Full SAP Calculation Printout

Property Reference	25873	**Issued on Date**	12/11/2023
Assessment Reference	00001	**Prop Type Ref**	
Property	Barn East of West Lawn, Newton Road, Congdons Shop, Launceston, Cornwall, PL15 7LS		

SAP Rating	101 A	**DER**	-0.80	**TER**	11.29
Environmental	101 A	**% DER < TER**			107.09
CO_2 Emissions (t/year)	-0.2	**DFEE**	50.94	**TFEE**	61.25
Compliance Check	See BREL	**% DFEE < TFEE**			16.82
% DPER < TPER	98.48	**DPER**	0.94	**TPER**	61.84

Assessor Details	Mr. Benjamin Marsh	**Assessor ID**	E695-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	135.8000	(1b)	x 3.3500	(2b) =	454.9300	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.8000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	454.9300	(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	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(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	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(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) =												75.6000	(23c)
Effective ac	0.3132	0.3095	0.3057	0.2870	0.2832	0.2645	0.2645	0.2607	0.2720	0.2832	0.2907	0.2982	(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 = 1.20)			30.7400	1.1450	35.1985			(27)
Doors			3.6500	1.2000	4.3800			(26)
Ground			135.8000	0.1200	16.2960	110.0000	14938.0000	(28a)
R-Wall	158.7900	34.3900	124.4000	0.1500	18.6600	190.0000	23636.0000	(29a)
Warm Roof	144.0600		144.0600	0.0900	12.9654	9.0000	1296.5400	(30)
Total net area of external elements Aum(A, m2)			438.6500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		87.4999			(33)
Internal Wall 1			251.2500			9.0000	2261.2500	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		42131.7900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							310.2488	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	21.1000	0.0170	0.3587
E3 Sill	10.0500	0.0480	0.4824

E4 Jamb	23.9500	0.0090	0.2155	
E5 Ground floor (normal)	47.4000	0.0570	2.7018	
E11 Eaves (insulation at rafter level)	28.0000	0.0350	0.9800	
E13 Gable (insulation at rafter level)	19.4000	0.0540	1.0476	
E16 Corner (normal)	13.4000	0.0380	0.5092	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.2953 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 93.7951 (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	47.0273	46.4643	45.9013	43.0864	42.5234	39.7086	39.7086	39.1456	40.8345	42.5234	43.6494	44.7753	(38)
Heat transfer coeff	140.8224	140.2594	139.6964	136.8815	136.3186	133.5037	133.5037	132.9407	134.6296	136.3186	137.4445	138.5705	(39)
Average = Sum(39)m / 12 =												136.7408	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0370	1.0328	1.0287	1.0080	1.0038	0.9831	0.9831	0.9789	0.9914	1.0038	1.0121	1.0204	(40)
HLP (average)												1.0069	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9086 (42)
Hot water usage for mixer showers

72.9879	71.8910	70.2927	67.2345	64.9777	62.4609	61.0303	62.6166	64.3554	67.0577	70.1815	72.7083	(42a)

Hot water usage for baths

31.5104	31.0424	30.3834	29.1683	28.2585	27.2496	26.7047	27.3591	28.0716	29.1511	30.3912	31.4039	(42b)

Hot water usage for other uses

44.4172	42.8020	41.1869	39.5717	37.9565	36.3414	36.3414	37.9565	39.5717	41.1869	42.8020	44.4172	(42c)

Average daily hot water use (litres/day) 136.8868 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.9155	145.7355	141.8630	135.9746	131.1927	126.0519	124.0764	127.9322	131.9987	137.3957	143.3748	148.5293	(44)
Energy conte	235.8458	207.5254	218.0381	186.1424	176.6106	154.9955	150.0596	158.4068	162.7676	186.4447	204.2637	232.5611	(45)
Energy content (annual)										Total = Sum(45)m =		2273.6613	
Distribution loss (46)m = 0.15 x (45)m	35.3769	31.1288	32.7057	27.9214	26.4916	23.2493	22.5089	23.7610	24.4151	27.9667	30.6396	34.8842	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0314	(55)
Total storage loss	31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734	(56)
If cylinder contains dedicated solar storage	31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734	(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	291.0816	257.4158	273.2739	239.5964	231.8464	208.4495	205.2954	213.6426	216.2216	241.6805	257.7177	287.7969	(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	291.0816	257.4158	273.2739	239.5964	231.8464	208.4495	205.2954	213.6426	216.2216	241.6805	257.7177	287.7969	(64)
										Total per year (kWh/year) = Sum(64)m =		2924.0183	(64)
12Total per year (kWh/year)												2924	(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	122.6074	108.9145	116.6863	104.6555	102.9117	94.2992	94.0835	96.8589	96.8834	106.1815	110.6809	121.5152	(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	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.6275	170.0876	153.6275	158.7484	153.6275	158.7484	153.6275	153.6275	158.7484	153.6275	158.7484	153.6275	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	304.5838	307.7444	299.7797	282.8239	261.4201	241.3037	227.8646	224.7040	232.6687	249.6245	271.0282	291.1447	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	(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)	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	(71)
Water heating gains (Table 5)	164.7948	162.0752	156.8364	145.3549	138.3221	130.9711	126.4563	130.1867	134.5603	142.7171	153.7234	163.3269	(72)
Total internal gains	689.6355	706.5366	676.8731	653.5566	619.9992	597.6526	574.5778	575.1476	592.6068	612.5985	650.1295	674.7285	(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	15.6100	10.6334	0.6300	0.8000	0.7700	57.9747	(74)
East	8.6900	19.6403	0.6300	0.8000	0.7700	59.6116	(76)
South	4.3000	46.7521	0.6300	0.8000	0.7700	70.2155	(78)
West	2.1400	19.6403	0.6300	0.8000	0.7700	14.6800	(80)

Solar gains	202.4818	371.1176	574.0848	817.0177	1007.6679	1040.0350	986.2800	838.6794	657.7328	428.3633	247.3814	170.0970	(83)
Total gains	892.1173	1077.6542	1250.9578	1470.5742	1627.6671	1637.6875	1560.8578	1413.8269	1250.3396	1040.9618	897.5109	844.8255	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.1066	83.4402	83.7765	85.4993	85.8524	87.6626	87.6626	88.0338	86.9294	85.8524	85.1491	84.4572	
alpha	6.5404	6.5627	6.5851	6.7000	6.7235	6.8442	6.8442	6.8689	6.7953	6.7235	6.6766	6.6305	
util living area	0.9989	0.9959	0.9836	0.9157	0.7413	0.5188	0.3760	0.4318	0.7148	0.9633	0.9966	0.9992	(86)
Living	20.2134	20.3526	20.5499	20.7962	20.9227	20.9521	20.9543	20.9542	20.9363	20.7427	20.4373	20.2003	
Non living	19.1296	19.3102	19.5619	19.8698	19.9988	20.0381	20.0391	20.0427	20.0220	19.8187	19.4333	19.1243	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.5976	20.3526	20.5499	20.7962	20.9227	20.9521	20.9543	20.9542	20.9363	20.7427	20.4373	20.3122	(87)
Th 2	20.0526	20.0561	20.0595	20.0767	20.0802	20.0974	20.0974	20.1009	20.0905	20.0802	20.0733	20.0664	(88)
util rest of house	0.9985	0.9943	0.9769	0.8867	0.6811	0.4471	0.2991	0.3478	0.6330	0.9440	0.9949	0.9989	(89)
MIT 2	19.6847	19.3102	19.5619	19.8698	19.9988	20.0381	20.0391	20.0427	20.0220	19.8187	19.4333	19.2940	(90)
Living area fraction										fLA = Living area / (4) =		0.4599	(91)
MIT	20.1045	19.7896	20.0163	20.2958	20.4237	20.4584	20.4600	20.4619	20.4425	20.2436	19.8950	19.7623	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1045	19.7896	20.0163	20.2958	20.4237	20.4584	20.4600	20.4619	20.4425	20.2436	19.8950	19.7623	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9937	0.9765	0.8943	0.7044	0.4760	0.3300	0.3816	0.6658	0.9481	0.9945	0.9988	(94)
Useful gains	890.7632	1070.8223	1221.6060	1315.1323	1146.6004	779.5151	515.1486	539.5370	832.5103	986.9400	892.5565	843.7957	(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	2225.6249	2088.4081	1888.1730	1559.8774	1189.2007	782.1209	515.3240	539.9861	853.8835	1314.6084	1758.5996	2156.4689	(97)
Space heating kWh	993.1372	683.8177	495.9259	176.2164	31.6946	0.0000	0.0000	0.0000	0.0000	243.7853	623.5510	976.6288	(98a)
Space heating requirement - total per year (kWh/year)												4224.7569	
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	993.1372	683.8177	495.9259	176.2164	31.6946	0.0000	0.0000	0.0000	0.0000	243.7853	623.5510	976.6288	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4224.7569	
Space heating per m2											(98c) / (4) =	31.1101	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 335.9664 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	993.1372	683.8177	495.9259	176.2164	31.6946	0.0000	0.0000	0.0000	0.0000	243.7853	623.5510	976.6288	(98)
Space heating efficiency (main heating system 1)	335.9664	335.9664	335.9664	335.9664	335.9664	0.0000	0.0000	0.0000	0.0000	335.9664	335.9664	335.9664	(210)
Space heating fuel (main heating system)	295.6061	203.5375	147.6117	52.4506	9.4339	0.0000	0.0000	0.0000	0.0000	72.5624	185.5992	290.6924	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	291.0816	257.4158	273.2739	239.5964	231.8464	208.4495	205.2954	213.6426	216.2216	241.6805	257.7177	287.7969	(64)
Efficiency of water heater												176.1309	(216)
(217)m	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	(217)
Fuel for water heating, kWh/month	165.2643	146.1503	155.1538	136.0331	131.6330	118.3491	116.5584	121.2976	122.7618	137.2163	146.3216	163.3994	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	55.4346	50.0699	55.4346	53.6463	55.4346	53.6463	55.4346	55.4346	53.6463	55.4346	53.6463	55.4346	(231)
Lighting	32.4336	26.0194	23.4276	17.1641	13.2580	10.8319	12.0944	15.7208	20.4197	26.7918	30.2613	33.3350	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-138.4418	-213.9987	-326.6352	-368.6081	-388.7736	-359.6438	-355.6975	-338.1233	-299.1410	-249.1740	-158.2802	-117.1503	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-11.8178	-36.7412	-100.4036	-203.7080	-318.2747	-335.4973	-330.2570	-261.1987	-170.2483	-71.3637	-19.9492	-8.5913	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 1257.4939 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 176.1309

Water heating fuel used 1660.1388 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.1760)

mechanical ventilation fans (SFP = 1.1760)	652.6972	(230a)
Total electricity for the above, kWh/year	652.6972	(231)
Electricity for lighting (calculated in Appendix L)	261.7575	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-5181.7182	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	-1349.6308	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1257.4939	0.1569	197.3569	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1660.1388	0.1409	233.9812	(264)
Space and water heating			431.3381	(265)
Pumps, fans and electric keep-hot	652.6972	0.1387	90.5371	(267)
Energy for lighting	261.7575	0.1443	37.7797	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3313.6675	0.1342	-444.6982	
PV Unit electricity exported	-1868.0506	0.1194	-222.9697	
Total			-667.6679	(269)
Total CO2, kg/year			-108.0130	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.8000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1257.4939	1.5810	1988.0971	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1660.1388	1.5211	2525.3198	(278)
Space and water heating			4513.4170	(279)
Pumps, fans and electric keep-hot	652.6972	1.5128	987.4003	(281)
Energy for lighting	261.7575	1.5338	401.4925	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3313.6675	1.4960	-4957.1955	
PV Unit electricity exported	-1868.0506	0.4378	-817.8694	
Total			-5775.0649	(283)
Total Primary energy kWh/year			127.2448	(286)
Dwelling Primary energy Rate (DPER)			0.9400	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	135.8000	(1b)	x 3.3500	(2b) =	454.9300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		454.9300	(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) = 0.0879	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3379	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3379	(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													
	0.4309	0.4224	0.4140	0.3717	0.3633	0.3210	0.3210	0.3126	0.3379	0.3633	0.3802	0.3971	(22b)
Effective ac	0.5928	0.5892	0.5857	0.5691	0.5660	0.5515	0.5515	0.5489	0.5571	0.5660	0.5723	0.5788	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			3.6500	1.0000	3.6500			(26)
TER Opening Type (Uw = 1.20)			30.3100	1.1450	34.7061			(27)
Ground			135.8000	0.1300	17.6540			(28a)
R-Wall	158.7900	33.9600	124.8300	0.1800	22.4694			(29a)
Warm Roof	144.0600		144.0600	0.1100	15.8466			(30)
Total net area of external elements Aum(A, m2)			438.6500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.3261			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			310.2488 (35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	21.1000	0.0500	1.0550
E3 Sill	10.0500	0.0500	0.5025
E4 Jamb	23.9500	0.0500	1.1975
E5 Ground floor (normal)	47.4000	0.1600	7.5840
E11 Eaves (insulation at rafter level)	28.0000	0.0400	1.1200
E13 Gable (insulation at rafter level)	19.4000	0.0800	1.5520
E16 Corner (normal)	13.4000	0.0900	1.2060
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			14.2170 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	108.5431 (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	88.9979	88.4568	87.9265	85.4353	84.9692	82.7995	82.7995	82.3977	83.6352	84.9692	85.9121	86.8979	(38)
Heat transfer coeff													
	197.5410	197.0000	196.4696	193.9784	193.5123	191.3426	191.3426	190.9408	192.1783	193.5123	194.4552	195.4410	(39)
Average = Sum(39)m / 12 =												193.9762	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4546	1.4507	1.4468	1.4284	1.4250	1.4090	1.4090	1.4060	1.4152	1.4250	1.4319	1.4392	(40)
HLP (average)												1.4284	
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												2.9086	(42)
Hot water usage for mixer showers													
	72.9879	71.8910	70.2927	67.2345	64.9777	62.4609	61.0303	62.6166	64.3554	67.0577	70.1815	72.7083	(42a)
Hot water usage for baths													
	31.5104	31.0424	30.3834	29.1683	28.2585	27.2496	26.7047	27.3591	28.0716	29.1511	30.3912	31.4039	(42b)
Hot water usage for other uses													
	44.4172	42.8020	41.1869	39.5717	37.9565	36.3414	36.3414	37.9565	39.5717	41.1869	42.8020	44.4172	(42c)
Average daily hot water use (litres/day)												136.8868	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	148.9155	145.7355	141.8630	135.9746	131.1927	126.0519	124.0764	127.9322	131.9987	137.3957	143.3748	148.5293	(44)
Energy conte	235.8458	207.5254	218.0381	186.1424	176.6106	154.9955	150.0596	158.4068	162.7676	186.4447	204.2637	232.5611	(45)
Energy content (annual)										Total = Sum(45)m =		2273.6613	
Distribution loss (46)m = 0.15 x (45)m													
	35.3769	31.1288	32.7057	27.9214	26.4916	23.2493	22.5089	23.7610	24.4151	27.9667	30.6396	34.8842	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	282.4407	249.6111	264.6330	231.2342	223.2055	200.0873	196.6545	205.0017	207.8594	233.0396	249.3556	279.1560	(62)
WWHRS	-33.3670	-29.5101	-30.9012	-25.5874	-23.8466	-20.4057	-19.1271	-20.3397	-21.1125	-24.8893	-28.1966	-32.7491	(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													
	249.0737	220.1011	233.7318	205.6468	199.3589	179.6816	177.5274	184.6619	186.7469	208.1502	221.1590	246.4069	(64)
										Total per year (kWh/year) = Sum(64)m =		2512.2463	(64)
12Total per year (kWh/year)												2512	(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													
	115.6946	102.6708	109.7736	97.9658	95.9990	87.6095	87.1707	89.9462	90.1937	99.2688	103.9912	114.6025	(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	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	153.6243	170.0841	153.6243	158.7452	153.6243	158.7452	153.6243	153.6243	158.7452	153.6243	158.7452	153.6243	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	304.5838	307.7444	299.7797	282.8239	261.4201	241.3037	227.8646	224.7040	232.6687	249.6245	271.0282	291.1447	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	(71)

Water heating gains (Table 5)

155.5036	152.7839	147.5452	136.0636	129.0308	121.6798	117.1650	120.8954	125.2690	133.4258	144.4322	154.0356	(72)

Total internal gains

683.3410	700.2417	670.5786	647.2620	613.7047	588.3580	565.2833	565.8531	583.3122	606.3040	643.8349	668.4340	(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	15.3900	10.6334	0.6300	0.7000	0.7700	50.0129	(74)
East	8.5700	19.6403	0.6300	0.7000	0.7700	51.4399	(76)
South	4.2400	46.7521	0.6300	0.7000	0.7700	60.5813	(78)
West	2.1100	19.6403	0.6300	0.7000	0.7700	12.6649	(80)

Solar gains	174.6990	320.1963	495.3135	704.9097	869.3952	897.3185	850.9409	723.5975	567.4831	369.5873	213.4380	146.7577	(83)
Total gains	858.0400	1020.4381	1165.8921	1352.1717	1483.0998	1485.6765	1416.2242	1289.4506	1150.7954	975.8913	857.2729	815.1917	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2448	59.4075	59.5679	60.3329	60.4782	61.1640	61.1640	61.2927	60.8980	60.4782	60.1849	59.8814	
alpha	4.9497	4.9605	4.9712	5.0222	5.0319	5.0776	5.0776	5.0862	5.0599	5.0319	5.0123	4.9921	
util living area	0.9991	0.9976	0.9930	0.9724	0.9035	0.7457	0.5765	0.6471	0.8881	0.9863	0.9978	0.9993	(86)
MIT	19.4531	19.6347	19.9274	20.3435	20.7075	20.9256	20.9838	20.9719	20.8063	20.3319	19.8257	19.4324	(87)
Th 2	19.7217	19.7247	19.7277	19.7416	19.7442	19.7564	19.7564	19.7587	19.7517	19.7442	19.7389	19.7334	(88)
util rest of house	0.9986	0.9965	0.9897	0.9582	0.8537	0.6337	0.4232	0.4901	0.8099	0.9769	0.9967	0.9990	(89)
MIT 2	17.9417	18.1763	18.5516	19.0828	19.5071	19.7194	19.7527	19.7510	19.6258	19.0779	18.4312	17.9234	(90)
Living area fraction										fLA = Living area / (4) =		0.4599	(91)
MIT	18.6368	18.8470	19.1843	19.6626	20.0591	20.2741	20.3188	20.3125	20.1686	19.6546	19.0725	18.6173	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6368	18.8470	19.1843	19.6626	20.0591	20.2741	20.3188	20.3125	20.1686	19.6546	19.0725	18.6173	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9954	0.9877	0.9571	0.8682	0.6838	0.4947	0.5636	0.8405	0.9760	0.9958	0.9985	(94)
Useful gains	856.4174	1015.7116	1151.5251	1294.1531	1287.6399	1015.8617	700.6555	726.7517	967.2459	952.4608	853.6423	814.0052	(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	2832.1018	2747.5545	2492.0821	2087.7031	1617.5911	1085.6937	711.5690	747.0532	1166.2601	1752.1690	2328.1126	2817.7389	(97)
Space heating kWh	1469.9092	1163.7984	997.3744	571.3560	245.4837	0.0000	0.0000	0.0000	0.0000	594.9829	1061.6186	1490.7779	(98a)
Space heating requirement - total per year (kWh/year)												7595.3010	
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	1469.9092	1163.7984	997.3744	571.3560	245.4837	0.0000	0.0000	0.0000	0.0000	594.9829	1061.6186	1490.7779	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7595.3010	
Space heating per m2											(98c) / (4) =	55.9301	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 92.3000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1469.9092	1163.7984	997.3744	571.3560	245.4837	0.0000	0.0000	0.0000	0.0000	594.9829	1061.6186	1490.7779	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	1592.5343	1260.8867	1080.5790	619.0205	265.9628	0.0000	0.0000	0.0000	0.0000	644.6185	1150.1826	1615.1440	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	249.0737	220.1011	233.7318	205.6468	199.3589	179.6816	177.5274	184.6619	186.7469	208.1502	221.1590	246.4069	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.3722	87.2352	86.9385	86.2262	84.5276	79.8000	79.8000	79.8000	79.8000	86.2781	87.1063	87.4018	(217)
Fuel for water heating, kWh/month	285.0720	252.3075	268.8474	238.4969	235.8506	225.1650	222.4655	231.4059	234.0187	241.2550	253.8956	281.9242	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	31.9201	25.6075	23.0567	16.8923	13.0481	10.6604	11.9029	15.4719	20.0964	26.3676	29.7822	32.8073	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-96.5635	-123.1697	-160.3396	-162.6817	-161.8135	-146.2833	-144.2264	-142.2875	-137.7422	-131.3986	-101.3007	-85.0717	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)

(233b)m	-102.2744	-206.9663	-397.3082	-577.7039	-746.5995	-744.2024	-735.6066	-630.6563	-472.8940	-289.4017	-134.2249	-81.5386	(233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	8228.9285	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2970.7044	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	257.6135	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-6712.2552	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4830.9911	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	8228.9285	0.2100	1728.0750	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2970.7044	0.2100	623.8479	(264)
Space and water heating			2351.9229	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	257.6135	0.1443	37.1816	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1592.8783	0.1368	-217.9390	
PV Unit electricity exported	-5119.3769	0.1269	-649.5135	
Total			-867.4525	(269)
Total CO2, kg/year			1533.5812	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.2900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	8228.9285	1.1300	9298.6892	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2970.7044	1.1300	3356.8959	(278)
Space and water heating			12655.5851	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	257.6135	1.5338	395.1362	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1592.8783	1.5058	-2398.5353	
PV Unit electricity exported	-5119.3769	0.4658	-2384.3756	
Total			-4782.9109	(283)
Total Primary energy kWh/year			8397.9112	(286)
Target Primary Energy Rate (TPER)			61.8400	(287)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		135.8000	(1b)	x 3.3500	(2b)	= 454.9300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.8000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 454.9300	(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) =	0.0879 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2379 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2379 (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	0.3034	0.2974	0.2915	0.2617	0.2558	0.2260	0.2260	0.2201	0.2379	0.2558	0.2677	0.2796	(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	0.5460 0.5442 0.5425 0.5342 0.5327 0.5255 0.5255 0.5242 0.5283 0.5327 0.5358 0.5391 (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 = 1.20)			30.7400	1.1450	35.1985			(27)
Doors			3.6500	1.2000	4.3800			(26)
Ground			135.8000	0.1200	16.2960	110.0000	14938.0000	(28a)
R-Wall	158.7900	34.3900	124.4000	0.1500	18.6600	190.0000	23636.0000	(29a)
Warm Roof	144.0600		144.0600	0.0900	12.9654	9.0000	1296.5400	(30)
Total net area of external elements Aum(A, m2)			438.6500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.4999			(33)
Internal Wall 1			251.2500			9.0000	2261.2500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 42131.7900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	310.2488 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	21.1000	0.0170	0.3587
E3 Sill	10.0500	0.0480	0.4824
E4 Jamb	23.9500	0.0090	0.2155
E5 Ground floor (normal)	47.4000	0.0570	2.7018
E11 Eaves (insulation at rafter level)	28.0000	0.0350	0.9800
E13 Gable (insulation at rafter level)	19.4000	0.0540	1.0476
E16 Corner (normal)	13.4000	0.0380	0.5092

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.2953 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 93.7951 (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	81.9711	81.7029	81.4400	80.2050	79.9740	78.8984	78.8984	78.6992	79.3127	79.9740	80.4414	80.9301	(38)
Heat transfer coeff	175.7662	175.4980	175.2351	174.0001	173.7691	172.6935	172.6935	172.4943	173.1078	173.7691	174.2365	174.7252	(39)
Average = Sum(39)m / 12 =												173.9990	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2943	1.2923	1.2904	1.2813	1.2796	1.2717	1.2717	1.2702	1.2747	1.2796	1.2830	1.2866	(40)
HLP (average)												1.2813	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9086 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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

31.5104	31.0424	30.3834	29.1683	28.2585	27.2496	26.7047	27.3591	28.0716	29.1511	30.3912	31.4039	(42b)

Hot water usage for other uses

44.4172	42.8020	41.1869	39.5717	37.9565	36.3414	36.3414	37.9565	39.5717	41.1869	42.8020	44.4172	(42c)

Average daily hot water use (litres/day)	69.5944 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	75.9276	73.8445	71.5703	68.7400	66.2150	63.5910	63.0460	65.3156	67.6433	70.3380	73.1933	75.8211	(44)
Energy conte	120.2508	105.1536	110.0009	94.1017	89.1382	78.1925	76.2487	80.8744	83.4110	95.4480	104.2772	118.7175	(45)
Energy content (annual)										Total = Sum(45)m =		1155.8144	

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

102.2132	89.3805	93.5008	79.9864	75.7674	66.4637	64.8114	68.7432	70.8993	81.1308	88.6357	100.9099	(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

102.2132	89.3805	93.5008	79.9864	75.7674	66.4637	64.8114	68.7432	70.8993	81.1308	88.6357	100.9099	(64)

	Total per year (kWh/year) = Sum(64)m = 982.4423 (64)
12Total per year (kWh/year)	982 (64)

Electric shower(s)

58.4511	52.0805	56.8699	54.2702	55.2886	52.7399	54.4979	55.2886	54.2702	56.8699	55.8005	58.4511	(64a)

	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 664.8783 (64a)

Heat gains from water heating, kWh/month

40.1661	35.3652	37.5927	33.5642	32.7640	29.8009	29.8273	31.0079	31.2924	34.5002	36.1090	39.8403	(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	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	153.6275	170.0876	153.6275	158.7484	153.6275	158.7484	153.6275	153.6275	158.7484	153.6275	158.7484	153.6275	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	304.5838	307.7444	299.7797	282.8239	261.4201	241.3037	227.8646	224.7040	232.6687	249.6245	271.0282	291.1447	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	(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)													
	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	(71)
Water heating gains (Table 5)													
	53.9867	52.6268	50.5278	46.6169	44.0376	41.3901	40.0905	41.6773	43.4616	46.3712	50.1514	53.5487	(72)
Total internal gains													
	578.8273	597.0882	570.5644	554.8186	525.7147	508.0716	488.2120	486.6382	501.5081	516.2526	546.5575	564.9503	(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	15.6100	10.6334	0.6300	0.8000	0.7700	57.9747	(74)
East	8.6900	19.6403	0.6300	0.8000	0.7700	59.6116	(76)
South	4.3000	46.7521	0.6300	0.8000	0.7700	70.2155	(78)
West	2.1400	19.6403	0.6300	0.8000	0.7700	14.6800	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	202.4818	371.1176	574.0848	817.0177	1007.6679	1040.0350	986.2800	838.6794	657.7328	428.3633	247.3814	170.0970	(83)
Total gains	781.3091	968.2058	1144.6491	1371.8362	1533.3826	1548.1066	1474.4920	1325.3176	1159.2410	944.6159	793.9389	735.0473	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.5843	66.6861	66.7861	67.2601	67.3496	67.7690	67.7690	67.8473	67.6069	67.3496	67.1689	66.9810	
alpha	5.4390	5.4457	5.4524	5.4840	5.4900	5.5179	5.5179	5.5232	5.5071	5.4900	5.4779	5.4654	
util living area													
	0.9995	0.9981	0.9929	0.9645	0.8672	0.6781	0.5088	0.5841	0.8587	0.9862	0.9985	0.9996	(86)
MIT	19.6024	19.7935	20.0884	20.4916	20.8139	20.9639	20.9937	20.9874	20.8705	20.4307	19.9413	19.5708	(87)
Th 2	19.8453	19.8468	19.8484	19.8555	19.8569	19.8631	19.8631	19.8642	19.8607	19.8569	19.8541	19.8513	(88)
util rest of house													
	0.9992	0.9972	0.9895	0.9477	0.8108	0.5739	0.3810	0.4478	0.7762	0.9771	0.9977	0.9994	(89)
MIT 2	18.5792	18.7712	19.0653	19.4615	19.7436	19.8497	19.8620	19.8616	19.7973	19.4111	18.9248	18.5523	(90)
Living area fraction										fLA = Living area / (4) =		0.4599	(91)
MIT	19.0497	19.2413	19.5357	19.9352	20.2358	20.3621	20.3824	20.3793	20.2908	19.8800	19.3923	19.0207	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0497	19.2413	19.5357	19.9352	20.2358	20.3621	20.3824	20.3793	20.2908	19.8800	19.3923	19.0207	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9966	0.9883	0.9491	0.8315	0.6215	0.4402	0.5112	0.8112	0.9773	0.9973	0.9993	(94)
Useful gains	780.5072	964.9205	1131.2964	1301.9716	1275.0341	962.2146	649.1088	677.5458	940.4160	923.1834	791.7590	734.5074	(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													
	2592.5036	2516.8746	2284.3203	1920.1214	1483.2592	995.0807	653.2009	686.4073	1071.6835	1612.5766	2141.7650	2589.5448	(97)
Space heating kWh													
	1348.1254	1042.9132	857.8498	445.0678	154.9195	0.0000	0.0000	0.0000	0.0000	512.9085	972.0043	1380.1478	(98a)
Space heating requirement - total per year (kWh/year)												6713.9363	
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													
	1348.1254	1042.9132	857.8498	445.0678	154.9195	0.0000	0.0000	0.0000	0.0000	512.9085	972.0043	1380.1478	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6713.9363	
Space heating per m2											(98c) / (4) =	49.4399	(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	1623.3190	1277.9320	1310.9569	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8753	0.9337	0.8953	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1420.8255	1193.2386	1173.6848	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1744.1448	1661.0389	1489.7432	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	232.7899	348.0435	235.1474	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	58.1975	87.0109	58.7869	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												203.9952	(107)
Energy for space heating												49.4399	(99)
Energy for space cooling												1.5022	(108)
Total												50.9421	(109)

Fabric Energy Efficiency (DFEE) 50.9 (109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	135.8000 (1b)	x	3.3500 (2b)	=	454.9300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 135.8000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	454.9300	(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) =	0.0879	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3379	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3379	(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	0.4309	0.4224	0.4140	0.3717	0.3633	0.3210	0.3210	0.3126	0.3379	0.3633	0.3802	0.3971	(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	0.5928	0.5892	0.5857	0.5691	0.5660	0.5515	0.5515	0.5489	0.5571	0.5660	0.5723	0.5788	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			3.6500	1.0000	3.6500			(26)
TER Opening Type (Uw = 1.20)			30.3100	1.1450	34.7061			(27)
Ground			135.8000	0.1300	17.6540			(28a)
R-Wall	158.7900	33.9600	124.8300	0.1800	22.4694			(29a)
Warm Roof	144.0600		144.0600	0.1100	15.8466			(30)
Total net area of external elements Aum(A, m2)			438.6500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.3261			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							310.2488	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	21.1000	0.0500	1.0550
E3 Sill	10.0500	0.0500	0.5025
E4 Jamb	23.9500	0.0500	1.1975
E5 Ground floor (normal)	47.4000	0.1600	7.5840
E11 Eaves (insulation at rafter level)	28.0000	0.0400	1.1200
E13 Gable (insulation at rafter level)	19.4000	0.0800	1.5520
E16 Corner (normal)	13.4000	0.0900	1.2060

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		14.2170	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	108.5431	(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	88.9979	88.4568	87.9265	85.4353	84.9692	82.7995	82.7995	82.3977	83.6352	84.9692	85.9121	86.8979	(38)
Heat transfer coeff	197.5410	197.0000	196.4696	193.9784	193.5123	191.3426	191.3426	190.9408	192.1783	193.5123	194.4552	195.4410	(39)
Average = Sum(39)m / 12 =												193.9762	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4546	1.4507	1.4468	1.4284	1.4250	1.4090	1.4090	1.4060	1.4152	1.4250	1.4319	1.4392	(40)
HLP (average)												1.4284	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9086	(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													
	31.5104	31.0424	30.3834	29.1683	28.2585	27.2496	26.7047	27.3591	28.0716	29.1511	30.3912	31.4039	(42b)
Hot water usage for other uses													
	44.4172	42.8020	41.1869	39.5717	37.9565	36.3414	36.3414	37.9565	39.5717	41.1869	42.8020	44.4172	(42c)
Average daily hot water use (litres/day)												69.5944	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	75.9276	73.8445	71.5703	68.7400	66.2150	63.5910	63.0460	65.3156	67.6433	70.3380	73.1933	75.8211	(44)
Energy conte	120.2508	105.1536	110.0009	94.1017	89.1382	78.1925	76.2487	80.8744	83.4110	95.4480	104.2772	118.7175	(45)
Energy content (annual)										Total = Sum(45)m =		1155.8144	
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													
	102.2132	89.3805	93.5008	79.9864	75.7674	66.4637	64.8114	68.7432	70.8993	81.1308	88.6357	100.9099	(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													
	102.2132	89.3805	93.5008	79.9864	75.7674	66.4637	64.8114	68.7432	70.8993	81.1308	88.6357	100.9099	(64)
									Total per year (kWh/year) = Sum(64)m =			982.4423	(64)
12Total per year (kWh/year)												982	(64)
Electric shower(s)													
	58.4511	52.0805	56.8699	54.2702	55.2886	52.7399	54.4979	55.2886	54.2702	56.8699	55.8005	58.4511	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						664.8783	(64a)
Heat gains from water heating, kWh/month													
	40.1661	35.3652	37.5927	33.5642	32.7640	29.8009	29.8273	31.0079	31.2924	34.5002	36.1090	39.8403	(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	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	145.4312	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	153.6243	170.0841	153.6243	158.7452	153.6243	158.7452	153.6243	153.6243	158.7452	153.6243	158.7452	153.6243	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	304.5838	307.7444	299.7797	282.8239	261.4201	241.3037	227.8646	224.7040	232.6687	249.6245	271.0282	291.1447	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	37.5431	(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)													
	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	(71)
Water heating gains (Table 5)													
	53.9867	52.6268	50.5278	46.6169	44.0376	41.3901	40.0905	41.6773	43.4616	46.3712	50.1514	53.5487	(72)
Total internal gains													
	578.8241	597.0847	570.5612	554.8153	525.7115	508.0683	488.2088	486.6350	501.5048	516.2494	546.5542	564.9472	(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	15.3900	10.6334	0.6300	0.7000	0.7700	50.0129	(74)
East	8.5700	19.6403	0.6300	0.7000	0.7700	51.4399	(76)
South	4.2400	46.7521	0.6300	0.7000	0.7700	60.5813	(78)
West	2.1100	19.6403	0.6300	0.7000	0.7700	12.6649	(80)

Solar gains	174.6990	320.1963	495.3135	704.9097	869.3952	897.3185	850.9409	723.5975	567.4831	369.5873	213.4380	146.7577	(83)
Total gains	753.5231	917.2810	1065.8747	1259.7249	1395.1066	1405.3868	1339.1497	1210.2325	1068.9880	885.8367	759.9922	711.7049	(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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2448	59.4075	59.5679	60.3329	60.4782	61.1640	61.1640	61.2927	60.8980	60.4782	60.1849	59.8814	
alpha	4.9497	4.9605	4.9712	5.0222	5.0319	5.0776	5.0776	5.0862	5.0599	5.0319	5.0123	4.9921	
util living area													
	0.9995	0.9985	0.9953	0.9792	0.9205	0.7731	0.6052	0.6803	0.9106	0.9909	0.9988	0.9996	(86)
MIT	19.3872	19.5701	19.8660	20.2917	20.6720	20.9119	20.9799	20.9649	20.7753	20.2780	19.7644	19.3669	(87)
Th 2	19.7217	19.7247	19.7277	19.7416	19.7442	19.7564	19.7564	19.7587	19.7517	19.7442	19.7389	19.7334	(88)
util rest of house													
	0.9993	0.9978	0.9929	0.9680	0.8764	0.6628	0.4466	0.5198	0.8416	0.9844	0.9981	0.9995	(89)
MIT 2	18.2687	18.4536	18.7506	19.1796	19.5317	19.7212	19.7527	19.7509	19.6329	19.1732	18.6589	18.2574	(90)
Living area fraction										fLA = Living area / (4) =		0.4599	(91)
MIT	18.7831	18.9670	19.2635	19.6911	20.0561	20.2688	20.3171	20.3092	20.1583	19.6812	19.1673	18.7676	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7831	18.9670	19.2635	19.6911	20.0561	20.2688	20.3171	20.3092	20.1583	19.6812	19.1673	18.7676	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9972	0.9918	0.9674	0.8892	0.7122	0.5209	0.5954	0.8685	0.9840	0.9976	0.9993	(94)
Useful gains	752.7705	914.7303	1057.1072	1218.6421	1240.5745	1000.8840	697.5207	720.5725	928.3830	871.6197	758.1842	711.1780	(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	2860.9993	2771.2053	2507.6440	2093.2325	1617.0020	1084.6812	711.2310	746.4257	1164.2654	1757.3315	2346.5443	2847.1127	(97)
Space heating kWh	1568.5222	1247.5512	1079.1994	629.7051	280.0621	0.0000	0.0000	0.0000	0.0000	658.9696	1143.6193	1589.1355	(98a)
Space heating requirement - total per year (kWh/year)												8196.7643	
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	1568.5222	1247.5512	1079.1994	629.7051	280.0621	0.0000	0.0000	0.0000	0.0000	658.9696	1143.6193	1589.1355	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8196.7643	
Space heating per m2											(98c) / (4) =	60.3591	(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	1798.6203	1415.9351	1451.1499	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7762	0.8593	0.8059	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1396.0777	1216.7204	1169.4097	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1577.3331	1502.8501	1355.2315	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	130.5039	212.8805	138.2514	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	32.6260	53.2201	34.5628	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												120.4089	(107)
Energy for space heating												60.3591	(99)
Energy for space cooling												0.8867	(108)
Total												61.2458	(109)
Fabric Energy Efficiency (TFEE)												61.2	(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	135.8000	(1b)	x 3.3500	(2b) =	454.9300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		454.9300	(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	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (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	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(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) =												75.6000	(23c)
Effective ac	0.3132	0.3095	0.3057	0.2870	0.2832	0.2645	0.2645	0.2607	0.2720	0.2832	0.2907	0.2982	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Windows (Uw = 1.20)			30.7400	1.1450	35.1985			(27)
Doors			3.6500	1.2000	4.3800			(26)
Ground			135.8000	0.1200	16.2960	110.0000	14938.0000	(28a)
R-Wall	158.7900	34.3900	124.4000	0.1500	18.6600	190.0000	23636.0000	(29a)
Warm Roof	144.0600		144.0600	0.0900	12.9654	9.0000	1296.5400	(30)
Total net area of external elements Aum(A, m2)			438.6500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		87.4999			(33)
Internal Wall 1			251.2500			9.0000	2261.2500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 42131.7900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 310.2488 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	21.1000	0.0170	0.3587
E3 Sill	10.0500	0.0480	0.4824
E4 Jamb	23.9500	0.0090	0.2155
E5 Ground floor (normal)	47.4000	0.0570	2.7018
E11 Eaves (insulation at rafter level)	28.0000	0.0350	0.9800
E13 Gable (insulation at rafter level)	19.4000	0.0540	1.0476
E16 Corner (normal)	13.4000	0.0380	0.5092

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.2953 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 93.7951 (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	47.0273	46.4643	45.9013	43.0864	42.5234	39.7086	39.7086	39.1456	40.8345	42.5234	43.6494	44.7753	(38)
Heat transfer coeff	140.8224	140.2594	139.6964	136.8815	136.3186	133.5037	133.5037	132.9407	134.6296	136.3186	137.4445	138.5705	(39)
Average = Sum(39)m / 12 =												136.7408	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0370	1.0328	1.0287	1.0080	1.0038	0.9831	0.9831	0.9789	0.9914	1.0038	1.0121	1.0204	(40)
HLP (average)												1.0069	
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 2.9086 (42)
Hot water usage for mixer showers

72.9879	71.8910	70.2927	67.2345	64.9777	62.4609	61.0303	62.6166	64.3554	67.0577	70.1815	72.7083	(42a)

Hot water usage for baths

31.5104	31.0424	30.3834	29.1683	28.2585	27.2496	26.7047	27.3591	28.0716	29.1511	30.3912	31.4039	(42b)

Hot water usage for other uses

44.4172	42.8020	41.1869	39.5717	37.9565	36.3414	36.3414	37.9565	39.5717	41.1869	42.8020	44.4172	(42c)

Average daily hot water use (litres/day) 136.8868 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.9155	145.7355	141.8630	135.9746	131.1927	126.0519	124.0764	127.9322	131.9987	137.3957	143.3748	148.5293	(44)
Energy conte	235.8458	207.5254	218.0381	186.1424	176.6106	154.9955	150.0596	158.4068	162.7676	186.4447	204.2637	232.5611	(45)
Energy content (annual)										Total = Sum(45)m =		2273.6613	
Distribution loss (46)m = 0.15 x (45)m	35.3769	31.1288	32.7057	27.9214	26.4916	23.2493	22.5089	23.7610	24.4151	27.9667	30.6396	34.8842	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0314	(55)
Total storage loss	31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734	(56)
If cylinder contains dedicated solar storage	31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734	(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	291.0816	257.4158	273.2739	239.5964	231.8464	208.4495	205.2954	213.6426	216.2216	241.6805	257.7177	287.7969	(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	291.0816	257.4158	273.2739	239.5964	231.8464	208.4495	205.2954	213.6426	216.2216	241.6805	257.7177	287.7969	(64)
										Total per year (kWh/year) = Sum(64)m =		2924.0183	(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	122.6074	108.9145	116.6863	104.6555	102.9117	94.2992	94.0835	96.8589	96.8834	106.1815	110.6809	121.5152	(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	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.0545	32.9115	26.7654	20.2631	15.1469	12.7877	13.8175	17.9606	24.1066	30.6089	35.7251	38.0843	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	454.6026	459.3200	447.4324	422.1252	390.1793	360.1547	340.0964	335.3791	347.2667	372.5739	404.5198	434.5444	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	(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)	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	(71)
Water heating gains (Table 5)	164.7948	162.0752	156.8364	145.3549	138.3221	130.9711	126.4563	130.1867	134.5603	142.7171	153.7234	163.3269	(72)
Total internal gains	769.9848	767.8395	744.5671	701.2761	657.1812	617.4464	593.9031	597.0592	619.4665	659.4327	707.5012	749.4884	(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	15.6100	10.6334	0.6300	0.8000	0.7700	57.9747	(74)
East	8.6900	19.6403	0.6300	0.8000	0.7700	59.6116	(76)
South	4.3000	46.7521	0.6300	0.8000	0.7700	70.2155	(78)
West	2.1400	19.6403	0.6300	0.8000	0.7700	14.6800	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	202.4818	371.1176	574.0848	817.0177	1007.6679	1040.0350	986.2800	838.6794	657.7328	428.3633	247.3814	170.0970	(83)
Total gains	972.4666	1138.9571	1318.6519	1518.2937	1664.8491	1657.4813	1580.1831	1435.7385	1277.1993	1087.7960	954.8826	919.5854	(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	83.1066	83.4402	83.7765	85.4993	85.8524	87.6626	87.6626	88.0338	86.9294	85.8524	85.1491	84.4572	
alpha	6.5404	6.5627	6.5851	6.7000	6.7235	6.8442	6.8442	6.8689	6.7953	6.7235	6.6766	6.6305	
util living area	0.9982	0.9944	0.9785	0.9047	0.7284	0.5128	0.3715	0.4252	0.7025	0.9550	0.9951	0.9987	(86)
Living	20.2536	20.3827	20.5802	20.8099	20.9257	20.9523	20.9544	20.9542	20.9381	20.7610	20.4656	20.2380	
Non living	19.1811	19.3483	19.5991	19.8843	20.0012	20.0381	20.0391	20.0427	20.0230	19.8394	19.4691	19.1725	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.6182	20.3827	20.5802	20.8099	20.9257	20.9523	20.9544	20.9542	20.9381	20.7610	20.4656	20.3446	(87)
Th 2	20.0526	20.0561	20.0595	20.0767	20.0802	20.0974	20.0974	20.1009	20.0905	20.0802	20.0733	20.0664	(88)
util rest of house	0.9974	0.9922	0.9701	0.8734	0.6681	0.4419	0.2954	0.3425	0.6209	0.9325	0.9928	0.9982	(89)
MIT 2	19.7052	19.3483	19.5991	19.8843	20.0012	20.0381	20.0391	20.0427	20.0230	19.8394	19.4691	19.3336	(90)
Living area fraction									fLA = Living area / (4) =			0.4599	(91)
MIT	20.1250	19.8240	20.0503	20.3099	20.4263	20.4585	20.4600	20.4619	20.4438	20.2632	19.9274	19.7985	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1250	19.8240	20.0503	20.3099	20.4263	20.4585	20.4600	20.4619	20.4438	20.2632	19.9274	19.7985	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9915	0.9700	0.8821	0.6915	0.4704	0.3260	0.3758	0.6537	0.9377	0.9923	0.9980	(94)
Useful gains	970.0443	1129.2931	1279.1010	1339.2690	1151.2738	779.7106	515.1631	539.5823	834.8629	1020.0189	947.5198	917.7548	(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	2228.5190	2093.2316	1892.9272	1561.8106	1189.5625	782.1365	515.3254	539.9902	854.0670	1317.2766	1763.0538	2161.4900	(97)
Space heating kWh	936.3051	647.7667	456.6867	160.2299	28.4867	0.0000	0.0000	0.0000	0.0000	221.1597	587.1844	925.3390	(98a)
Space heating requirement - total per year (kWh/year)												3963.1583	
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	936.3051	647.7667	456.6867	160.2299	28.4867	0.0000	0.0000	0.0000	0.0000	221.1597	587.1844	925.3390	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3963.1583	
Space heating per m2											(98c) / (4) =	29.1838	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	335.9664	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	936.3051	647.7667	456.6867	160.2299	28.4867	0.0000	0.0000	0.0000	0.0000	221.1597	587.1844	925.3390	(98)
Space heating efficiency (main heating system 1)	335.9664	335.9664	335.9664	335.9664	335.9664	0.0000	0.0000	0.0000	0.0000	335.9664	335.9664	335.9664	(210)
Space heating fuel (main heating system)	278.6901	192.8070	135.9323	47.6922	8.4790	0.0000	0.0000	0.0000	0.0000	65.8279	174.7748	275.4260	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	291.0816	257.4158	273.2739	239.5964	231.8464	208.4495	205.2954	213.6426	216.2216	241.6805	257.7177	287.7969	(64)
Efficiency of water heater												176.1309	(216)
(217)m	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	(217)
Fuel for water heating, kWh/month	165.2643	146.1503	155.1538	136.0331	131.6330	118.3491	116.5584	121.2976	122.7618	137.2163	146.3216	163.3994	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	55.4346	50.0699	55.4346	53.6463	55.4346	53.6463	55.4346	55.4346	53.6463	55.4346	53.6463	55.4346	(231)
Lighting	32.4336	26.0194	23.4276	17.1641	13.2580	10.8319	12.0944	15.7208	20.4197	26.7918	30.2613	33.3350	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-138.2382	-213.5356	-325.3006	-367.3470	-388.3691	-359.6438	-355.6975	-338.1233	-299.1410	-248.4886	-158.0118	-117.0130	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.0213	-37.2043	-101.7381	-204.9692	-318.6793	-335.4973	-330.2570	-261.1987	-170.2483	-72.0491	-20.2176	-8.7285	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1179.6294	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	176.1309	
Water heating fuel used	1660.1388	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.1760)		
mechanical ventilation fans (SFP = 1.1760)	652.6972	(230a)
Total electricity for the above, kWh/year	652.6972	(231)
Electricity for lighting (calculated in Appendix L)	261.7575	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-5181.7182	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	-1427.4953	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1179.6294	16.4900	194.5209	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1660.1388	16.4900	273.7569	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	652.6972	16.4900	107.6298	(249)
Energy for lighting	261.7575	16.4900	43.1638	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3308.9096	16.4900	-545.6392	
PV Unit electricity exported	-1872.8086	5.5900	-104.6900	
Total			-650.3292	(252)
Total energy cost			-31.2578	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	-0.0622	(257)
SAP value		101.0089	
SAP rating (Section 12)		101	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1179.6294	0.1570	185.2505	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1660.1388	0.1409	233.9812	(264)
Space and water heating			419.2317	(265)
Pumps, fans and electric keep-hot	652.6972	0.1387	90.5371	(267)
Energy for lighting	261.7575	0.1443	37.7797	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3308.9096	0.1342	-443.9969	
PV Unit electricity exported	-1872.8086	0.1195	-223.7433	
Total			-667.7402	(269)
Total CO2, kg/year			-120.1917	(272)
CO2 emissions per m2			-0.8900	(273)
EI value			100.8908	
EI rating			101	(274)
EI band			A	

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		135.8000 (1b)	x	3.3500 (2b)	=	454.9300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.8000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	454.9300	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		0 * 10 =	0.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.4000	5.0000	5.0000	4.5000	4.4000	3.9000	4.0000	3.8000	4.0000	4.6000	4.7000	5.1000	(22)
Wind factor	1.3500	1.2500	1.2500	1.1250	1.1000	0.9750	1.0000	0.9500	1.0000	1.1500	1.1750	1.2750	(22a)
Adj infilt rate	0.2025	0.1875	0.1875	0.1687	0.1650	0.1462	0.1500	0.1425	0.1500	0.1725	0.1762	0.1912	(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) =	75.6000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3245	0.3095	0.3095	0.2907	0.2870	0.2682	0.2720	0.2645	0.2720	0.2945	0.2982	0.3132	(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 = 1.20)			30.7400	1.1450	35.1985			(27)
Doors			3.6500	1.2000	4.3800			(26)
Ground			135.8000	0.1200	16.2960	110.0000	14938.0000	(28a)
R-Wall	158.7900	34.3900	124.4000	0.1500	18.6600	190.0000	23636.0000	(29a)
Warm Roof	144.0600		144.0600	0.0900	12.9654	9.0000	1296.5400	(30)
Total net area of external elements Aum(A, m2)			438.6500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		87.4999			(33)
Internal Wall 1			251.2500			9.0000	2261.2500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 42131.7900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	310.2488 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	21.1000	0.0170	0.3587
E3 Sill	10.0500	0.0480	0.4824
E4 Jamb	23.9500	0.0090	0.2155
E5 Ground floor (normal)	47.4000	0.0570	2.7018
E11 Eaves (insulation at rafter level)	28.0000	0.0350	0.9800
E13 Gable (insulation at rafter level)	19.4000	0.0540	1.0476
E16 Corner (normal)	13.4000	0.0380	0.5092

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.2953 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	93.7951 (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	48.7162	46.4643	46.4643	43.6494	43.0864	40.2715	40.8345	39.7086	40.8345	44.2124	44.7753	47.0273	(38)
Heat transfer coeff	142.5113	140.2594	140.2594	137.4445	136.8815	134.0667	134.6296	133.5037	134.6296	138.0075	138.5705	140.8224	(39)
Average = Sum(39)m / 12 =												137.6322	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0494	1.0328	1.0328	1.0121	1.0080	0.9872	0.9914	0.9831	0.9914	1.0163	1.0204	1.0370	(40)
HLP (average)												1.0135	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9086 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
72.9879	71.8910	70.2927	67.2345	64.9777	62.4609	61.0303	62.6166	64.3554	67.0577	70.1815	72.7083	(42a)

Hot water usage for baths

31.5104	31.0424	30.3834	29.1683	28.2585	27.2496	26.7047	27.3591	28.0716	29.1511	30.3912	31.4039	(42b)

Hot water usage for other uses

44.4172	42.8020	41.1869	39.5717	37.9565	36.3414	36.3414	37.9565	39.5717	41.1869	42.8020	44.4172	(42c)

Average daily hot water use (litres/day)	136.8868 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.9155	145.7355	141.8630	135.9746	131.1927	126.0519	124.0764	127.9322	131.9987	137.3957	143.3748	148.5293	(44)
Energy conte	235.8458	207.5254	218.0381	186.1424	176.6106	154.9955	150.0596	158.4068	162.7676	186.4447	204.2637	232.5611	(45)
Energy content (annual)										Total = Sum(45)m =		2273.6613	
Distribution loss (46)m = 0.15 x (45)m	35.3769	31.1288	32.7057	27.9214	26.4916	23.2493	22.5089	23.7610	24.4151	27.9667	30.6396	34.8842	(46)

Water storage loss:	
Store volume	150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.9100 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	1.0314 (55)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss 31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734	(56)

If cylinder contains dedicated solar storage

	31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734	(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

	291.0816	257.4158	273.2739	239.5964	231.8464	208.4495	205.2954	213.6426	216.2216	241.6805	257.7177	287.7969	(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

	291.0816	257.4158	273.2739	239.5964	231.8464	208.4495	205.2954	213.6426	216.2216	241.6805	257.7177	287.7969	(64)
										Total per year (kWh/year) = Sum(64)m =		2924.0183	(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

	122.6074	108.9145	116.6863	104.6555	102.9117	94.2992	94.0835	96.8589	96.8834	106.1815	110.6809	121.5152	(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	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	37.0545	32.9115	26.7654	20.2631	15.1469	12.7877	13.8175	17.9606	24.1066	30.6089	35.7251	38.0843	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	454.6026	459.3200	447.4324	422.1252	390.1793	360.1547	340.0964	335.3791	347.2667	372.5739	404.5198	434.5444	(68)

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

	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	(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)

	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	(71)

Water heating gains (Table 5)

	164.7948	162.0752	156.8364	145.3549	138.3221	130.9711	126.4563	130.1867	134.5603	142.7171	153.7234	163.3269	(72)

Total internal gains

	769.9848	767.8395	744.5671	701.2761	657.1812	617.4464	593.9031	597.0592	619.4665	659.4327	707.5012	749.4884	(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	15.6100	13.8174	0.6300	0.8000	0.7700	75.3343	(74)
East	8.6900	25.8543	0.6300	0.8000	0.7700	78.4722	(76)
South	4.3000	57.7293	0.6300	0.8000	0.7700	86.7018	(78)
West	2.1400	25.8543	0.6300	0.8000	0.7700	19.3246	(80)

Solar gains	259.8329	402.3487	610.2059	879.9915	1026.9960	1129.2870	970.9579	898.1476	721.1138	469.2224	307.8094	215.8733	(83)
Total gains	1029.8177	1170.1882	1354.7730	1581.2676	1684.1772	1746.7334	1564.8610	1495.2068	1340.5803	1128.6551	1015.3105	965.3617	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	82.1217	83.4402	83.4402	85.1491	85.4993	87.2944	86.9294	87.6626	86.9294	84.8017	84.4572	83.1066	
alpha	6.4748	6.5627	6.5627	6.6766	6.7000	6.8196	6.7953	6.8442	6.7953	6.6534	6.6305	6.5404	
util living area	0.9963	0.9908	0.9701	0.8906	0.7361	0.5189	0.4379	0.4542	0.6909	0.9337	0.9888	0.9971	(86)
Living	20.3474	20.4673	20.6309	20.8240	20.9228	20.9518	20.9535	20.9537	20.9391	20.8017	20.5696	20.3493	
Non living	19.2923	19.4556	19.6583	19.8955	19.9951	20.0342	20.0316	20.0389	20.0235	19.8755	19.5947	19.3035	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.6661	20.4673	20.6309	20.8240	20.9228	20.9518	20.9535	20.9537	20.9391	20.8017	20.5696	20.4403	(87)
Th 2	20.0424	20.0561	20.0561	20.0733	20.0767	20.0940	20.0905	20.0974	20.0905	20.0698	20.0664	20.0526	(88)
util rest of house	0.9947	0.9870	0.9585	0.8567	0.6770	0.4513	0.3603	0.3745	0.6122	0.9018	0.9832	0.9958	(89)
MIT 2	19.7433	19.4556	19.6583	19.8955	19.9951	20.0342	20.0316	20.0389	20.0235	19.8755	19.5947	19.4385	(90)
Living area fraction										fLA = Living area / (4) =		0.4599	(91)
MIT	20.1677	19.9209	20.1056	20.3225	20.4217	20.4562	20.4556	20.4596	20.4445	20.3014	20.0430	19.8992	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1677	19.9209	20.1056	20.3225	20.4217	20.4562	20.4556	20.4596	20.4445	20.3014	20.0430	19.8992	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9863	0.9592	0.8666	0.6999	0.4785	0.3915	0.4066	0.6437	0.9109	0.9831	0.9956	(94)
Useful gains	1024.6511	1154.1649	1299.4571	1370.3131	1178.6736	835.8052	612.6714	607.9512	862.9683	1028.1191	998.1067	961.0785	(95)
Ext temp.	5.4000	5.9000	7.1000	8.9000	11.5000	14.2000	15.9000	15.9000	13.9000	11.2000	8.3000	5.7000	(96)

Heat loss rate W

	2104.5651	1966.5574	1824.1522	1569.9579	1221.2194	838.7440	613.3136	608.7214	881.0904	1256.0662	1627.2348	1999.5622	(97)

Space heating kWh

	803.4560	545.9278	390.3732	143.7443	31.6540	0.0000	0.0000	0.0000	0.0000	169.5927	452.9722	772.6319	(98a)

Space heating requirement - total per year (kWh/year) 3310.3520

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

	803.4560	545.9278	390.3732	143.7443	31.6540	0.0000	0.0000	0.0000	0.0000	169.5927	452.9722	772.6319	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 3310.3520

Space heating per m2 (98c) / (4) = 24.3767 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												336.4449	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	803.4560	545.9278	390.3732	143.7443	31.6540	0.0000	0.0000	0.0000	0.0000	169.5927	452.9722	772.6319	(98)
Space heating efficiency (main heating system 1)													
	336.4449	336.4449	336.4449	336.4449	336.4449	0.0000	0.0000	0.0000	0.0000	336.4449	336.4449	336.4449	(210)
Space heating fuel (main heating system)													
	238.8076	162.2636	116.0288	42.7245	9.4084	0.0000	0.0000	0.0000	0.0000	50.4073	134.6349	229.6459	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	291.0816	257.4158	273.2739	239.5964	231.8464	208.4495	205.2954	213.6426	216.2216	241.6805	257.7177	287.7969	(64)
Efficiency of water heater												176.1420	(216)
(217)m	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	(217)
Fuel for water heating, kWh/month													
	165.2539	146.1411	155.1441	136.0246	131.6247	118.3417	116.5511	121.2900	122.7541	137.2077	146.3125	163.3891	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	55.4346	50.0699	55.4346	53.6463	55.4346	53.6463	55.4346	55.4346	53.6463	55.4346	53.6463	55.4346	(231)
Lighting	32.4336	26.0194	23.4276	17.1641	13.2580	10.8319	12.0944	15.7208	20.4197	26.7918	30.2613	33.3350	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-173.3111	-227.0764	-336.4201	-379.6591	-390.1637	-368.9690	-352.0895	-346.9902	-313.6372	-263.8583	-190.1693	-145.7755	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-20.2695	-44.9105	-115.2556	-230.9814	-322.7953	-377.9732	-316.0770	-288.2808	-197.3656	-86.7332	-32.2713	-14.5665	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												983.9209	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												176.1420	
Water heating fuel used												1660.0345	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.1760)													
mechanical ventilation fans (SFP = 1.1760)												652.6972	(230a)
Total electricity for the above, kWh/year												652.6972	(231)
Electricity for lighting (calculated in Appendix L)												261.7575	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-5535.5993	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												-1977.1891	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	983.9209	21.5100	211.6414	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1660.0345	21.5100	357.0734	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	652.6972	21.5100	140.3952	(249)
Energy for lighting	261.7575	21.5100	56.3040	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3488.1193	21.5100	-750.2945	
PV Unit electricity exported	-2047.4800	5.5900	-114.4541	
Total			-864.7486	(252)
Total energy cost			-99.3346	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	983.9209	0.1571	154.6093	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1660.0345	0.1409	233.9665	(264)
Space and water heating			388.5758	(265)
Pumps, fans and electric keep-hot	652.6972	0.1387	90.5371	(267)
Energy for lighting	261.7575	0.1443	37.7797	(268)
Energy saving/generation technologies				

PV Unit electricity used in dwelling	-3488.1193	0.1349	-470.6936	
PV Unit electricity exported	-2047.4800	0.1209	-247.6135	
Total			-718.3071	(269)
Total CO2, kg/year			-201.4145	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	983.9209	1.5817	1556.2733	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1660.0345	1.5211	2525.1612	(278)
Space and water heating			4081.4345	(279)
Pumps, fans and electric keep-hot	652.6972	1.5128	987.4003	(281)
Energy for lighting	261.7575	1.5338	401.4925	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3488.1193	1.4987	-5227.7740	
PV Unit electricity exported	-2047.4800	0.4438	-908.5882	
Total			-6136.3621	(283)
Total Primary energy kWh/year			-666.0349	(286)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating: A 101
Current environmental impact rating: A 101

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

Recommended measures	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 51	-42 kg (21.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£51	0.31 kg/m²	A 102	A 101
Total Savings	£51	0.31 kg/m²		

Potential energy efficiency rating: A 102
Potential environmental impact rating: A 101

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South West England):

	Current	Potential	Saving
Electricity	£765	£691	£75
Space heating	£352	£370	-£18
Water heating	£357	£265	£92
Lighting	£56	£56	£0
Generated (PV)	-£865	-£841	-£24
Total cost of fuels	-£100	-£150	£51
Total cost of uses	-£100	-£150	£50
Delivered energy	-15 kWh/m²	-17 kWh/m²	3 kWh/m²
Carbon dioxide emissions	-0.2 tonnes	-0.2 tonnes	0.0 tonnes
CO2 emissions per m²	-1 kg/m²	-2 kg/m²	0 kg/m²
Primary energy	-5 kWh/m²	-8 kWh/m²	3 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	135.8000	(1b)	x 3.3500	(2b) =	454.9300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		454.9300	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)

Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
		Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (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	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(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) =	75.6000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3132	0.3095	0.3057	0.2870	0.2832	0.2645	0.2645	0.2607	0.2720	0.2832	0.2907	0.2982	(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 = 1.20)			30.7400	1.1450	35.1985			(27)
Doors			3.6500	1.2000	4.3800			(26)
Ground			135.8000	0.1200	16.2960	110.0000	14938.0000	(28a)
R-Wall	158.7900	34.3900	124.4000	0.1500	18.6600	190.0000	23636.0000	(29a)
Warm Roof	144.0600		144.0600	0.0900	12.9654	9.0000	1296.5400	(30)
Total net area of external elements Aum(A, m2)			438.6500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		87.4999			(33)
Internal Wall 1			251.2500			9.0000	2261.2500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 42131.7900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	310.2488 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	21.1000	0.0170	0.3587
E3 Sill	10.0500	0.0480	0.4824
E4 Jamb	23.9500	0.0090	0.2155
E5 Ground floor (normal)	47.4000	0.0570	2.7018
E11 Eaves (insulation at rafter level)	28.0000	0.0350	0.9800
E13 Gable (insulation at rafter level)	19.4000	0.0540	1.0476
E16 Corner (normal)	13.4000	0.0380	0.5092

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.2953 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 93.7951 (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	47.0273	46.4643	45.9013	43.0864	42.5234	39.7086	39.7086	39.1456	40.8345	42.5234	43.6494	44.7753	(38)
Heat transfer coeff	140.8224	140.2594	139.6964	136.8815	136.3186	133.5037	133.5037	132.9407	134.6296	136.3186	137.4445	138.5705	(39)
Average = Sum(39)m / 12 =												136.7408	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0370	1.0328	1.0287	1.0080	1.0038	0.9831	0.9831	0.9789	0.9914	1.0038	1.0121	1.0204	(40)
HLP (average)												1.0069	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9086 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
72.9879	71.8910	70.2927	67.2345	64.9777	62.4609	61.0303	62.6166	64.3554	67.0577	70.1815	72.7083	(42a)

Hot water usage for baths

31.5104	31.0424	30.3834	29.1683	28.2585	27.2496	26.7047	27.3591	28.0716	29.1511	30.3912	31.4039	(42b)

Hot water usage for other uses

44.4172	42.8020	41.1869	39.5717	37.9565	36.3414	36.3414	37.9565	39.5717	41.1869	42.8020	44.4172	(42c)

Average daily hot water use (litres/day)	136.8868 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.9155	145.7355	141.8630	135.9746	131.1927	126.0519	124.0764	127.9322	131.9987	137.3957	143.3748	148.5293	(44)
Energy conte	235.8458	207.5254	218.0381	186.1424	176.6106	154.9955	150.0596	158.4068	162.7676	186.4447	204.2637	232.5611	(45)
Energy content (annual)										Total = Sum(45)m =		2273.6613	
Distribution loss (46)m = 0.15 x (45)m	35.3769	31.1288	32.7057	27.9214	26.4916	23.2493	22.5089	23.7610	24.4151	27.9667	30.6396	34.8842	(46)

Water storage loss:	
Store volume	150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.9100 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	1.0314 (55)

Total storage loss

31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734	(56)

If cylinder contains dedicated solar storage

31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734	(57)
Primary loss 23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	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

291.0816	257.4158	271.8782	232.8428	219.0521	195.8428	192.2685	201.5461	210.8187	240.2847	257.7177	287.7969	(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)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.8000 (H2)

Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												632.0510	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												632.0510	
Solar input	-0.0000	-16.1936	-58.8459	-81.3224	-106.8056	-98.5458	-97.8809	-85.2581	-58.4513	-28.7475	-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													
	291.0816	241.2222	213.0323	151.5204	112.2465	97.2970	94.3875	116.2881	152.3674	211.5372	257.7177	287.7969	(64)
										Total per year (kWh/year) = Sum(64)m =		2226.4949	(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													
	122.6074	108.9145	115.5697	99.2527	92.6762	84.2138	83.6619	87.1817	92.5611	105.0649	110.6809	121.5152	(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	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	37.0545	32.9115	26.7654	20.2631	15.1469	12.7877	13.8175	17.9606	24.1066	30.6089	35.7251	38.0843	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	454.6026	459.3200	447.4324	422.1252	390.1793	360.1547	340.0964	335.3791	347.2667	372.5739	404.5198	434.5444	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	(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)													
	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	(71)
Water heating gains (Table 5)													
	164.7948	162.0752	155.3356	137.8509	124.5648	116.9636	112.4488	117.1798	128.5571	141.2163	153.7234	163.3269	(72)
Total internal gains													
	769.9848	767.8395	743.0663	693.7721	643.4239	603.4389	579.8956	584.0523	613.4633	657.9319	707.5012	749.4884	(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	15.6100	10.6334	0.6300	0.8000	0.7700	57.9747	(74)
East	8.6900	19.6403	0.6300	0.8000	0.7700	59.6116	(76)
South	4.3000	46.7521	0.6300	0.8000	0.7700	70.2155	(78)
West	2.1400	19.6403	0.6300	0.8000	0.7700	14.6800	(80)

Solar gains	202.4818	371.1176	574.0848	817.0177	1007.6679	1040.0350	986.2800	838.6794	657.7328	428.3633	247.3814	170.0970	(83)
Total gains	972.4666	1138.9571	1317.1511	1510.7897	1651.0918	1643.4738	1566.1756	1422.7316	1271.1961	1086.2952	954.8826	919.5854	(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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.1066	83.4402	83.7765	85.4993	85.8524	87.6626	87.6626	88.0338	86.9294	85.8524	85.1491	84.4572	
alpha	6.5404	6.5627	6.5851	6.7000	6.7235	6.8442	6.8442	6.8689	6.7953	6.7235	6.6766	6.6305	
util living area													
	0.9982	0.9944	0.9786	0.9065	0.7331	0.5170	0.3748	0.4291	0.7052	0.9553	0.9951	0.9987	(86)
Living	20.2536	20.3827	20.5796	20.8078	20.9246	20.9522	20.9544	20.9542	20.9377	20.7605	20.4656	20.2380	
Non living	19.1811	19.3483	19.5983	19.8821	20.0003	20.0381	20.0391	20.0427	20.0228	19.8387	19.4691	19.1725	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.6182	20.3827	20.5796	20.8078	20.9246	20.9522	20.9544	20.9542	20.9377	20.7605	20.4656	20.3446	(87)
Th 2	20.0526	20.0561	20.0595	20.0767	20.0802	20.0974	20.0974	20.1009	20.0905	20.0802	20.0733	20.0664	(88)
util rest of house													
	0.9974	0.9922	0.9703	0.8755	0.6729	0.4456	0.2981	0.3457	0.6236	0.9328	0.9928	0.9982	(89)
MIT 2	19.7052	19.3483	19.5983	19.8821	20.0003	20.0381	20.0391	20.0427	20.0228	19.8387	19.4691	19.3336	(90)
Living area fraction											fLA = Living area / (4) =	0.4599	(91)
MIT	20.1250	19.8240	20.0496	20.3078	20.4254	20.4585	20.4600	20.4619	20.4435	20.2626	19.9274	19.7985	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1250	19.8240	20.0496	20.3078	20.4254	20.4585	20.4600	20.4619	20.4435	20.2626	19.9274	19.7985	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9915	0.9702	0.8840	0.6963	0.4743	0.3289	0.3792	0.6564	0.9380	0.9923	0.9980	(94)
Useful gains	970.0443	1129.2931	1277.8508	1335.5959	1149.6048	779.5739	515.1527	539.5560	834.3600	1018.9912	947.5198	917.7548	(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													
	2228.5190	2093.2316	1892.8238	1561.5168	1189.4333	782.1256	515.3244	539.9878	854.0278	1317.1937	1763.0538	2161.4900	(97)
Space heating kWh													
	936.3051	647.7667	457.5399	162.6630	29.6324	0.0000	0.0000	0.0000	0.0000	221.8627	587.1844	925.3390	(98a)
Space heating requirement - total per year (kWh/year)												3968.2932	
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

936.3051	647.7667	457.5399	162.6630	29.6324	0.0000	0.0000	0.0000	0.0000	221.8627	587.1844	925.3390	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 3968.2932

Space heating per m2 (98c) / (4) = 29.2216 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 335.9664 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	936.3051	647.7667	457.5399	162.6630	29.6324	0.0000	0.0000	0.0000	0.0000	221.8627	587.1844	925.3390	(98)
Space heating efficiency (main heating system 1)													
	335.9664	335.9664	335.9664	335.9664	335.9664	0.0000	0.0000	0.0000	0.0000	335.9664	335.9664	335.9664	(210)
Space heating fuel (main heating system)													
	278.6901	192.8070	136.1862	48.4164	8.8200	0.0000	0.0000	0.0000	0.0000	66.0372	174.7748	275.4260	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	291.0816	241.2222	213.0323	151.5204	112.2465	97.2970	94.3875	116.2881	152.3674	211.5372	257.7177	287.7969	(64)
Efficiency of water heater												176.1309	(216)
(217)m	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	176.1309	(217)
Fuel for water heating, kWh/month													
	165.2643	136.9562	120.9511	86.0271	63.7290	55.2413	53.5894	66.0236	86.5080	120.1022	146.3216	163.3994	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	62.2291	56.2069	62.2291	60.2217	62.2291	60.2217	62.2291	62.2291	60.2217	62.2291	60.2217	62.2291	(231)
Lighting	32.4336	26.0194	23.4276	17.1641	13.2580	10.8319	12.0944	15.7208	20.4197	26.7918	30.2613	33.3350	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-138.3208	-213.4015	-322.0523	-355.2754	-360.3264	-329.7424	-326.1160	-317.3648	-290.6058	-247.4339	-158.1758	-117.0747	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-11.9387	-37.3385	-104.9864	-217.0407	-346.7219	-365.3987	-359.8386	-281.9571	-178.7835	-73.1038	-20.0537	-8.6669	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 1181.1578 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 176.1309

Water heating fuel used 1264.1134 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.1760)

mechanical ventilation fans (SFP = 1.1760) 652.6972 (230a)

pump for solar water heating 80.0000 (230g)

Total electricity for the above, kWh/year 732.6972 (231)

Electricity for lighting (calculated in Appendix L) 261.7575 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation -5181.7182 (233)

Wind generation 0.0000 (234)

Hydro-electric generation (Appendix N) 0.0000 (235a)

Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated -0.0000 (236)

Energy used 0.0000 (237)

Total delivered energy for all uses -1741.9923 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1181.1578	16.4900	194.7729	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1264.1134	16.4900	208.4523	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	652.6972	16.4900	107.6298	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	261.7575	16.4900	43.1638	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3175.8897	16.4900	-523.7042	
PV Unit electricity exported	-2005.8285	5.5900	-112.1258	
Total			-635.8300	(252)
Total energy cost			-68.6192	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.3600 (256)

Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = -0.1366 (257)

SAP value	102.2148	
SAP rating (Section 12)	102	(258)
SAP band	A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1181.1578	0.1570	185.4664	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1264.1134	0.1453	183.6593	(264)
Space and water heating			369.1257	(265)
Pumps, fans and electric keep-hot	732.6972	0.1387	101.6341	(267)
Energy for lighting	261.7575	0.1443	37.7797	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3175.8897	0.1347	-427.7174	
PV Unit electricity exported	-2005.8285	0.1190	-238.6516	
Total			-666.3691	(269)
Total CO2, kg/year			-157.8296	(272)
CO2 emissions per m2			-1.1600	(273)
EI value			101.1698	
EI rating			101	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	135.8000	(1b)	x 3.3500	(2b) =	454.9300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		454.9300	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.4000	5.0000	5.0000	4.5000	4.4000	3.9000	4.0000	3.8000	4.0000	4.6000	4.7000	5.1000	(22)
Wind factor	1.3500	1.2500	1.2500	1.1250	1.1000	0.9750	1.0000	0.9500	1.0000	1.1500	1.1750	1.2750	(22a)
Adj infilt rate	0.2025	0.1875	0.1875	0.1687	0.1650	0.1462	0.1500	0.1425	0.1500	0.1725	0.1762	0.1912	(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) =	75.6000	(23c)

Effective ac	0.3245	0.3095	0.3095	0.2907	0.2870	0.2682	0.2720	0.2645	0.2720	0.2945	0.2982	0.3132	(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 = 1.20)			30.7400	1.1450	35.1985			(27)
Doors			3.6500	1.2000	4.3800			(26)
Ground			135.8000	0.1200	16.2960	110.0000	14938.0000	(28a)
R-Wall	158.7900	34.3900	124.4000	0.1500	18.6600	190.0000	23636.0000	(29a)
Warm Roof	144.0600		144.0600	0.0900	12.9654	9.0000	1296.5400	(30)
Total net area of external elements Aum(A, m2)			438.6500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		87.4999			(33)
Internal Wall 1			251.2500			9.0000	2261.2500	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		42131.7900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							310.2488	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	21.1000	0.0170	0.3587	
E3 Sill	10.0500	0.0480	0.4824	
E4 Jamb	23.9500	0.0090	0.2155	
E5 Ground floor (normal)	47.4000	0.0570	2.7018	
E11 Eaves (insulation at rafter level)	28.0000	0.0350	0.9800	
E13 Gable (insulation at rafter level)	19.4000	0.0540	1.0476	
E16 Corner (normal)	13.4000	0.0380	0.5092	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.2953	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	93.7951	(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	48.7162	46.4643	46.4643	43.6494	43.0864	40.2715	40.8345	39.7086	40.8345	44.2124	44.7753	47.0273	(38)
Heat transfer coeff	142.5113	140.2594	140.2594	137.4445	136.8815	134.0667	134.6296	133.5037	134.6296	138.0075	138.5705	140.8224	(39)
Average = Sum(39)m / 12 =												137.6322	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0494	1.0328	1.0328	1.0121	1.0080	0.9872	0.9914	0.9831	0.9914	1.0163	1.0204	1.0370	(40)
HLP (average)												1.0135	
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												2.9086	(42)
Hot water usage for mixer showers	72.9879	71.8910	70.2927	67.2345	64.9777	62.4609	61.0303	62.6166	64.3554	67.0577	70.1815	72.7083	(42a)
Hot water usage for baths	31.5104	31.0424	30.3834	29.1683	28.2585	27.2496	26.7047	27.3591	28.0716	29.1511	30.3912	31.4039	(42b)
Hot water usage for other uses	44.4172	42.8020	41.1869	39.5717	37.9565	36.3414	36.3414	37.9565	39.5717	41.1869	42.8020	44.4172	(42c)
Average daily hot water use (litres/day)												136.8868	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.9155	145.7355	141.8630	135.9746	131.1927	126.0519	124.0764	127.9322	131.9987	137.3957	143.3748	148.5293	(44)
Energy conte	235.8458	207.5254	218.0381	186.1424	176.6106	154.9955	150.0596	158.4068	162.7676	186.4447	204.2637	232.5611	(45)
Energy content (annual)										Total = Sum(45)m =		2273.6613	
Distribution loss (46)m = 0.15 x (45)m	35.3769	31.1288	32.7057	27.9214	26.4916	23.2493	22.5089	23.7610	24.4151	27.9667	30.6396	34.8842	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0314	(55)
Total storage loss	31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734	(56)
If cylinder contains dedicated solar storage	31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	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	291.0816	257.4158	271.8782	232.8428	219.0521	195.8428	192.2685	201.5461	210.8187	240.2847	257.7177	287.7969	(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)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												691.4235	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												691.4235	
Solar input	-4.7842	-22.0967	-65.1128	-88.6171	-107.5926	-106.4115	-94.0953	-91.1176	-66.3824	-36.3820	-8.8312	-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	286.2974	235.3191	206.7654	144.2257	111.4595	89.4312	98.1732	110.4285	144.4363	203.9027	248.8865	287.7969	(64)
										Total per year (kWh/year) = Sum(64)m =		2167.1224	(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	122.6074	108.9145	115.5697	99.2527	92.6762	84.2138	83.6619	87.1817	92.5611	105.0649	110.6809	121.5152	(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	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	174.5174	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.0545	32.9115	26.7654	20.2631	15.1469	12.7877	13.8175	17.9606	24.1066	30.6089	35.7251	38.0843	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	454.6026	459.3200	447.4324	422.1252	390.1793	360.1547	340.0964	335.3791	347.2667	372.5739	404.5198	434.5444	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	55.3604	(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)	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	-116.3450	(71)
Water heating gains (Table 5)	164.7948	162.0752	155.3356	137.8509	124.5648	116.9636	112.4488	117.1798	128.5571	141.2163	153.7234	163.3269	(72)
Total internal gains	769.9848	767.8395	743.0663	693.7721	643.4239	603.4389	579.8956	584.0523	613.4633	657.9319	707.5012	749.4884	(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	15.6100	13.8174	0.6300	0.8000	0.7700	75.3343	(74)
East	8.6900	25.8543	0.6300	0.8000	0.7700	78.4722	(76)
South	4.3000	57.7293	0.6300	0.8000	0.7700	86.7018	(78)
West	2.1400	25.8543	0.6300	0.8000	0.7700	19.3246	(80)

Solar gains	259.8329	402.3487	610.2059	879.9915	1026.9960	1129.2870	970.9579	898.1476	721.1138	469.2224	307.8094	215.8733	(83)
Total gains	1029.8177	1170.1882	1353.2722	1573.7636	1670.4199	1732.7259	1550.8536	1482.1998	1334.5771	1127.1543	1015.3105	965.3617	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	82.1217	83.4402	83.4402	85.1491	85.4993	87.2944	86.9294	87.6626	86.9294	84.8017	84.4572	83.1066	
alpha	6.4748	6.5627	6.5627	6.6766	6.7000	6.8196	6.7953	6.8442	6.7953	6.6534	6.6305	6.5404	
util living area	0.9963	0.9908	0.9703	0.8924	0.7408	0.5230	0.4418	0.4582	0.6935	0.9341	0.9888	0.9971	(86)
Living	20.3474	20.4673	20.6303	20.8221	20.9216	20.9516	20.9535	20.9537	20.9388	20.8012	20.5696	20.3493	
Non living	19.2923	19.4556	19.6575	19.8935	19.9942	20.0342	20.0316	20.0389	20.0233	19.8750	19.5947	19.3035	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.6661	20.4673	20.6303	20.8221	20.9216	20.9516	20.9535	20.9537	20.9388	20.8012	20.5696	20.4403	(87)
Th 2	20.0424	20.0561	20.0561	20.0733	20.0767	20.0940	20.0905	20.0974	20.0905	20.0698	20.0664	20.0526	(88)
util rest of house	0.9947	0.9870	0.9587	0.8588	0.6818	0.4549	0.3635	0.3778	0.6147	0.9023	0.9832	0.9958	(89)
MIT 2	19.7433	19.4556	19.6575	19.8935	19.9942	20.0342	20.0316	20.0389	20.0233	19.8750	19.5947	19.4385	(90)
Living area fraction										fLA = Living area / (4) =		0.4599	(91)
MIT	20.1677	19.9209	20.1049	20.3205	20.4207	20.4561	20.4555	20.4596	20.4443	20.3009	20.0430	19.8992	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1677	19.9209	20.1049	20.3205	20.4207	20.4561	20.4555	20.4596	20.4443	20.3009	20.0430	19.8992	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9863	0.9594	0.8686	0.7045	0.4823	0.3950	0.4101	0.6463	0.9114	0.9831	0.9956	(94)
Useful gains	1024.6511	1154.1649	1298.2833	1366.9783	1176.8707	835.6499	612.6314	607.9047	862.5112	1027.2416	998.1067	961.0785	(95)
Ext temp.	5.4000	5.9000	7.1000	8.9000	11.5000	14.2000	15.9000	15.9000	13.9000	11.2000	8.3000	5.7000	(96)
Heat loss rate W	2104.5651	1966.5574	1824.0548	1569.6912	1221.0794	838.7317	613.3101	608.7174	881.0548	1255.9952	1627.2348	1999.5622	(97)
Space heating kWh	803.4560	545.9278	391.1740	145.9533	32.8912	0.0000	0.0000	0.0000	0.0000	170.1926	452.9722	772.6319	(98a)
Space heating requirement - total per year (kWh/year)												3315.1991	
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	803.4560	545.9278	391.1740	145.9533	32.8912	0.0000	0.0000	0.0000	0.0000	170.1926	452.9722	772.6319	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3315.1991	
Space heating per m2											(98c) / (4) =	24.4124	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	336.4449	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	803.4560	545.9278	391.1740	145.9533	32.8912	0.0000	0.0000	0.0000	0.0000	170.1926	452.9722	772.6319	(98)
Space heating efficiency (main heating system 1)	336.4449	336.4449	336.4449	336.4449	336.4449	0.0000	0.0000	0.0000	0.0000	336.4449	336.4449	336.4449	(210)
Space heating fuel (main heating system)	238.8076	162.2636	116.2669	43.3810	9.7761	0.0000	0.0000	0.0000	0.0000	50.5856	134.6349	229.6459	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	286.2974	235.3191	206.7654	144.2257	111.4595	89.4312	98.1732	110.4285	144.4363	203.9027	248.8865	287.7969	(64)
Efficiency of water heater												176.1420	(216)
(217)m	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	176.1420	(217)
Fuel for water heating, kWh/month	162.5378	133.5963	117.3856	81.8803	63.2782	50.7722	55.7353	62.6929	81.9999	115.7604	141.2988	163.3891	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	62.2291	56.2069	62.2291	60.2217	62.2291	60.2217	62.2291	62.2291	60.2217	62.2291	60.2217	62.2291	(231)
Lighting	32.4336	26.0194	23.4276	17.1641	13.2580	10.8319	12.0944	15.7208	20.4197	26.7918	30.2613	33.3350	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-173.3976	-226.7244	-332.1674	-364.7653	-361.6675	-333.4171	-324.6840	-322.8541	-302.3995	-262.0072	-190.2343	-145.8828	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-20.1829	-45.2625	-119.5084	-245.8751	-351.2915	-413.5250	-343.4825	-312.4169	-208.6032	-88.5843	-32.2063	-14.4592	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	985.3616	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	176.1420	
Water heating fuel used	1230.3268	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.1760)		
mechanical ventilation fans (SFP = 1.1760)	652.6972	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	732.6972	(231)
Electricity for lighting (calculated in Appendix L)	261.7575	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-5535.5993	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	-2325.4562	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	985.3616	21.5100	211.9513	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1230.3268	21.5100	264.6433	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	652.6972	21.5100	140.3952	(249)
Pump for solar water heating	80.0000	21.5100	17.2080	(249)
Energy for lighting	261.7575	21.5100	56.3040	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3340.2013	21.5100	-718.4773	
PV Unit electricity exported	-2195.3980	5.5900	-122.7227	
Total			-841.2000	(252)
Total energy cost			-150.6983	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	985.3616	0.1571	154.8124	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1230.3268	0.1454	178.9075	(264)
Space and water heating			333.7199	(265)
Pumps, fans and electric keep-hot	732.6972	0.1387	101.6341	(267)
Energy for lighting	261.7575	0.1443	37.7797	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3340.2013	0.1355	-452.5025	
PV Unit electricity exported	-2195.3980	0.1204	-264.3563	
Total			-716.8589	(269)
Total CO2, kg/year			-243.7251	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	985.3616	1.5816	1558.4661	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1230.3268	1.5379	1892.1124	(278)
Space and water heating			3450.5785	(279)
Pumps, fans and electric keep-hot	732.6972	1.5128	1108.4243	(281)
Energy for lighting	261.7575	1.5338	401.4925	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3340.2013	1.5007	-5012.7521	
PV Unit electricity exported	-2195.3980	0.4418	-969.9471	
Total			-5982.6992	(283)
Total Primary energy kWh/year			-1022.2040	(286)