	2033.9100	(97)
Space heating kWh													
	1017.1637	826.8115	737.0752	455.9837	226.8144	0.0000	0.0000	0.0000	0.0000	427.5775	733.1093	1025.8916	(98a)
Space heating requirement - total per year (kWh/year)												5450.4269	
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													
	1017.1637	826.8115	737.0752	455.9837	226.8144	0.0000	0.0000	0.0000	0.0000	427.5775	733.1093	1025.8916	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5450.4269	
Space heating per m2											(98c) / (4) =	54.2655	(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	1312.4287	1033.1886	1057.7931	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7305	0.8215	0.7782	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	958.7249	848.8054	823.1270	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1056.2338	1009.1921	937.8899	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	70.2065	119.3277	85.3836	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		0.6372	(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	11.1838	19.0088	13.6015	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												43.7941	(107)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Boilers-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.5000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	1017.1637	826.8115	737.0752	455.9837	226.8144	0.0000	0.0000	0.0000	0.0000	427.5775	733.1093	1025.8916	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.50													
307a	1525.7455	1240.2173	1105.6128	683.9755	340.2216	0.0000	0.0000	0.0000	0.0000	641.3663	1099.6639	1538.8374	
Space heating requirement													
	1525.7455	1240.2173	1105.6128	683.9755	340.2216	0.0000	0.0000	0.0000	0.0000	641.3663	1099.6639	1538.8374	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.50													
310a	446.3165	394.8254	419.2553	367.5951	355.7613	319.8981	314.9808	327.6978	331.5743	370.5881	395.1790	441.2604	
Water heating fuel													
	446.3165	394.8254	419.2553	367.5951	355.7613	319.8981	314.9808	327.6978	331.5743	370.5881	395.1790	441.2604	(310)
Cooling System Energy Efficiency Ratio												2.6000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	4.3015	7.3111	5.2314	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	24.8683	22.4617	24.8683	24.0661	24.8683	24.0661	24.8683	24.8683	24.0661	24.8683	24.0661	24.8683	(331)
Lighting	31.3329	25.1364	22.6325	16.5816	12.8081	10.4643	11.6840	15.1873	19.7267	25.8826	29.2343	32.2037	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												8175.6403	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												4484.9319	(310)
Efficiency of water heater												0.0000	(311)

Electricity used for heat distribution	81.7564	(313)
Space cooling fuel	16.8439	(321)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9520)		
mechanical ventilation fans (SFP = 0.9520)	292.8041	(330a)
Total electricity for the above, kWh/year	292.8041	(331)
Electricity for lighting (calculated in Appendix L)	252.8744	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(333)
Wind generation	0.0000	(334)
Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	13223.0947	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367)
Space and Water heating from Boilers	13326.9182	0.2100	1807.2468	(367)
Electrical energy for heat distribution (space & water)	81.7564	0.0000	18.9521	(372)
Overall CO2 factor for heat network			0.2225	(386)
Total CO2 associated with community systems			2817.6049	(373)
Space and water heating			2817.6049	(376)
Space cooling	16.8439	0.1136	1.9136	(377)
Pumps, fans and electric keep-hot	292.8041	0.1387	40.6155	(378)
Energy for lighting	252.8744	0.1443	36.4976	(379)
Total CO2, kg/year			2896.6317	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			28.8400	(384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(467a)
Space and Water heating from Boilers	13326.9182	1.1300	9724.7090	(467)
Electrical energy for heat distribution (space & water)	81.7564	0.0000	196.7429	(472)
Overall CO2 factor for heat network			1.2050	(486)
Total CO2 associated with community systems			15256.1605	(473)
Space and water heating			15256.1605	(476)
Space cooling	16.8439	1.4188	23.8989	(477)
Pumps, fans and electric keep-hot	292.8041	1.5128	442.9541	(478)
Energy for lighting	252.8744	1.5338	387.8671	(479)
Total Primary energy kWh/year			16110.8806	(483)
Dwelling Primary energy Rate (DPER)			160.4000	(484)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	100.4400	(1b)	x 2.5100	(2b) =	252.1044	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	252.1044	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1587	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4087	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2861	(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	0.3647	0.3576	0.3504	0.3147	0.3075	0.2718	0.2718	0.2646	0.2861	0.3075	0.3218	0.3361 (22b)
Effective ac	0.5665	0.5639	0.5614	0.5495	0.5473	0.5369	0.5369	0.5350	0.5409	0.5473	0.5518	0.5565 (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 Opening Type (Uw = 1.20)			25.1100	1.1450	28.7519			(27)
Basement Floor			100.4400	0.1300	13.0572			(28a)
Retaining Walls	37.5500		37.5500	0.1800	6.7590			(29a)
Wall to Lightwells	44.4400	25.1100	19.3300	0.1800	3.4794			(29a)
Total net area of external elements Aum(A, m2)			182.4300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.0475			(33)
Wall to Corridor			29.9700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		305.2452 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		9.1215 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	61.1690 (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	47.1309	46.9160	46.7054	45.7161	45.5310	44.6694	44.6694	44.5098	45.0013	45.5310	45.9055	46.2969	(38)
Heat transfer coeff	108.2999	108.0850	107.8744	106.8851	106.7000	105.8384	105.8384	105.6788	106.1703	106.7000	107.0745	107.4659	(39)
Average = Sum(39)m / 12 =												106.8842	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0783	1.0761	1.0740	1.0642	1.0623	1.0537	1.0537	1.0522	1.0571	1.0623	1.0661	1.0700	(40)
HLP (average)												1.0642	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.7436	(42)
Hot water usage for mixer showers	70.2203	69.1650	67.6273	64.6851	62.5138	60.0925	58.7161	60.2423	61.9151	64.5150	67.5204	69.9513	(42a)
Hot water usage for baths	30.3202	29.8700	29.2358	28.0666	27.1912	26.2204	25.6960	26.3257	27.0113	28.0501	29.2433	30.2177	(42b)
Hot water usage for other uses	42.7268	41.1731	39.6194	38.0657	36.5120	34.9583	34.9583	36.5120	38.0657	39.6194	41.1731	42.7268	(42c)
Average daily hot water use (litres/day)												131.6950	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.2674	140.2081	136.4825	130.8174	126.2170	121.2712	119.3705	123.0800	126.9922	132.1845	137.9368	142.8958	(44)
Energy conte	226.9005	199.6545	209.7686	179.0825	169.9123	149.1170	144.3683	152.3987	156.5941	179.3731	196.5163	223.7403	(45)
Energy content (annual)										Total = Sum(45)m =		2187.4262	
Distribution loss (46)m = 0.15 x (45)m	34.0351	29.9482	31.4653	26.8624	25.4869	22.3676	21.6552	22.8598	23.4891	26.9060	29.4774	33.5610	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4400	(48)
Temperature factor from Table 2b												1.0000	(49)
Enter (49) or (54) in (55)												1.4400	(55)
Total storage loss	44.6400	40.3200	44.6400	43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400	(56)
If cylinder contains dedicated solar storage	44.6400	40.3200	44.6400	43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	271.5405	239.9745	254.4086	222.2825	214.5523	192.3170	189.0083	197.0387	199.7941	224.0131	239.7163	268.3803	(62)
WWHRS	-32.1018	-28.3911	-29.7295	-24.6172	-22.9424	-19.6319	-18.4018	-19.5685	-20.3120	-23.9456	-27.1274	-31.5073	(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	239.4387	211.5834	224.6791	197.6653	191.6100	172.6851	170.6065	177.4702	179.4821	200.0675	212.5889	236.8730	(64)
									Total per year (kWh/year) = Sum(64)m =			2414.7498	(64)
12Total per year (kWh/year)												2415	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	111.1564	98.6411	105.4600	94.1049	92.2079	84.1414	83.7144	86.3846	86.6275	95.3535	99.9017	110.1057	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	130.4399	144.4156	130.4399	134.7879	130.4399	134.7879	130.4399	130.4399	134.7879	130.4399	134.7879	130.4399	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.0371	259.7044	252.9830	238.6740	220.6115	203.6353	192.2941	189.6269	196.3482	210.6572	228.7198	245.6960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	(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)	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	(71)
Water heating gains (Table 5)	149.4038	146.7874	141.7474	130.7013	123.9353	116.8631	112.5194	116.1083	120.3160	128.1634	138.7523	147.9915	(72)
Total internal gains	601.0343	615.0608	589.3237	568.3167	539.1401	519.4397	499.4069	500.3285	515.6056	533.4139	566.4134	588.2808	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.3000	10.6334	0.6300	0.7000	0.5400	21.1948	(74)
East	4.5000	19.6403	0.6300	0.7000	0.5400	18.9424	(76)
West	11.3100	19.6403	0.6300	0.7000	0.5400	47.6085	(80)

Solar gains	87.7457	170.6921	283.2275	423.2441	532.1397	551.7171	522.3216	438.9002	332.1090	202.6939	109.1277	72.3973	(83)
Total gains	688.7800	785.7529	872.5512	991.5607	1071.2799	1071.1568	1021.7285	939.2288	847.7145	736.1078	675.5411	660.6781	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.6366	78.7930	78.9468	79.6775	79.8157	80.4655	80.4655	80.5870	80.2140	79.8157	79.5366	79.2469	
alpha	6.2424	6.2529	6.2631	6.3118	6.3210	6.3644	6.3644	6.3725	6.3476	6.3210	6.3024	6.2831	
util living area													
	0.9985	0.9962	0.9884	0.9491	0.8282	0.6193	0.4541	0.5138	0.7935	0.9735	0.9962	0.9989	(86)
MIT	19.9702	20.1201	20.3548	20.6757	20.9032	20.9871	20.9984	20.9967	20.9448	20.6380	20.2494	19.9462	(87)
Th 2	20.0186	20.0204	20.0221	20.0302	20.0317	20.0388	20.0388	20.0401	20.0361	20.0317	20.0287	20.0254	(88)
util rest of house													
	0.9979	0.9946	0.9835	0.9283	0.7715	0.5326	0.3559	0.4088	0.7107	0.9586	0.9944	0.9984	(89)
MIT 2	18.8220	19.0147	19.3137	19.7122	19.9579	20.0327	20.0384	20.0392	20.0032	19.6763	19.1870	18.7965	(90)
Living area fraction									fLA = Living area / (4) =			0.2903	(91)
MIT	19.1553	19.3356	19.6159	19.9919	20.2323	20.3098	20.3171	20.3172	20.2766	19.9555	19.4954	19.1302	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1553	19.3356	19.6159	19.9919	20.2323	20.3098	20.3171	20.3172	20.2766	19.9555	19.4954	19.1302	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9931	0.9809	0.9274	0.7843	0.5576	0.3845	0.4394	0.7331	0.9571	0.9930	0.9978	(94)
Useful gains	686.8011	780.3664	855.8516	919.5335	840.1908	597.3158	392.8558	412.7089	621.4652	704.5279	670.8051	659.2023	(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													
	1608.8320	1560.2734	1414.8734	1185.5590	910.4007	604.3128	393.4132	413.9627	655.7686	998.2306	1327.2329	1604.4922	(97)
Space heating kWh													
	685.9909	524.0975	415.9122	191.5384	52.2361	0.0000	0.0000	0.0000	0.0000	218.5148	472.6280	703.2957	(98a)
Space heating requirement - total per year (kWh/year)												3264.2137	
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													
	685.9909	524.0975	415.9122	191.5384	52.2361	0.0000	0.0000	0.0000	0.0000	218.5148	472.6280	703.2957	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3264.2137	
Space heating per m2										(98c) / (4) =		32.4991	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Boilers-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.5000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	685.9909	524.0975	415.9122	191.5384	52.2361	0.0000	0.0000	0.0000	0.0000	218.5148	472.6280	703.2957	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.50													
307a	1028.9864	786.1463	623.8684	287.3075	78.3542	0.0000	0.0000	0.0000	0.0000	327.7722	708.9420	1054.9435	
Space heating requirement													
	1028.9864	786.1463	623.8684	287.3075	78.3542	0.0000	0.0000	0.0000	0.0000	327.7722	708.9420	1054.9435	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	239.4387	211.5834	224.6791	197.6653	191.6100	172.6851	170.6065	177.4702	179.4821	200.0675	212.5889	236.8730	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.50													
310a	359.1581	317.3751	337.0186	296.4980	287.4150	259.0277	255.9097	266.2054	269.2231	300.1012	318.8833	355.3095	
Water heating fuel													
	359.1581	317.3751	337.0186	296.4980	287.4150	259.0277	255.9097	266.2054	269.2231	300.1012	318.8833	355.3095	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
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	(331)
Lighting	27.1028	21.7429	19.5771	14.3430	11.0789	9.0516	10.1066	13.1369	17.0636	22.3883	25.2876	27.8561	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	-13.1020	-20.0685	-31.3000	-38.2673	-44.0180	-42.0799	-41.5416	-37.8162	-31.8011	-24.2152	-14.9515	-11.1476	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	-3.2384	-7.0620	-14.5273	-22.5773	-30.6350	-31.0999	-30.7628	-25.7041	-18.3808	-10.3661	-4.4039	-2.5444	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												4896.3205	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												3622.1246	(310)
Efficiency of water heater												0.0000	(311)

Electricity used for heat distribution	48.9632	(313)
Space cooling fuel	0.0000	(321)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	218.7354	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-551.6110	(333)
Wind generation	0.0000	(334)
Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	8185.5696	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367)
Space and Water heating from Boilers	8966.7844	0.2100	1082.3445	(367)
Electrical energy for heat distribution (space & water)	48.9632	0.0000	12.7423	(372)
Overall CO2 factor for heat network			0.2225	(386)
Total CO2 associated with community systems			1895.7670	(373)
Space and water heating			1895.7670	(376)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(378)
Energy for lighting	218.7354	0.1443	31.5703	(379)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-350.3089	0.1329	-46.5619	
PV Unit electricity exported	-201.3020	0.1249	-25.1402	
Total			-71.7021	(380)
Total CO2, kg/year			1855.6351	(383)
EPC Target Carbon Dioxide Emission Rate (TER)			18.4800	(384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(467a)
Space and Water heating from Boilers	8966.7844	1.1300	5824.0444	(467)
Electrical energy for heat distribution (space & water)	48.9632	0.0000	132.3357	(472)
Overall CO2 factor for heat network			1.2050	(486)
Total CO2 associated with community systems			10264.8021	(473)
Space and water heating			10264.8021	(476)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(478)
Energy for lighting	218.7354	1.5338	335.5037	(479)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-350.3089	1.4911	-522.3604	
PV Unit electricity exported	-201.3020	0.4584	-92.2714	
Total			-614.6318	(480)
Total Primary energy kWh/year			9985.6740	(483)
Target Primary Energy Rate (TPER)			99.4200	(484)

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		100.4400 (1b)	x	2.5100 (2b)	=	252.1044	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.4400						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	252.1044	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1587	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		6.0000	(17)
Infiltration rate		0.4587	(18)
Number of sides sheltered		4	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3211 (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	0.4094	0.4013	0.3933	0.3532	0.3451	0.3050	0.3050	0.2970	0.3211	0.3451	0.3612	0.3773	(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	0.5838	0.5805	0.5773	0.5624	0.5596	0.5465	0.5465	0.5441	0.5515	0.5596	0.5652	0.5712	(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	
Windows (Uw = 1.40)			13.8700	1.3258	18.3883			(27)
Glazed Doors (Uw = 1.40)			13.6000	1.3258	18.0303			(27)
Basement Floor			100.4400	0.2500	25.1100	110.0000	11048.4000	(28a)
Retaining Walls	37.5500		37.5500	0.3000	11.2650	9.0000	337.9500	(29a)
Wall to Lightwells	44.4400	27.4700	16.9700	0.3000	5.0910	9.0000	152.7300	(29a)
Total net area of external elements Aum(A, m2)			182.4300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.8846			(33)
Wall to Corridor			29.9700	0.0000	0.0000	70.0000	2097.9000	(32)
Party Ceiling 1			100.4400			40.0000	4017.6000	(32b)
Internal Wall 1			173.3900			75.0000	13004.2500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 30658.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 305.2452 (35)
Thermal bridges (Default value 0.200 * total exposed area) 36.4860 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 114.3706 (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	48.5678	48.2972	48.0318	46.7857	46.5525	45.4671	45.4671	45.2661	45.8852	46.5525	47.0242	47.5173	(38)
Heat transfer coeff	162.9384	162.6677	162.4024	161.1562	160.9231	159.8377	159.8377	159.6367	160.2557	160.9231	161.3947	161.8878	(39)

Average = Sum(39)m / 12 = 161.1551

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6222	1.6196	1.6169	1.6045	1.6022	1.5914	1.5914	1.5894	1.5955	1.6022	1.6069	1.6118	(40)
HLP (average)												1.6045	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7436 (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	30.3202	29.8700	29.2358	28.0666	27.1912	26.2204	25.6960	26.3257	27.0113	28.0501	29.2433	30.2177	(42b)
Hot water usage for other uses	42.7268	41.1731	39.6194	38.0657	36.5120	34.9583	34.9583	36.5120	38.0657	39.6194	41.1731	42.7268	(42c)

Average daily hot water use (litres/day) 66.9542 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	73.0471	71.0431	68.8552	66.1324	63.7032	61.1787	60.6543	62.8377	65.0770	67.6695	70.4165	72.9446	(44)
Energy conte	115.6887	101.1644	105.8280	90.5319	85.7567	75.2264	73.3562	77.8062	80.2465	91.8269	100.3212	114.2136	(45)

Energy content (annual) Total = Sum(45)m = 1111.9665

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	98.3354	85.9897	89.9538	76.9521	72.8932	63.9424	62.3527	66.1353	68.2095	78.0528	85.2730	97.0815	(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	98.3354	85.9897	89.9538	76.9521	72.8932	63.9424	62.3527	66.1353	68.2095	78.0528	85.2730	97.0815	(64)

Total per year (kWh/year) = Sum(64)m = 945.1715 (64)
12Total per year (kWh/year) 945 (64)

Electric shower(s)	56.2348	50.1056	54.7134	52.2124	53.1921	50.7401	52.4314	53.1921	52.2124	54.7134	53.6846	56.2348	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 639.6671 (64a)

Heat gains from water heating, kWh/month	38.6425	34.0238	36.1668	32.2911	31.5213	28.6706	28.6960	29.8319	30.1055	33.1916	34.7394	38.3291	(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	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	129.6766	143.5705	129.6766	133.9991	129.6766	133.9991	129.6766	129.6766	133.9991	129.6766	133.9991	129.6766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.0371	259.7044	252.9830	238.6740	220.6115	203.6353	192.2941	189.6269	196.3482	210.6572	228.7198	245.6960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	(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)	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	(71)

Water heating gains (Table 5)

	51.9389	50.6307	48.6113	44.8488	42.3674	39.8203	38.5700	40.0966	41.8132	44.6123	48.2492	51.5176 (72)
Total internal gains												
	502.8060	518.0590	495.4243	481.6754	456.8089	441.6082	424.6941	423.5535	436.3140	449.0996	475.1215	491.0436 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.3600	10.6334	0.4000	0.7000	0.5400	4.8619 (74)
East	4.9200	19.6403	0.4000	0.7000	0.5400	13.1494 (76)
West	5.5900	19.6403	0.4000	0.7000	0.5400	14.9401 (80)
North	6.8200	10.6334	0.4000	0.7000	0.5400	9.8685 (74)
West	6.7800	19.6403	0.4000	0.7000	0.5400	18.1205 (80)

Solar gains	60.9404	118.5472	196.7051	293.9533	369.5904	383.1909	362.7731	304.8292	230.6552	140.7728	75.7903	50.2809 (83)
Total gains	563.7465	636.6062	692.1294	775.6287	826.3993	824.7990	787.4672	728.3826	666.9692	589.8724	550.9118	541.3244 (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	52.2672	52.3542	52.4398	52.8453	52.9218	53.2812	53.2812	53.3483	53.1422	52.9218	52.7672	52.6064	
alpha	4.4845	4.4903	4.4960	4.5230	4.5281	4.5521	4.5521	4.5566	4.5428	4.5281	4.5178	4.5071	
util living area													
	0.9993	0.9987	0.9971	0.9906	0.9684	0.8958	0.7707	0.8233	0.9575	0.9942	0.9987	0.9994	(86)
MIT	19.1734	19.3204	19.5896	19.9971	20.4088	20.7584	20.9180	20.8855	20.6030	20.0770	19.5634	19.1528	(87)
Th 2	19.5971	19.5990	19.6010	19.6100	19.6117	19.6197	19.6197	19.6211	19.6166	19.6117	19.6083	19.6047	(88)
util rest of house													
	0.9990	0.9981	0.9957	0.9850	0.9454	0.8084	0.5856	0.6563	0.9136	0.9898	0.9979	0.9992	(89)
MIT 2	17.9638	18.1121	18.3822	18.7936	19.1941	19.5044	19.6013	19.5904	19.3831	18.8762	18.3619	17.9489	(90)
Living area fraction									fLA = Living area / (4) =			0.2903	(91)
MIT	18.3150	18.4629	18.7328	19.1430	19.5468	19.8684	19.9836	19.9664	19.7373	19.2248	18.7107	18.2984	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3150	18.4629	18.7328	19.1430	19.5468	19.8684	19.9836	19.9664	19.7373	19.2248	18.7107	18.2984	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9973	0.9943	0.9823	0.9439	0.8283	0.6424	0.7071	0.9190	0.9880	0.9972	0.9988	(94)
Useful gains	562.9454	634.8974	688.1789	761.9152	780.0760	683.1722	505.8580	515.0648	612.9328	582.7671	549.3686	540.6943	(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													
	2283.5741	2206.2534	1986.6309	1650.7209	1262.7254	842.0957	540.8280	569.3246	903.4088	1387.9322	1873.9120	2282.3630	(97)
Space heating kWh													
	1280.1477	1055.9512	966.0483	639.9401	359.0911	0.0000	0.0000	0.0000	0.0000	599.0428	953.6713	1295.8015	(98a)
Space heating requirement - total per year (kWh/year)												7149.6941	
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													
	1280.1477	1055.9512	966.0483	639.9401	359.0911	0.0000	0.0000	0.0000	0.0000	599.0428	953.6713	1295.8015	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7149.6941	
Space heating per m2											(98c) / (4) =	71.1837	(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	1502.4741	1182.7988	1213.2387	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6067	0.7031	0.6485	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	911.5009	831.6172	786.7767	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	960.9048	917.1737	843.2828	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	35.5708	63.6540	42.0405	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	8.8927	15.9135	10.5101	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												35.3163	(107)
Energy for space heating												71.1837	(99)
Energy for space cooling												0.3516	(108)
Total												71.5353	(109)
Fabric Energy Efficiency (DFEE)												71.5	(109)

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

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	100.4400 (1b)	x	2.5100 (2b)	=	252.1044	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	252.1044	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1587	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4087	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2861	(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	0.3647	0.3576	0.3504	0.3147	0.3075	0.2718	0.2718	0.2646	0.2861	0.3075	0.3218	0.3361	(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	0.5665	0.5639	0.5614	0.5495	0.5473	0.5369	0.5369	0.5350	0.5409	0.5473	0.5518	0.5565	(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 Opening Type (Uw = 1.20)			25.1100	1.1450	28.7519			(27)
Basement Floor			100.4400	0.1300	13.0572			(28a)
Retaining Walls	37.5500		37.5500	0.1800	6.7590			(29a)
Wall to Lightwells	44.4400	25.1100	19.3300	0.1800	3.4794			(29a)
Total net area of external elements Aum(A, m2)			182.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.0475			(33)
Wall to Corridor			29.9700	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							305.2452	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							9.1215	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		61.1690	(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	47.1309	46.9160	46.7054	45.7161	45.5310	44.6694	44.6694	44.5098	45.0013	45.5310	45.9055	46.2969	(38)
Heat transfer coeff	108.2999	108.0850	107.8744	106.8851	106.7000	105.8384	105.8384	105.6788	106.1703	106.7000	107.0745	107.4659	(39)
Average = Sum(39)m / 12 =												106.8842	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0783	1.0761	1.0740	1.0642	1.0623	1.0537	1.0537	1.0522	1.0571	1.0623	1.0661	1.0700	(40)
HLP (average)												1.0642	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7436	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	30.3202	29.8700	29.2358	28.0666	27.1912	26.2204	25.6960	26.3257	27.0113	28.0501	29.2433	30.2177	(42b)
Hot water usage for other uses	42.7268	41.1731	39.6194	38.0657	36.5120	34.9583	34.9583	36.5120	38.0657	39.6194	41.1731	42.7268	(42c)
Average daily hot water use (litres/day)												66.9542	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	73.0471	71.0431	68.8552	66.1324	63.7032	61.1787	60.6543	62.8377	65.0770	67.6695	70.4165	72.9446	(44)
Energy conte	115.6887	101.1644	105.8280	90.5319	85.7567	75.2264	73.3562	77.8062	80.2465	91.8269	100.3212	114.2136	(45)
Energy content (annual)										Total = Sum(45)m =		1111.9665	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	98.3354	85.9897	89.9538	76.9521	72.8932	63.9424	62.3527	66.1353	68.2095	78.0528	85.2730	97.0815	(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													
	98.3354	85.9897	89.9538	76.9521	72.8932	63.9424	62.3527	66.1353	68.2095	78.0528	85.2730	97.0815	(64)
											Total per year (kWh/year) = Sum(64)m =	945.1715	(64)
12Total per year (kWh/year)												945	(64)
Electric shower(s)													
	56.2348	50.1056	54.7134	52.2124	53.1921	50.7401	52.4314	53.1921	52.2124	54.7134	53.6846	56.2348	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	639.6671	(64a)
Heat gains from water heating, kWh/month													
	38.6425	34.0238	36.1668	32.2911	31.5213	28.6706	28.6960	29.8319	30.1055	33.1916	34.7394	38.3291	(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	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	137.1781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	130.4399	144.4156	130.4399	134.7879	130.4399	134.7879	130.4399	130.4399	134.7879	130.4399	134.7879	130.4399	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.0371	259.7044	252.9830	238.6740	220.6115	203.6353	192.2941	189.6269	196.3482	210.6572	228.7198	245.6960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	36.7178	(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)													
	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	(71)
Water heating gains (Table 5)													
	51.9389	50.6307	48.6113	44.8488	42.3674	39.8203	38.5700	40.0966	41.8132	44.6123	48.2492	51.5176	(72)
Total internal gains													
	503.5694	518.9041	496.1876	482.4641	457.5722	442.3969	425.4574	424.3168	437.1027	449.8629	475.9103	491.8069	(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	9.3000	10.6334	0.6300	0.7000	0.5400	21.1948	(74)
East	4.5000	19.6403	0.6300	0.7000	0.5400	18.9424	(76)
West	11.3100	19.6403	0.6300	0.7000	0.5400	47.6085	(80)

Solar gains	87.7457	170.6921	283.2275	423.2441	532.1397	551.7171	522.3216	438.9002	332.1090	202.6939	109.1277	72.3973	(83)
Total gains	591.3151	689.5962	779.4151	905.7082	989.7119	994.1141	947.7790	863.2170	769.2117	652.5567	585.0380	564.2042	(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	78.6366	78.7930	78.9468	79.6775	79.8157	80.4655	80.4655	80.5870	80.2140	79.8157	79.5366	79.2469	
alpha	6.2424	6.2529	6.2631	6.3118	6.3210	6.3644	6.3644	6.3725	6.3476	6.3210	6.3024	6.2831	
util living area													
	0.9994	0.9981	0.9936	0.9658	0.8645	0.6613	0.4886	0.5567	0.8419	0.9853	0.9983	0.9995	(86)
MIT	19.8812	20.0333	20.2739	20.6146	20.8741	20.9816	20.9976	20.9949	20.9217	20.5701	20.1676	19.8579	(87)
Th 2	20.0186	20.0204	20.0221	20.0302	20.0317	20.0388	20.0388	20.0401	20.0361	20.0317	20.0287	20.0254	(88)
util rest of house													
	0.9991	0.9974	0.9907	0.9506	0.8130	0.5714	0.3835	0.4442	0.7650	0.9763	0.9975	0.9993	(89)
MIT 2	18.9974	19.1505	19.3909	19.7275	19.9540	20.0318	20.0383	20.0390	19.9975	19.6916	19.2915	18.9796	(90)
Living area fraction											fLA = Living area / (4) =	0.2903	(91)
MIT	19.2540	19.4068	19.6473	19.9851	20.2211	20.3075	20.3168	20.3165	20.2658	19.9466	19.5458	19.2346	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2540	19.4068	19.6473	19.9851	20.2211	20.3075	20.3168	20.3165	20.2658	19.9466	19.5458	19.2346	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9967	0.9893	0.9497	0.8242	0.5974	0.4142	0.4772	0.7854	0.9752	0.9969	0.9991	(94)
Useful gains	590.6179	687.3190	771.0448	860.1701	815.7075	593.8626	392.5272	411.8893	604.1773	636.3818	583.2018	563.7097	(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													
	1619.5152	1567.9642	1418.2548	1184.8289	909.2065	604.0739	393.3824	413.8888	654.6276	997.2864	1332.6326	1615.7027	(97)
Space heating kWh													
	765.4995	591.7935	481.5242	233.7543	69.5632	0.0000	0.0000	0.0000	0.0000	268.5130	539.5902	782.6828	(98a)
Space heating requirement - total per year (kWh/year)												3732.9209	
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													
	765.4995	591.7935	481.5242	233.7543	69.5632	0.0000	0.0000	0.0000	0.0000	268.5130	539.5902	782.6828	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3732.9209	
Space heating per m2											(98c) / (4) =	37.1657	(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	994.8807	783.2040	803.1590	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9258	0.9673	0.9434	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	921.1012	757.5918	757.6864	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1179.4316	1124.0680	1017.1725	0.0000	0.0000	0.0000	0.0000	(103)

Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	185.9979	272.6583	193.0576	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	46.4995	68.1646	48.2644	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												162.9284	(107)
Energy for space heating												37.1657	(99)
Energy for space cooling												1.6221	(108)
Total												38.7878	(109)
Fabric Energy Efficiency (TFEE)												38.8	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	100.4400	(1b)	x 2.5100	(2b) =	252.1044	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.4400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	252.1044	(5)

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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		6.0000	(17)
Infiltration rate		0.3000	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2100	(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													
	0.2677	0.2625	0.2573	0.2310	0.2257	0.1995	0.1995	0.1943	0.2100	0.2257	0.2362	0.2467	(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) =												79.2000	(23c)
Effective ac	0.3717	0.3665	0.3613	0.3350	0.3297	0.3035	0.3035	0.2983	0.3140	0.3297	0.3402	0.3508	(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	
Windows (Uw = 1.40)			13.8700	1.3258	18.3883			(27)
Glazed Doors (Uw = 1.40)			13.6000	1.3258	18.0303			(27)
Basement Floor			100.4400	0.2500	25.1100	110.0000	11048.4000	(28a)
Retaining Walls	37.5500		37.5500	0.3000	11.2650	9.0000	337.9500	(29a)
Wall to Lightwells	44.4400	27.4700	16.9700	0.3000	5.0910	9.0000	152.7300	(29a)
Total net area of external elements Aum(A, m2)			182.4300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.8846			(33)
Wall to Corridor			29.9700	0.0000	0.0000	70.0000	2097.9000	(32)
Party Ceiling 1			100.4400			40.0000	4017.6000	(32b)
Internal Wall 1			173.3900			75.0000	13004.2500	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		30658.8300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							305.2452	(35)
Thermal bridges (Default value 0.200 * total exposed area)							36.4860	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		114.3706	(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	30.9275	30.4908	30.0540	27.8701	27.4334	25.2495	25.2495	24.8127	26.1231	27.4334	28.3069	29.1805	(38)
Heat transfer coeff													
	145.2981	144.8613	144.4246	142.2407	141.8039	139.6201	139.6201	139.1833	140.4936	141.8039	142.6775	143.5510	(39)
Average = Sum(39)m / 12 =												142.1315	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4466	1.4423	1.4379	1.4162	1.4118	1.3901	1.3901	1.3857	1.3988	1.4118	1.4205	1.4292	(40)

HLP (average)												1.4151	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7436	(42)
Hot water usage for mixer showers													
	78.9978	77.8107	76.0807	72.7707	70.3281	67.6040	66.0557	67.7725	69.6545	72.5793	75.9604	78.6952	(42a)
Hot water usage for baths													
	30.3202	29.8700	29.2358	28.0666	27.1912	26.2204	25.6960	26.3257	27.0113	28.0501	29.2433	30.2177	(42b)
Hot water usage for other uses													
	42.7268	41.1731	39.6194	38.0657	36.5120	34.9583	34.9583	36.5120	38.0657	39.6194	41.1731	42.7268	(42c)
Average daily hot water use (litres/day)												139.7876	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	152.0449	148.8537	144.9359	138.9031	134.0312	128.7827	126.7100	130.6103	134.7316	140.2488	146.3769	151.6397	(44)
Energy conte	240.8020	211.9657	222.7611	190.1514	180.4318	158.3534	153.2448	161.7228	166.1375	190.3163	208.5407	237.4312	(45)
Energy content (annual)										Total = Sum(45)m =		2321.8586	
Distribution loss (46)m = 0.15 x (45)m													
	36.1203	31.7949	33.4142	28.5227	27.0648	23.7530	22.9867	24.2584	24.9206	28.5474	31.2811	35.6147	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												1.0800	(55)
Total storage loss													
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
If cylinder contains dedicated solar storage													
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(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													
	297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(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													
	297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(64)
										Total per year (kWh/year) = Sum(64)m =		2989.9546	(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													
	125.4606	111.4796	119.4620	107.1549	105.3875	96.5821	96.3478	99.1667	99.1703	108.6741	113.2694	124.3398	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.7970	31.7946	25.8571	19.5755	14.6329	12.3537	13.3486	17.3510	23.2885	29.5701	34.5127	36.7919	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	383.6375	387.6185	377.5866	356.2299	329.2709	303.9333	287.0062	283.0252	293.0571	314.4138	341.3728	366.7104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	(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)													
	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	(71)
Water heating gains (Table 5)													
	168.6298	165.8922	160.5672	148.8263	141.6499	134.1418	129.4997	133.2886	137.7366	146.0673	157.3186	167.1234	(72)
Total internal gains													
	697.1405	694.3814	673.0870	633.7078	594.6298	559.5049	538.9307	542.7410	563.1583	599.1274	642.2802	679.7018	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3600	10.6334	0.4000	0.7000	0.5400	4.8619	(74)
East	4.9200	19.6403	0.4000	0.7000	0.5400	13.1494	(76)
West	5.5900	19.6403	0.4000	0.7000	0.5400	14.9401	(80)
North	6.8200	10.6334	0.4000	0.7000	0.5400	9.8685	(74)
West	6.7800	19.6403	0.4000	0.7000	0.5400	18.1205	(80)

Solar gains	60.9404	118.5472	196.7051	293.9533	369.5904	383.1909	362.7731	304.8292	230.6552	140.7728	75.7903	50.2809	(83)
Total gains	758.0809	812.9286	869.7921	927.6612	964.2202	942.6958	901.7038	847.5702	793.8135	739.9002	718.0706	729.9827	(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	58.6129	58.7896	58.9674	59.8727	60.0572	60.9965	60.9965	61.1880	60.6173	60.0572	59.6895	59.3262	
alpha	4.9075	4.9193	4.9312	4.9915	5.0038	5.0664	5.0664	5.0792	5.0412	5.0038	4.9793	4.9551	
util living area													
	0.9977	0.9963	0.9923	0.9784	0.9338	0.8120	0.6469	0.7011	0.9056	0.9839	0.9959	0.9981	(86)
MIT	19.5493	19.6769	19.9293	20.2902	20.6347	20.8878	20.9728	20.9596	20.7809	20.3480	19.8943	19.5343	(87)
Th 2	19.7278	19.7311	19.7344	19.7510	19.7543	19.7709	19.7709	19.7743	19.7643	19.7543	19.7476	19.7410	(88)
util rest of house													
	0.9968	0.9948	0.9887	0.9670	0.8954	0.7080	0.4841	0.5414	0.8355	0.9733	0.9939	0.9973	(89)
MIT 2	18.0715	18.2368	18.5610	19.0272	19.4420	19.7096	19.7640	19.7622	19.6155	19.1067	18.5270	18.0616	(90)
Living area fraction											fLA = Living area / (4) =	0.2903	(91)

MIT	18.5005	18.6549	18.9582	19.3939	19.7882	20.0517	20.1149	20.1099	19.9538	19.4671	18.9240	18.4892	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5005	18.6549	18.9582	19.3939	19.7882	20.0517	20.1149	20.1099	19.9538	19.4671	18.9240	18.4892	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9928	0.9855	0.9626	0.8967	0.7350	0.5326	0.5890	0.8489	0.9698	0.9918	0.9961	(94)
Useful gains	754.5493	807.0513	857.1521	892.9673	864.6182	692.9284	480.2327	499.2271	673.8536	717.5325	712.1698	727.1652	(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													
	2063.3119	1992.5527	1799.2724	1492.6592	1146.9430	761.1617	490.7525	516.3498	822.4226	1257.3891	1687.0153	2051.2220	(97)
Space heating kWh													
	973.7194	796.6569	700.9375	431.7782	210.0497	0.0000	0.0000	0.0000	0.0000	401.6533	701.8887	985.0982	(98a)
Space heating requirement - total per year (kWh/year)												5201.7820	
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													
	973.7194	796.6569	700.9375	431.7782	210.0497	0.0000	0.0000	0.0000	0.0000	401.6533	701.8887	985.0982	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5201.7820	
Space heating per m2											(98c) / (4) =	51.7899	(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	1312.4287	1033.1886	1057.7931	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7334	0.8252	0.7815	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	962.5226	852.5786	826.6554	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1056.2338	1009.1921	937.8899	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	67.4721	116.5204	82.7585	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	0.6372	(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	10.7482	18.5616	13.1834	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												42.4932	(107)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Boilers-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.5000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	973.7194	796.6569	700.9375	431.7782	210.0497	0.0000	0.0000	0.0000	0.0000	401.6533	701.8887	985.0982	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.50													
307a	1460.5791	1194.9854	1051.4063	647.6673	315.0745	0.0000	0.0000	0.0000	0.0000	602.4800	1052.8331	1477.6474	
Space heating requirement													
	1460.5791	1194.9854	1051.4063	647.6673	315.0745	0.0000	0.0000	0.0000	0.0000	602.4800	1052.8331	1477.6474	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.50													
310a	446.3165	394.8254	419.2553	367.5951	355.7613	319.8981	314.9808	327.6978	331.5743	370.5881	395.1790	441.2604	
Water heating fuel													
	446.3165	394.8254	419.2553	367.5951	355.7613	319.8981	314.9808	327.6978	331.5743	370.5881	395.1790	441.2604	(310)
Cooling System Energy Efficiency Ratio												2.6000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	4.1339	7.1391	5.0705	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	24.8683	22.4617	24.8683	24.0661	24.8683	24.0661	24.8683	24.8683	24.0661	24.8683	24.0661	24.8683	(331)
Lighting	31.3329	25.1364	22.6325	16.5816	12.8081	10.4643	11.6840	15.1873	19.7267	25.8826	29.2343	32.2037	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												7802.6730	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												4484.9319	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												78.0267	(313)
Space cooling fuel												16.3435	(321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9520)													
mechanical ventilation fans (SFP = 0.9520)												292.8041	(330a)
Total electricity for the above, kWh/year												292.8041	(331)
Electricity for lighting (calculated in Appendix L)												252.8744	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(333)
Wind generation												0.0000	(334)

Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	12849.6270	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	7802.6730	4.4400	346.4387	(340a)
Space heating total			346.4387	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	4484.9319	4.4400	199.1310	(342a)
Water heating total			199.1310	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Space cooling	16.3435	16.4900	2.6950	(348)
Pumps, fans and electric keep-hot	292.8041	16.4900	48.2834	(349)
Energy for lighting	252.8744	16.4900	41.6990	(350)
Additional standing charges			92.0000	(351)
Total energy cost			730.2471	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600	(356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.8075	(357)
SAP value		70.6997	
SAP rating (Section 12)		71	(358)
SAP band		C	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367)
Space and Water heating from Boilers	12934.3210	0.2100	1724.8014	(367)
Electrical energy for heat distribution (space & water)	78.0267	0.0000	18.3821	(372)
Overall CO2 factor for heat network			0.2225	(386)
Total CO2 associated with community systems			2734.5895	(373)
Space and water heating			2734.5895	(376)
Space cooling	16.3435	0.1136	1.8564	(377)
Pumps, fans and electric keep-hot	292.8041	0.1387	40.6155	(378)
Energy for lighting	252.8744	0.1443	36.4976	(379)
Total CO2, kg/year			2813.5591	(383)
CO2 emissions per m2			28.0100	(384)
EI value			74.0775	(384a)
EI rating			74	(385)
EI band			C	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		100.4400 (1b)	x	2.5100 (2b)	=	252.1044	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.4400						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	252.1044	(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		6.0000	(17)
Infiltration rate		0.3000	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2100	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.2000	4.1000	3.8000	3.9000	3.4000	3.5000	3.4000	3.4000	3.7000	3.6000	4.0000	(22)
Wind factor	1.0750	1.0500	1.0250	0.9500	0.9750	0.8500	0.8750	0.8500	0.8500	0.9250	0.9000	1.0000	(22a)
Adj infilt rate	0.2257	0.2205	0.2152	0.1995	0.2047	0.1785	0.1837	0.1785	0.1785	0.1943	0.1890	0.2100	(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) = 79.2000 (23c)

Effective ac	0.3297	0.3245	0.3192	0.3035	0.3087	0.2825	0.2877	0.2825	0.2825	0.2983	0.2930	0.3140	(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	
Windows (Uw = 1.40)			13.8700	1.3258	18.3883			(27)
Glazed Doors (Uw = 1.40)			13.6000	1.3258	18.0303			(27)
Basement Floor			100.4400	0.2500	25.1100	110.0000	11048.4000	(28a)
Retaining Walls	37.5500		37.5500	0.3000	11.2650	9.0000	337.9500	(29a)
Wall to Lightwells	44.4400	27.4700	16.9700	0.3000	5.0910	9.0000	152.7300	(29a)
Total net area of external elements Aum(A, m2)			182.4300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.8846			(33)
Wall to Corridor			29.9700	0.0000	0.0000	70.0000	2097.9000	(32)
Party Ceiling 1			100.4400			40.0000	4017.6000	(32b)
Internal Wall 1			173.3900			75.0000	13004.2500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 30658.8300 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 305.2452 (35)

Thermal bridges (Default value 0.200 * total exposed area) 36.4860 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 114.3706 (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	27.4334	26.9966	26.5598	25.2495	25.6863	23.5024	23.9392	23.5024	23.5024	24.8127	24.3760	26.1231	(38)
Heat transfer coeff	141.8039	141.3672	140.9304	139.6201	140.0568	137.8730	138.3098	137.8730	137.8730	139.1833	138.7465	140.4936	(39)

Average = Sum(39)m / 12 = 139.5109

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4118	1.4075	1.4031	1.3901	1.3944	1.3727	1.3770	1.3727	1.3727	1.3857	1.3814	1.3988	(40)
HLP (average)												1.3890	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7436 (42)

Hot water usage for mixer showers

78.9978	77.8107	76.0807	72.7707	70.3281	67.6040	66.0557	67.7725	69.6545	72.5793	75.9604	78.6952	(42a)

Hot water usage for baths

30.3202	29.8700	29.2358	28.0666	27.1912	26.2204	25.6960	26.3257	27.0113	28.0501	29.2433	30.2177	(42b)

Hot water usage for other uses

42.7268	41.1731	39.6194	38.0657	36.5120	34.9583	34.9583	36.5120	38.0657	39.6194	41.1731	42.7268	(42c)

Average daily hot water use (litres/day) 139.7876 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.0449	148.8537	144.9359	138.9031	134.0312	128.7827	126.7100	130.6103	134.7316	140.2488	146.3769	151.6397	(44)
Energy conte	240.8020	211.9657	222.7611	190.1514	180.4318	158.3534	153.2448	161.7228	166.1375	190.3163	208.5407	237.4312	(45)
Energy content (annual)										Total = Sum(45)m =		2321.8586	
Distribution loss (46)m = 0.15 x (45)m	36.1203	31.7949	33.4142	28.5227	27.0648	23.7530	22.9867	24.2584	24.9206	28.5474	31.2811	35.6147	(46)

Water storage loss:

Store volume 300.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.8000 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 1.0800 (55)

Total storage loss

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)

If cylinder contains dedicated solar storage

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)
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)
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)

Primary loss / Combi loss

Total heat required for water heating calculated for each month

297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(62)
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)
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)
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)
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)

WWHRS / PV diverter / Solar input / FGHRS

Output from w/h

297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(64)

Total per year (kWh/year) = Sum(64)m = 2989.9546 (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

125.4606	111.4796	119.4620	107.1549	105.3875	96.5821	96.3478	99.1667	99.1703	108.6741	113.2694	124.3398	(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	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.7970	31.7946	25.8571	19.5755	14.6329	12.3537	13.3486	17.3510	23.2885	29.5701	34.5127	36.7919	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	383.6375	387.6185	377.5866	356.2299	329.2709	303.9333	287.0062	283.0252	293.0571	314.4138	341.3728	366.7104	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	(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)													
	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	(71)
Water heating gains (Table 5)													
	168.6298	165.8922	160.5672	148.8263	141.6499	134.1418	129.4997	133.2886	137.7366	146.0673	157.3186	167.1234	(72)
Total internal gains													
	697.1405	694.3814	673.0870	633.7078	594.6298	559.5049	538.9307	542.7410	563.1583	599.1274	642.2802	679.7018	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3600	11.5683	0.4000	0.7000	0.5400	5.2894	(74)
East	4.9200	21.5704	0.4000	0.7000	0.5400	14.4416	(76)
West	5.5900	21.5704	0.4000	0.7000	0.5400	16.4083	(80)
North	6.8200	11.5683	0.4000	0.7000	0.5400	10.7362	(74)
West	6.7800	21.5704	0.4000	0.7000	0.5400	19.9013	(80)

Solar gains	66.7767	116.8379	194.8121	300.2639	366.7702	405.5636	383.1582	332.6811	250.7829	151.6289	85.8151	54.0560	(83)
Total gains	763.9172	811.2193	867.8991	933.9717	961.4001	965.0685	922.0889	875.4221	813.9413	750.7563	728.0953	733.7578	(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	60.0572	60.2427	60.4294	60.9965	60.8063	61.7695	61.5744	61.7695	61.7695	61.1880	61.3806	60.6173	
alpha	5.0038	5.0162	5.0286	5.0664	5.0538	5.1180	5.1050	5.1180	5.1180	5.0792	5.0920	5.0412	
util living area													
	0.9967	0.9950	0.9876	0.9605	0.8645	0.6056	0.3587	0.4070	0.7793	0.9661	0.9930	0.9972	(86)
MIT	19.7457	19.8526	20.1476	20.5016	20.8203	20.9805	20.9990	20.9981	20.9274	20.5621	20.1130	19.7351	(87)
Th 2	19.7543	19.7576	19.7609	19.7709	19.7676	19.7843	19.7810	19.7843	19.7843	19.7743	19.7776	19.7643	(88)
util rest of house													
	0.9952	0.9927	0.9812	0.9382	0.7872	0.4505	0.1771	0.2180	0.6427	0.9412	0.9890	0.9960	(89)
MIT 2	18.3414	18.4800	18.8569	19.3009	19.6474	19.7795	19.7810	19.7843	19.7548	19.3833	18.8270	18.3350	(90)
Living area fraction									fLA = Living area / (4) =			0.2903	(91)
MIT	18.7491	18.8785	19.2316	19.6495	19.9879	20.1282	20.1346	20.1367	20.0952	19.7256	19.2004	18.7415	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7491	18.8785	19.2316	19.6495	19.9879	20.1282	20.1346	20.1367	20.0952	19.7256	19.2004	18.7415	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9903	0.9774	0.9353	0.8034	0.4964	0.2301	0.2733	0.6822	0.9399	0.9863	0.9944	(94)
Useful gains	758.8739	803.3618	848.2785	873.5533	772.3872	479.0889	212.1568	239.2096	555.2325	705.6147	718.1079	729.6608	(95)
Ext temp.	5.5000	6.0000	8.0000	10.5000	13.6000	16.6000	18.6000	18.4000	15.8000	12.2000	8.5000	5.5000	(96)
Heat loss rate W													
	1878.7791	1820.5996	1582.8762	1277.4537	894.6683	486.4399	212.2473	239.4382	592.1930	1047.4333	1484.6386	1860.3452	(97)
Space heating kWh													
	833.2095	683.5838	546.5407	290.8083	90.9772	0.0000	0.0000	0.0000	0.0000	254.3131	551.9021	841.2292	(98a)
Space heating requirement - total per year (kWh/year)												4092.5638	
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													
	833.2095	683.5838	546.5407	290.8083	90.9772	0.0000	0.0000	0.0000	0.0000	254.3131	551.9021	841.2292	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4092.5638	
Space heating per m2											(98c) / (4) =	40.7464	(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.	5.5000	6.0000	8.0000	10.5000	13.6000	16.6000	18.6000	18.4000	15.8000	12.2000	8.5000	5.5000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1020.2602	746.8727	772.0888	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8612	0.9392	0.9168	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	878.6873	701.4409	707.8337	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1085.2355	1035.6172	973.9943	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	148.7148	248.6272	198.0235	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			0.6372	(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	23.6901	39.6061	31.5450	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												94.8412	(107)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers-Space and Water	1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating	1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.5000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		
Space heating requirement		

	833.2095	683.5838	546.5407	290.8083	90.9772	0.0000	0.0000	0.0000	0.0000	254.3131	551.9021	841.2292	(98)

Space heat from Boilers = (98) x 1.00 x 1.00 x 1.50

307a	1249.8142	1025.3757	819.8110	436.2125	136.4657	0.0000	0.0000	0.0000	0.0000	381.4696	827.8532	1261.8438	
Space heating requirement													
	1249.8142	1025.3757	819.8110	436.2125	136.4657	0.0000	0.0000	0.0000	0.0000	381.4696	827.8532	1261.8438	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)

Water heating

Annual water heating requirement													
	297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.50													
310a	446.3165	394.8254	419.2553	367.5951	355.7613	319.8981	314.9808	327.6978	331.5743	370.5881	395.1790	441.2604	
Water heating fuel													
	446.3165	394.8254	419.2553	367.5951	355.7613	319.8981	314.9808	327.6978	331.5743	370.5881	395.1790	441.2604	(310)
Cooling System Energy Efficiency Ratio												2.6000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	9.1116	15.2331	12.1327	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	24.8683	22.4617	24.8683	24.0661	24.8683	24.0661	24.8683	24.8683	24.0661	24.8683	24.0661	24.8683	(331)
Lighting	31.3329	25.1364	22.6325	16.5816	12.8081	10.4643	11.6840	15.1873	19.7267	25.8826	29.2343	32.2037	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)

Annual totals kWh/year		
Space heating fuel - community heating	6138.8458	(307)
Space heating fuel - secondary	0.0000	(309)
Water heating fuel - community heating	4484.9319	(310)
Efficiency of water heater	0.0000	(311)
Electricity used for heat distribution	61.3885	(313)
Space cooling fuel	36.4774	(321)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9520)		
mechanical ventilation fans (SFP = 0.9520)	292.8041	(330a)
Total electricity for the above, kWh/year	292.8041	(331)
Electricity for lighting (calculated in Appendix L)	252.8744	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(333)
Wind generation	0.0000	(334)
Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	11205.9336	(338)

10b. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	6138.8458	4.8000	294.6646	(340a)
Space heating total			294.6646	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	4484.9319	4.8000	215.2767	(342a)
Water heating total			215.2767	(342)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(347a)
Space cooling	36.4774	21.5100	7.8463	(348)
Pumps, fans and electric keep-hot	292.8041	21.5100	62.9822	(349)
Energy for lighting	252.8744	21.5100	54.3933	(350)
Additional standing charges			98.0000	(351)
Total energy cost			733.1631	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367)
Space and Water heating from Boilers	11182.9239	0.2100	1357.0080	(367)
Electrical energy for heat distribution (space & water)	61.3885	0.0000	15.8827	(372)
Overall CO2 factor for heat network			0.2225	(386)
Total CO2 associated with community systems			2364.2967	(373)
Space and water heating			2364.2967	(376)
Space cooling	36.4774	0.1136	4.1431	(377)
Pumps, fans and electric keep-hot	292.8041	0.1387	40.6155	(378)
Energy for lighting	252.8744	0.1443	36.4976	(379)
Total CO2, kg/year			2445.5529	(383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(467a)
Space and Water heating from Boilers	11182.9239	1.1300	7301.9955	(467)
Electrical energy for heat distribution (space & water)	61.3885	0.0000	165.0115	(472)
Overall CO2 factor for heat network			1.2050	(486)
Total CO2 associated with community systems			12801.7155	(473)
Space and water heating			12801.7155	(476)
Space cooling	36.4774	1.4187	51.7520	(477)
Pumps, fans and electric keep-hot	292.8041	1.5128	442.9541	(478)
Energy for lighting	252.8744	1.5338	387.8671	(479)
Total Primary energy kWh/year			13684.2886	(483)

SAP 10 EPC IMPROVEMENTS

Apartment 1 Be Green

Current energy efficiency rating: C 71
Current environmental impact rating: C 74

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 71
Potential environmental impact rating: C 74

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£125	£125	£0
Community scheme	£608	£608	£0
Space heating	£456	£456	£0
Space cooling	£8	£8	£0
Water heating	£215	£215	£0
Lighting	£54	£54	£0
Total cost of fuels	£733	£733	£0
Total cost of uses	£733	£733	£0
Delivered energy	112 kWh/m²	112 kWh/m²	0 kWh/m²
Carbon dioxide emissions	2.4 tonnes	2.4 tonnes	0.0 tonnes
CO2 emissions per m²	24 kg/m²	24 kg/m²	0 kg/m²
Primary energy	136 kWh/m²	136 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	100.4400	(1b)	x 2.5100	(2b) =	252.1044	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	252.1044	(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		6.0000 (17)
Infiltration rate		0.3000 (18)
Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2100 (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	0.2677	0.2625	0.2573	0.2310	0.2257	0.1995	0.1995	0.1943	0.2100	0.2257	0.2362	0.2467	(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) = 79.2000 (23c)

Effective ac	0.3717	0.3665	0.3613	0.3350	0.3297	0.3035	0.3035	0.2983	0.3140	0.3297	0.3402	0.3508	(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	
Windows (Uw = 1.40)			13.8700	1.3258	18.3883			(27)
Glazed Doors (Uw = 1.40)			13.6000	1.3258	18.0303			(27)
Basement Floor			100.4400	0.2500	25.1100	110.0000	11048.4000	(28a)
Retaining Walls	37.5500		37.5500	0.3000	11.2650	9.0000	337.9500	(29a)
Wall to Lightwells	44.4400	27.4700	16.9700	0.3000	5.0910	9.0000	152.7300	(29a)
Total net area of external elements Aum(A, m2)			182.4300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.8846			(33)
Wall to Corridor			29.9700	0.0000	0.0000	70.0000	2097.9000	(32)
Party Ceiling 1			100.4400			40.0000	4017.6000	(32b)
Internal Wall 1			173.3900			75.0000	13004.2500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 30658.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 305.2452 (35)
Thermal bridges (Default value 0.200 * total exposed area) 36.4860 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 114.3706 (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	30.9275	30.4908	30.0540	27.8701	27.4334	25.2495	25.2495	24.8127	26.1231	27.4334	28.3069	29.1805	(38)
Heat transfer coeff	145.2981	144.8613	144.4246	142.2407	141.8039	139.6201	139.6201	139.1833	140.4936	141.8039	142.6775	143.5510	(39)

Average = Sum(39)m / 12 = 142.1315

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4466	1.4423	1.4379	1.4162	1.4118	1.3901	1.3901	1.3857	1.3988	1.4118	1.4205	1.4292	(40)
HLP (average)												1.4151	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7436 (42)
Hot water usage for mixer showers

78.9978	77.8107	76.0807	72.7707	70.3281	67.6040	66.0557	67.7725	69.6545	72.5793	75.9604	78.6952	(42a)

Hot water usage for baths

30.3202	29.8700	29.2358	28.0666	27.1912	26.2204	25.6960	26.3257	27.0113	28.0501	29.2433	30.2177	(42b)

Hot water usage for other uses

42.7268	41.1731	39.6194	38.0657	36.5120	34.9583	34.9583	36.5120	38.0657	39.6194	41.1731	42.7268	(42c)

Average daily hot water use (litres/day) 139.7876 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.0449	148.8537	144.9359	138.9031	134.0312	128.7827	126.7100	130.6103	134.7316	140.2488	146.3769	151.6397	(44)
Energy conte	240.8020	211.9657	222.7611	190.1514	180.4318	158.3534	153.2448	161.7228	166.1375	190.3163	208.5407	237.4312	(45)
Energy content (annual)											Total = Sum(45)m =	2321.8586	
Distribution loss (46)m = 0.15 x (45)m	36.1203	31.7949	33.4142	28.5227	27.0648	23.7530	22.9867	24.2584	24.9206	28.5474	31.2811	35.6147	(46)

Water storage loss:
Store volume 300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.8000 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 1.0800 (55)
Total storage loss

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)

If cylinder contains dedicated solar storage

33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(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

297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(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

297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(64)

Total per year (kWh/year) = Sum(64)m = 2989.9546 (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

125.4606	111.4796	119.4620	107.1549	105.3875	96.5821	96.3478	99.1667	99.1703	108.6741	113.2694	124.3398	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.7970	31.7946	25.8571	19.5755	14.6329	12.3537	13.3486	17.3510	23.2885	29.5701	34.5127	36.7919	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	383.6375	387.6185	377.5866	356.2299	329.2709	303.9333	287.0062	283.0252	293.0571	314.4138	341.3728	366.7104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	(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)	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	(71)
Water heating gains (Table 5)	168.6298	165.8922	160.5672	148.8263	141.6499	134.1418	129.4997	133.2886	137.7366	146.0673	157.3186	167.1234	(72)
Total internal gains	697.1405	694.3814	673.0870	633.7078	594.6298	559.5049	538.9307	542.7410	563.1583	599.1274	642.2802	679.7018	(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	3.3600	10.6334	0.4000	0.7000	0.5400	4.8619	(74)
East	4.9200	19.6403	0.4000	0.7000	0.5400	13.1494	(76)
West	5.5900	19.6403	0.4000	0.7000	0.5400	14.9401	(80)
North	6.8200	10.6334	0.4000	0.7000	0.5400	9.8685	(74)
West	6.7800	19.6403	0.4000	0.7000	0.5400	18.1205	(80)

Solar gains	60.9404	118.5472	196.7051	293.9533	369.5904	383.1909	362.7731	304.8292	230.6552	140.7728	75.7903	50.2809	(83)
Total gains	758.0809	812.9286	869.7921	927.6612	964.2202	942.6958	901.7038	847.5702	793.8135	739.9002	718.0706	729.9827	(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	58.6129	58.7896	58.9674	59.8727	60.0572	60.9965	60.9965	61.1880	60.6173	60.0572	59.6895	59.3262	
alpha	4.9075	4.9193	4.9312	4.9915	5.0038	5.0664	5.0664	5.0792	5.0412	5.0038	4.9793	4.9551	
util living area	0.9977	0.9963	0.9923	0.9784	0.9338	0.8120	0.6469	0.7011	0.9056	0.9839	0.9959	0.9981	(86)
MIT	19.5493	19.6769	19.9293	20.2902	20.6347	20.8878	20.9728	20.9596	20.7809	20.3480	19.8943	19.5343	(87)
Th 2	19.7278	19.7311	19.7344	19.7510	19.7543	19.7709	19.7709	19.7743	19.7643	19.7543	19.7476	19.7410	(88)
util rest of house	0.9968	0.9948	0.9887	0.9670	0.8954	0.7080	0.4841	0.5414	0.8355	0.9733	0.9939	0.9973	(89)
MIT 2	18.0715	18.2368	18.5610	19.0272	19.4420	19.7096	19.7640	19.7622	19.6155	19.1067	18.5270	18.0616	(90)
Living area fraction									fLA = Living area / (4) =			0.2903	(91)
MIT	18.5005	18.6549	18.9582	19.3939	19.7882	20.0517	20.1149	20.1099	19.9538	19.4671	18.9240	18.4892	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5005	18.6549	18.9582	19.3939	19.7882	20.0517	20.1149	20.1099	19.9538	19.4671	18.9240	18.4892	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9928	0.9855	0.9626	0.8967	0.7350	0.5326	0.5890	0.8489	0.9698	0.9918	0.9961	(94)
Useful gains	754.5493	807.0513	857.1521	892.9673	864.6182	692.9284	480.2327	499.2271	673.8536	717.5325	712.1698	727.1652	(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	2063.3119	1992.5527	1799.2724	1492.6592	1146.9430	761.1617	490.7525	516.3498	822.4226	1257.3891	1687.0153	2051.2220	(97)
Space heating kWh	973.7194	796.6569	700.9375	431.7782	210.0497	0.0000	0.0000	0.0000	0.0000	401.6533	701.8887	985.0982	(98a)
Space heating requirement - total per year (kWh/year)												5201.7820	
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	973.7194	796.6569	700.9375	431.7782	210.0497	0.0000	0.0000	0.0000	0.0000	401.6533	701.8887	985.0982	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5201.7820	
Space heating per m2										(98c) / (4) =		51.7899	(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	1312.4287	1033.1886	1057.7931	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7334	0.8252	0.7815	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	962.5226	852.5786	826.6554	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1056.2338	1009.1921	937.8899	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	67.4721	116.5204	82.7585	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			0.6372	(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	10.7482	18.5616	13.1834	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												42.4932	(107)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers-Space and Water	1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating	1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.5000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

Space heating:

Space heating requirement

	973.7194	796.6569	700.9375	431.7782	210.0497	0.0000	0.0000	0.0000	0.0000	401.6533	701.8887	985.0982	(98)

Space heat from Boilers = (98) x 1.00 x 1.00 x 1.50

307a	1460.5791	1194.9854	1051.4063	647.6673	315.0745	0.0000	0.0000	0.0000	0.0000	602.4800	1052.8331	1477.6474	

Space heating requirement

	1460.5791	1194.9854	1051.4063	647.6673	315.0745	0.0000	0.0000	0.0000	0.0000	602.4800	1052.8331	1477.6474	(307)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)

Space heating fuel for secondary/supplementary system

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)

Water heating

Annual water heating requirement

	297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736 (64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.50												
310a	446.3165	394.8254	419.2553	367.5951	355.7613	319.8981	314.9808	327.6978	331.5743	370.5881	395.1790	441.2604
Water heating fuel												
	446.3165	394.8254	419.2553	367.5951	355.7613	319.8981	314.9808	327.6978	331.5743	370.5881	395.1790	441.2604 (310)
Cooling System Energy Efficiency Ratio												2.6000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	4.1339	7.1391	5.0705	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	24.8683	22.4617	24.8683	24.0661	24.8683	24.0661	24.8683	24.8683	24.0661	24.8683	24.0661	24.8683 (331)
Lighting	31.3329	25.1364	22.6325	16.5816	12.8081	10.4643	11.6840	15.1873	19.7267	25.8826	29.2343	32.2037 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)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 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)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 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)

Annual totals kWh/year	
Space heating fuel - community heating	7802.6730 (307)
Space heating fuel - secondary	0.0000 (309)
Water heating fuel - community heating	4484.9319 (310)
Efficiency of water heater	0.0000 (311)
Electricity used for heat distribution	78.0267 (313)
Space cooling fuel	16.3435 (321)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9520)	
mechanical ventilation fans (SFP = 0.9520)	292.8041 (330a)
Total electricity for the above, kWh/year	292.8041 (331)
Electricity for lighting (calculated in Appendix L)	252.8744 (332)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (333)
Wind generation	0.0000 (334)
Hydro-electric generation (Appendix N)	0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	12849.6270 (338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	7802.6730	4.4400	346.4387	(340a)
Space heating total			346.4387	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	4484.9319	4.4400	199.1310	(342a)
Water heating total			199.1310	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Space cooling	16.3435	16.4900	2.6950	(348)
Pumps, fans and electric keep-hot	292.8041	16.4900	48.2834	(349)
Energy for lighting	252.8744	16.4900	41.6990	(350)
Additional standing charges			92.0000	(351)
Total energy cost			730.2471	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600	(356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.8075	(357)
SAP value		70.6997	
SAP rating (Section 12)		71	(358)
SAP band		C	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367)
Space and Water heating from Boilers	12934.3210	0.2100	1724.8014	(367)
Electrical energy for heat distribution (space & water)	78.0267	0.0000	18.3821	(372)
Overall CO2 factor for heat network			0.2225	(386)
Total CO2 associated with community systems			2734.5895	(373)
Space and water heating			2734.5895	(376)
Space cooling	16.3435	0.1136	1.8564	(377)
Pumps, fans and electric keep-hot	292.8041	0.1387	40.6155	(378)
Energy for lighting	252.8744	0.1443	36.4976	(379)
Total CO2, kg/year			2813.5591	(383)
CO2 emissions per m2			28.0100	(384)
EI value			74.0775	(384a)
EI rating			74	(385)
EI band			C	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	100.4400 (1b)	x	2.5100 (2b)	=	252.1044	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	252.1044	(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		6.0000	(17)
Infiltration rate		0.3000	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2100	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.2000	4.1000	3.8000	3.9000	3.4000	3.5000	3.4000	3.4000	3.7000	3.6000	4.0000	(22)
Wind factor	1.0750	1.0500	1.0250	0.9500	0.9750	0.8500	0.8750	0.8500	0.8500	0.9250	0.9000	1.0000	(22a)
Adj infilt rate	0.2257	0.2205	0.2152	0.1995	0.2047	0.1785	0.1837	0.1785	0.1785	0.1943	0.1890	0.2100	(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) =	79.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3297	0.3245	0.3192	0.3035	0.3087	0.2825	0.2877	0.2825	0.2825	0.2983	0.2930	0.3140	(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	
Windows (Uw = 1.40)			13.8700	1.3258	18.3883			(27)
Glazed Doors (Uw = 1.40)			13.6000	1.3258	18.0303			(27)
Basement Floor			100.4400	0.2500	25.1100	110.0000	11048.4000	(28a)
Retaining Walls	37.5500		37.5500	0.3000	11.2650	9.0000	337.9500	(29a)
Wall to Lightwells	44.4400	27.4700	16.9700	0.3000	5.0910	9.0000	152.7300	(29a)
Total net area of external elements Aum(A, m2)			182.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		77.8846			(33)
Wall to Corridor			29.9700	0.0000	0.0000	70.0000	2097.9000	(32)
Party Ceiling 1			100.4400			40.0000	4017.6000	(32b)
Internal Wall 1			173.3900			75.0000	13004.2500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	30658.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		305.2452 (35)
Thermal bridges (Default value 0.200 * total exposed area)		36.4860 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	114.3706 (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	27.4334	26.9966	26.5598	25.2495	25.6863	23.5024	23.9392	23.5024	23.5024	24.8127	24.3760	26.1231	(38)
Heat transfer coeff	141.8039	141.3672	140.9304	139.6201	140.0568	137.8730	138.3098	137.8730	137.8730	139.1833	138.7465	140.4936	(39)
Average = Sum(39)m / 12 =												139.5109	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4118	1.4075	1.4031	1.3901	1.3944	1.3727	1.3770	1.3727	1.3727	1.3857	1.3814	1.3988	(40)
HLP (average)												1.3890	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7436	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	78.9978	77.8107	76.0807	72.7707	70.3281	67.6040	66.0557	67.7725	69.6545	72.5793	75.9604	78.6952	(42a)
Hot water usage for baths	30.3202	29.8700	29.2358	28.0666	27.1912	26.2204	25.6960	26.3257	27.0113	28.0501	29.2433	30.2177	(42b)
Hot water usage for other uses	42.7268	41.1731	39.6194	38.0657	36.5120	34.9583	34.9583	36.5120	38.0657	39.6194	41.1731	42.7268	(42c)
Average daily hot water use (litres/day)												139.7876	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.0449	148.8537	144.9359	138.9031	134.0312	128.7827	126.7100	130.6103	134.7316	140.2488	146.3769	151.6397	(44)
Energy conte	240.8020	211.9657	222.7611	190.1514	180.4318	158.3534	153.2448	161.7228	166.1375	190.3163	208.5407	237.4312	(45)
Energy content (annual)										Total = Sum(45)m =		2321.8586	
Distribution loss (46)m = 0.15 x (45)m	36.1203	31.7949	33.4142	28.5227	27.0648	23.7530	22.9867	24.2584	24.9206	28.5474	31.2811	35.6147	(46)

Water storage loss:

Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												1.0800	(55)
Total storage loss													
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
If cylinder contains dedicated solar storage													
	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(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													
	297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(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													
	297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(64)
										Total per year (kWh/year) = Sum(64)m =		2989.9546	(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													
	125.4606	111.4796	119.4620	107.1549	105.3875	96.5821	96.3478	99.1667	99.1703	108.6741	113.2694	124.3398	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	164.6137	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.7970	31.7946	25.8571	19.5755	14.6329	12.3537	13.3486	17.3510	23.2885	29.5701	34.5127	36.7919	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	383.6375	387.6185	377.5866	356.2299	329.2709	303.9333	287.0062	283.0252	293.0571	314.4138	341.3728	366.7104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	54.2049	(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)													
	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	-109.7425	(71)
Water heating gains (Table 5)													
	168.6298	165.8922	160.5672	148.8263	141.6499	134.1418	129.4997	133.2886	137.7366	146.0673	157.3186	167.1234	(72)
Total internal gains													
	697.1405	694.3814	673.0870	633.7078	594.6298	559.5049	538.9307	542.7410	563.1583	599.1274	642.2802	679.7018	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3600	11.5683	0.4000	0.7000	0.5400	5.2894	(74)
East	4.9200	21.5704	0.4000	0.7000	0.5400	14.4416	(76)
West	5.5900	21.5704	0.4000	0.7000	0.5400	16.4083	(80)
North	6.8200	11.5683	0.4000	0.7000	0.5400	10.7362	(74)
West	6.7800	21.5704	0.4000	0.7000	0.5400	19.9013	(80)

Solar gains	66.7767	116.8379	194.8121	300.2639	366.7702	405.5636	383.1582	332.6811	250.7829	151.6289	85.8151	54.0560	(83)
Total gains	763.9172	811.2193	867.8991	933.9717	961.4001	965.0685	922.0889	875.4221	813.9413	750.7563	728.0953	733.7578	(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	60.0572	60.2427	60.4294	60.9965	60.8063	61.7695	61.5744	61.7695	61.7695	61.1880	61.3806	60.6173	
alpha	5.0038	5.0162	5.0286	5.0664	5.0538	5.1180	5.1050	5.1180	5.1180	5.0792	5.0920	5.0412	
util living area													
	0.9967	0.9950	0.9876	0.9605	0.8645	0.6056	0.3587	0.4070	0.7793	0.9661	0.9930	0.9972	(86)
MIT	19.7457	19.8526	20.1476	20.5016	20.8203	20.9805	20.9990	20.9981	20.9274	20.5621	20.1130	19.7351	(87)
Th 2	19.7543	19.7576	19.7609	19.7709	19.7676	19.7843	19.7810	19.7843	19.7843	19.7743	19.7776	19.7643	(88)
util rest of house													
	0.9952	0.9927	0.9812	0.9382	0.7872	0.4505	0.1771	0.2180	0.6427	0.9412	0.9890	0.9960	(89)
MIT 2	18.3414	18.4800	18.8569	19.3009	19.6474	19.7795	19.7810	19.7843	19.7548	19.3833	18.8270	18.3350	(90)
Living area fraction										fLA = Living area / (4) =		0.2903	(91)
MIT	18.7491	18.8785	19.2316	19.6495	19.9879	20.1282	20.1346	20.1367	20.0952	19.7256	19.2004	18.7415	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7491	18.8785	19.2316	19.6495	19.9879	20.1282	20.1346	20.1367	20.0952	19.7256	19.2004	18.7415	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9903	0.9774	0.9353	0.8034	0.4964	0.2301	0.2733	0.6822	0.9399	0.9863	0.9944	(94)
Useful gains	758.8739	803.3618	848.2785	873.5533	772.3872	479.0889	212.1568	239.2096	555.2325	705.6147	718.1079	729.6608	(95)
Ext temp.	5.5000	6.0000	8.0000	10.5000	13.6000	16.6000	18.6000	18.4000	15.8000	12.2000	8.5000	5.5000	(96)
Heat loss rate W													
	1878.7791	1820.5996	1582.8762	1277.4537	894.6683	486.4399	212.2473	239.4382	592.1930	1047.4333	1484.6386	1860.3452	(97)
Space heating kWh													
	833.2095	683.5838	546.5407	290.8083	90.9772	0.0000	0.0000	0.0000	0.0000	254.3131	551.9021	841.2292	(98a)
Space heating requirement - total per year (kWh/year)												4092.5638	
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													
	833.2095	683.5838	546.5407	290.8083	90.9772	0.0000	0.0000	0.0000	0.0000	254.3131	551.9021	841.2292	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4092.5638	

Space heating per m2 (98c) / (4) = 40.7464 (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.	5.5000	6.0000	8.0000	10.5000	13.6000	16.6000	18.6000	18.4000	15.8000	12.2000	8.5000	5.5000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1020.2602	746.8727	772.0888	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8612	0.9392	0.9168	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	878.6873	701.4409	707.8337	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1085.2355	1035.6172	973.9943	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	148.7148	248.6272	198.0235	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		0.6372	(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	23.6901	39.6061	31.5450	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												94.8412	(107)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Boilers-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.5000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	833.2095	683.5838	546.5407	290.8083	90.9772	0.0000	0.0000	0.0000	0.0000	254.3131	551.9021	841.2292	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.50													
307a	1249.8142	1025.3757	819.8110	436.2125	136.4657	0.0000	0.0000	0.0000	0.0000	381.4696	827.8532	1261.8438	
Space heating requirement													
	1249.8142	1025.3757	819.8110	436.2125	136.4657	0.0000	0.0000	0.0000	0.0000	381.4696	827.8532	1261.8438	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	297.5444	263.2169	279.5035	245.0634	237.1742	213.2654	209.9872	218.4652	221.0495	247.0587	263.4527	294.1736	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.50													
310a	446.3165	394.8254	419.2553	367.5951	355.7613	319.8981	314.9808	327.6978	331.5743	370.5881	395.1790	441.2604	
Water heating fuel													
	446.3165	394.8254	419.2553	367.5951	355.7613	319.8981	314.9808	327.6978	331.5743	370.5881	395.1790	441.2604	(310)
Cooling System Energy Efficiency Ratio												2.6000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	9.1116	15.2331	12.1327	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	24.8683	22.4617	24.8683	24.0661	24.8683	24.0661	24.8683	24.8683	24.0661	24.8683	24.0661	24.8683	(331)
Lighting	31.3329	25.1364	22.6325	16.5816	12.8081	10.4643	11.6840	15.1873	19.7267	25.8826	29.2343	32.2037	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												6138.8458	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												4484.9319	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												61.3885	(313)
Space cooling fuel												36.4774	(321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9520)													
mechanical ventilation fans (SFP = 0.9520)												292.8041	(330a)
Total electricity for the above, kWh/year												292.8041	(331)
Electricity for lighting (calculated in Appendix L)												252.8744	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												11205.9336	(338)

10b. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	6138.8458	4.8000	294.6646	(340a)
Space heating total			294.6646	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	4484.9319	4.8000	215.2767	(342a)
Water heating total			215.2767	(342)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(347a)
Space cooling	36.4774	21.5100	7.8463	(348)
Pumps, fans and electric keep-hot	292.8041	21.5100	62.9822	(349)
Energy for lighting	252.8744	21.5100	54.3933	(350)
Additional standing charges			98.0000	(351)

Total energy cost 733.1631 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367)
Space and Water heating from Boilers	11182.9239	0.2100	1357.0080	(367)
Electrical energy for heat distribution (space & water)	61.3885	0.0000	15.8827	(372)
Overall CO2 factor for heat network			0.2225	(386)
Total CO2 associated with community systems			2364.2967	(373)
Space and water heating			2364.2967	(376)
Space cooling	36.4774	0.1136	4.1431	(377)
Pumps, fans and electric keep-hot	292.8041	0.1387	40.6155	(378)
Energy for lighting	252.8744	0.1443	36.4976	(379)
Total CO2, kg/year			2445.5529	(383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(467a)
Space and Water heating from Boilers	11182.9239	1.1300	7301.9955	(467)
Electrical energy for heat distribution (space & water)	61.3885	0.0000	165.0115	(472)
Overall CO2 factor for heat network			1.2050	(486)
Total CO2 associated with community systems			12801.7155	(473)
Space and water heating			12801.7155	(476)
Space cooling	36.4774	1.4187	51.7520	(477)
Pumps, fans and electric keep-hot	292.8041	1.5128	442.9541	(478)
Energy for lighting	252.8744	1.5338	387.8671	(479)
Total Primary energy kWh/year			13684.2886	(483)