SAP 2012 WORKSHEET (Version 9.94, September 2019) CALCULATION OF ENERGY RATINGS 30 Nov 2020

Calculated by Lambda Calculation Engine SAP Engine version v94.0.1.1 RRN: 3723-2990-5662-3791-6053

1. Overall dwelling dimensions

Ground floor(main)	80.07	2.82	225.7974	(1b)-	(3b)
First floor(main)	80.07	2.81	224.9967	(1c)-	(3c)
Ground floor (extension 1)	16.93	1.89	31.9977	(1b)-	(3b)
First floor (extension 2)	16.93	2.81	47.5733	(1c)-	(3c)

Total floor area 194.0000 (4)
Dwelling volume (m³) 530.3651 (5)

2. Ventilation rate

Number of chimneys	0	(6a) Number of open flues	20	(6b)
Number of intermittent fans	0	(7a) Number of passive vents	0	
(7b) Number of flueless gas fires 0 (7c)				

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Infiltration due to chimneys, flues and fans	0.0377	(8)
Number of storeys 2	(9) Additional infiltration 0.1000	(10)
Structural infiltration	0.3500	(11)
Floor infiltration	0.2000	(12)
0.05 if no draught lobby	0.0500	(13)
% of windows and doors draught proofed 100	(14) Window infiltration 0.0500	(15)
Infiltration rate	0.7877	(18)
Number of sides sheltered 2	(19) Shelter factor 0.8500	(20)
Infiltration rate incorporating shelter factor	0.6696	(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	0.8537	0.8369	0.8202	0.7365	0.7198	0.6361	0.6361	0.6193	0.6696	0.7198	0.7532		0.7867	(22b)
Effective ach	0.8644	0.8502	0.8364	0.7712	0.7590	0.7023	0.7023	0.6918	0.7242	0.7590	0.7837		0.8095	(25)

3. Heat losses and heat loss parameter

Element Net U-value A x U K-value A xK

Element						(26)
(Main) Doors	3.7000	3.0000	11.1000			
Windows(1)	13.6100	4.0268	54.8054			(27)
Windows(2)	11.6000	2.7580	31.9929			(27)
Ground Floor	80.0700	0.5200	41.6364			(28a)
Walls	106.6600	2.3400	249.5844			(29a)
Roof	80.0700	0.4000	32.0280			(30)
Element (extension 1)						
Windows(1)	1.4400	4.0268	5.7987			(27)
Windows(2)	1.2300	2.7580	3.3923			(27)
Ground Floor	16.9300	0.3400	5.7562			(28a)
Walls	3.1700	1.6700	5.2939			(29a)
Alternative wall	0.0000	0.0000	0.0000			(29b)
Roof	0.0000	0.0000	0.0000			(30)
Element (extension 2)						
Windows(1)	1.4400	4.0268	5.7987			(27)
Windows(2)	1.2300	2.7580	3.3923			(27)
Ground Floor	0.0000	0.0000	0.0000			(28a)
Walls	8.6500	2.3400	20.2410			(29a)
Roof	16.9300	0.4000	6.7720			(30)

Total area of elements (whole dwelling)	346.7300	(31)
Party wall (main) 25.1100	0.2500 6.2775	(32)
Party wall (extn 1) 7.9400	0.2500 1.9850	(32)
Party wall (extn 2) 10.7500	0.2500 2.6875	(32)
Fabric heat loss	488.5422	(33)
Thermal mass parameter	250.0000	(35)
Thermal bridges (0.15 × total area)	52.0095 (36)	
Total fabric heat loss	540.5517 (37)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Vent loss	151.2851	148.8087	146.3813	134.9797	132.8466	122.9162	122.9162	121.0773	126.7412	132.8466	137.1620		141.6735	(38)
Heat transfer coeff	691.8368	689.3603	686.9329	675.5314	673.3982	663.4679	663.4679	661.6289	667.2929	673.3982	677.7136		682.2252	(39)
Heat transfer coeff (average)													675.5212	(39)
HLP	3.5662	3.5534	3.5409	3.4821	3.4711	3.4199	3.4199	3.4105	3.4397	3.4711	3.4934		3.5166	(40)
HLP (average)													3.4821	(40)
Days in month	31.0000	28.0000	31.0000	30.0000	31.0000	30.0000	31.0000	31.0000	30.0000	31.0000	30.0000		31.0000	(41)

4. Water heating energy requirements

Assumed occupancy	2.9941 (42)
Average daily hot water use (litres/day)	110.8527 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	121.9380	117.5039	113.0698	108.6357	104.2016	99.7674	99.7674	104.2016	108.6357	113.0698	117.5039		121.9380	(44)
Energy content	180.8305	158.1555	163.2023	142.2837	136.5246	117.8104	109.1686	125.2726	126.7688	147.7368	161.2662		175.1247	(45)
Energy content(annual)													1744.1449	(45)
Distribution loss	27.1246	23.7233	24.4803	21.3426	20.4787	17.6716	16.3753	18.7909	19.0153	22.1605	24.1899		26.2687	(46)
Cylinder volume													110.0000	(47)
Cylinder loss factor (kWh/litre/day)													0.0330	(51)
Volume factor													1.0294	(52)
Temperature factor													0.7800	(53)
Energy lost from cylinder in kWh/day													2.9170	(55)
Total storage loss	90.4262	81.6753	90.4262	87.5092	90.4262	87.5092	90.4262	90.4262	87.5092	90.4262	87.5092		90.4262	(56)
Net storage loss	90.4262	81.6753	90.4262	87.5092	90.4262	87.5092	90.4262	90.4262	87.5092	90.4262	87.5092		90.4262	(57)
Primary loss	128.3772	115.9536	128.3772	124.2360	128.3772	41.9160	43.3132	43.3132	41.9160	128.3772	124.2360		128.3772	(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	399.6339	355.7844	382.0057	354.0290	355.3280	247.2356	242.9080	259.0120	256.1940	366.5402	373.0115		393.9281	(62)
WW heat rec.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	(G10)
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	(63)
Solar input(sum of months)													0.0000	(63)
Flue gas heat rec.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	(G6)
Fghrs PV	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	
Output from w/h	399.6339	355.7844	382.0057	354.0290	355.3280	247.2356	242.9080	259.0120	256.1940	366.5402	373.0115		393.9281	(64)
Output from water heater(annual)													3985.6104	(64)
Heat gains (kWh)	235.1689	210.6898	229.3075	216.7055	220.4372	142.7121	143.2901	148.6447	145.6908	224.1652	223.0172		233.2717	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Metabolic	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465		179.6465	(66)
Lighting	126.2170	112.1048	91.1698	69.0214	51.5943	43.5581	47.0660	61.1782	82.1133	104.2616	121.6887		129.7249	(67)
Appliances	545.2340	550.8918	536.6343	506.2817	467.9670	431.9566	407.8994	402.2416	416.4991	446.8517	485.1664		521.1768	(68)
Cooking	55.9588	55.9588	55.9588	55.9588	55.9588	55.9588	55.9588	55.9588	55.9588	55.9588	55.9588		55.9588	(69)
Pumps, fans	20.0000	20.0000	20.0000	20.0000	20.0000	20.0000	20.0000	20.0000	20.0000	20.0000	20.0000		20.0000	(70)
Losses	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643		119.7643	(71)
Water heating	316.0872	313.5265	308.2090	300.9799	296.2865	198.2113	192.5942	199.7912	202.3483	301.2973	309.7461		313.5372	(72)
Total internal	1123.3791	1112.3641	1071.8540	1012.1239	951.6887	809.5669	783.4006	799.0519	836.8016	988.2516	1052.4422		1100.2799	(73)

6. Solar gains

(calculation for January)

Orientation	Area	Gains[W]		
East/West(1)(main)	13.6100	110.2188	(76)	
East/West(2)(main)	11.6000	83.9944	(76)	
East/West(1)(extn 1)	1.4400	11.6617	(76)	
East/West(2)(extn 1)	1.2300	8.9063	(76)	
East/West(1)(extn 2)	1.4400	11.6617	(76)	
East/West(2)(extn 2)	1.2300	8.9063	(76)	
	total:	235.3491		(83-1)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Solar gains	235.3491	460.3927	758.2012	1105.7912	1355.1886	1387.2767	1320.7440	1134.4996	881.8193	546.2947	293.4526		193.5396	(83)
Total gains	1358.7282	1572.7568	1830.0552	2117.9151	2306.8774	2196.8436	2104.1446	1933.5515	1718.6210	1534.5463	1345.8948		1293.8195	(84)

7. Mean internal temperature

Living room temperature during heating periods Th1 ..... 21.0000 (85)
Heating system responsiveness 0.0000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	19.4731	19.5431	19.6121	19.9431	20.0063	20.3058	20.3058	20.3622	20.1894	20.0063			19.8789	19.7475
alpha	2.2982	2.3029	2.3075	2.3295	2.3338	2.3537	2.3537	2.3575	2.3460	2.3338	2.3253		2.3165	
external 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	
util living area	0.9935	0.9904	0.9836	0.9678	0.9363	0.8851	0.8062	0.8399	0.9355	0.9773	0.9907		0.9943	(86)
MIT 1	17.5699	17.7875	18.2479	18.9191	19.6041	20.2116	20.5811	20.5133	19.9763	19.1274	18.2562		17.5580	(87)
th2														(88)
util rest	0.9908	0.9863	0.9757	0.9494	0.8894	0.7613	0.5220	0.5906	0.8607	0.9606	0.9858		0.9920	(89)
MIT 2	15.6452	15.8647	16.3253	17.0015	17.6654	18.2289	18.4868	18.4606	18.0380	17.2169	16.3470		15.6446	(90)
Living area fraction =													0.1600	(91)
MIT	15.9531	16.1723	16.6329	17.3083	17.9756	18.5461	18.8219	18.7890	18.3482	17.5225	16.6525		15.9508	(92)
Temperature adjustment	0.0000													
adjusted MIT	15.9531	16.1723	16.6329	17.3083	17.9756	18.5461	18.8219	18.7890	18.3482	17.5225	16.6525		15.9508	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9861	0.9798	0.9658	0.9346	0.8725	0.7606	0.5703	0.6288	0.8502	0.9486	0.9793		0.9877	(94)
Useful gains W	1339.8062	1540.9188	1767.4675	1979.3163	2012.7215	1670.9262	1200.0037	1215.7816	1461.1958	1455.6171	1318.1004		1277.9153	(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	8062.0661	7770.6939	6960.6084	5680.0997	4225.9850	2618.1219	1474.1343	1580.6582	2834.7609	4661.6204	6473.8611		8016.6760	(97)
Month fraction	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000		1.0000	(97a)
Space heating kWh	5001.3613	4186.4089	3863.6968	2664.5641	1646.6680	0.0000	0.0000	0.0000	0.0000	2385.2664	3712.1477		5013.6380	(98)
Space heating													28473.7512	(98)
Space heating per m2													146.7719	(99)

8c. Space cooling requirement

- not applicable

9. Energy requirements

Fraction of space heat from secondary	0.1000	(201)
Fraction of space heat from main system	0.9000	(202)
Fraction of main heating from main system 2	0.3000	(203)
Fraction of total space heat from main system 1	0.6300	(204)
Fraction of total space heat from main system 2	0.2700	(205)
Efficiency of main heating system 1	66.0000	(206)
Efficiency of main heating system 2	71.0000	(207)
Efficiency of secondary heating system	60.0000	(208)
Space heating requirement	27179.4898	(211)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Space heating requirement
5001.3613	4186.4089	3863.6968	2664.5641	1646.6680	0.0000	0.0000	0.0000	0.0000	2385.2664	3712.1477	5013.6380	(98) Space heating efficiency (main heating system)
66.0000	66.0000	66.0000	66.0000	66.0000	0.0000	0.0000	0.0000	0.0000	66.0000	66.0000	66.0000	(210) Space heating fuel (main heating system)
4774.0267	3996.1176	3688.0743	2543.4475	1571.8195	0.0000	0.0000	0.0000	0.0000	2276.8452	3543.4137	4785.7453	(211) Space heating efficiency (main heating system 2)
71.0000	71.0000	71.0000	71.0000	71.0000	0.0000	0.0000	0.0000	0.0000	71.0000	71.0000	71.0000	(212) Space heating fuel (main heating system 2)
1901.9261	1592.0146	1469.2932	1013.2849	626.1977	0.0000	0.0000	0.0000	0.0000	907.0732	1411.6618	1906.5947	(213) Space heating fuel (secondary)
833.5602	697.7348	643.9495	444.0940	274.4447	0.0000	0.0000	0.0000	0.0000	397.5444	618.6913	835.6063	(215) Water heating requirement
399.6339	355.7844	382.0057	354.0290	355.3280	247.2356	242.9080	259.0120	256.1940	366.5402	373.0115	393.9281	(64) Efficiency of water heater 64.3894 (216)
64.3894	64.3015	64.0687	63.5407	62.4588	54.0000	54.0000	54.0000	54.0000	63.2441	64.0423	64.4128	(217) Water heating fuel
620.6513	553.3062	596.2439	557.1685	568.8994	457.8437	449.8297	479.6519	474.4333	579.5640	582.4452	611.5683	(219) Space cooling fuel 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (221)

Annual totals: kWh/year

Space heating fuel - main system	27179.4898	(211)
Space heating fuel - main system 2	10828.0462	(213)
Space heating fuel - secondary	4745.6252	(215)
Water heating fuel	6531.6056	(219)
central heating pump	120.0000	(230c)
oil boiler pump	200.0000	(230d)
Electricity for pumps and fans	320.0000	(231)
Electricity for lighting	891.6126	(232)
Total delivered energy for all uses	50496.3794	(238)

10. Fuel costs

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year		
Space heating - main system	27179.4898	5.4400		1478.5642	(240)
Space heating - main system 2	10828.0462	5.4400		589.0457	(241)
Space heating - secondary	4745.6252	3.9900		189.3504	(242)
Water heating	6531.6056	5.4400		355.3193	(247)
Pumps and fans for heating	0.0000	320.0000		42.2080	(249)
Electricity for lighting	891.6126	13.1900		117.6037	(250)
Additional standing charges				0.0000	(251)
Total energy cost				2772.0914	(255)

11. SAP rating

Energy cost deflator	0.4200	(256)
Energy cost factor (ECF)	4.8715	(257)

SAP value 33.7933

SAP rating 34 (258) SAP BAND F

12. Carbon dioxide emissions

	Energy kWh/year	Emission factor	Emissions kg/year		
Space heating - main system	27179.4898	0.2980		8099.4880	(261)
Space heating - main system 2	10828.0462	0.2980		3226.7578	(262)
Space heating - secondary	4745.6252	0.2260		1072.5113	(263)
Water heating	6531.6056	0.2980		1946.4185	(264)
Space and water heating				14345.1755	(265)
Pumps and fans	0.5190	320.0000		166.0800	(267)
Energy for lighting	891.6126	0.5190		462.7469	(268)
Total kg/year				14974.0024	(272)

	kg/m2/year	
CO2 emissions per m2	77.19	(273)

EI value 29.2907

EI rating 29 (274) EI band F

Calculated by Lambda Calculation Engine SAP Engine version v94.0.1.1 RRN: 3723-2990-

5662-3791-6053

1. Overall dwelling dimensions

Ground floor(main)	80.07	2.82	225.7974	(1b)-	(3b)
First floor(main)	80.07	2.81	224.9967	(1c)-	(3c)
Ground floor (extension 1)	16.93	1.89	31.9977	(1b)-	(3b)
First floor (extension 2)	16.93	2.81	47.5733	(1c)-	(3c)

Total floor area	194.0000	(4)
Dwelling volume (m³)	530.3651	(5)

2. Ventilation rate

Number of chimneys 0 (6a)

Number of open flues 20 (6b) Number of intermittent fans 0
(7a) Number of passive vents 0 (7b) Number of flueless gas fires 0 (7c)

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Infiltration due to chimneys, flues and fans 0.0377 (8)
Number of storeys 2 (9) Additional infiltration 0.1000 (10)
Structural infiltration 0.3500 (11)
Floor infiltration 0.1000 (12)
0.05 if no draught lobby 0.0500 (13)
% of windows and doors draught proofed 100 (14) Window infiltration 0.0500 (15)
Infiltration rate 0.6877 (18)
Number of sides sheltered 2 (19) Shelter factor 0.8500 (20)
Infiltration rate incorporating shelter factor 0.5846 (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	0.7453	0.7307	0.7161	0.6430	0.6284	0.5553	0.5553	0.5407	0.5846	0.6284	0.6576		0.6869	(22b)
Effective ach	0.7777	0.7670	0.7564	0.7067	0.6974	0.6542	0.6542	0.6462	0.6709	0.6974	0.7162		0.7359	(25)

3. Heat losses and heat loss parameter

Element	Net U-value	A x U	K-value	A xK	
Element (Main) Doors			3.7000	3.0000	11.1000 (26)
Windows	11.6000	2.7580			31.9929 (27)
Windows	13.6100	1.5038			20.4662 (27)
Ground Floor	80.0700	0.2500			20.0175 (28a)
Walls	106.6600	0.3000			31.9980 (29a)
Roof	80.0700	0.1600			12.8112 (30)
Element (extension 1)					
Windows	1.2300	2.7580			3.3923 (27)
Windows	1.4400	1.5038			2.1654 (27)
Ground Floor	16.9300	0.3400			5.7562 (28a)
Walls	3.1700	0.3000			0.9510 (29a)
Alternative wall	0.0000	0.0000			0.0000 (29b)
Roof	0.0000	0.0000			0.0000 (30)
Element (extension 2)					
Windows	1.2300	2.7580			3.3923 (27)
Windows	1.4400	1.5038			2.1654 (27)
Ground Floor	0.0000	0.0000			0.0000 (28a)
Walls	8.6500	0.3000			2.5950 (29a)
Roof	16.9300	0.1600			2.7088 (30)

Total area of elements (whole dwelling) 346.7300 (31)
Party wall (main) 25.1100 0.2500 ..... 6.2775 (32)
Party wall (extn 1) 7.9400 0.2500 ..... 1.9850 (32)
Party wall (extn 2) 10.7500 0.2500 ..... 2.6875 (32)
Fabric heat loss 162.4623 (33)
Thermal mass parameter 250.0000 (35)
Thermal bridges (0.15 × total area) 52.0095 (36)
Total fabric heat loss 214.4718 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Vent loss	136.1205	134.2329	132.3827	123.6922	122.0663	114.4972	114.4972	113.0956	117.4127	122.0663	125.3556		128.7944	(38)
Heat transfer coeff	350.5922	348.7046	346.8544	338.1640	336.5381	328.9690	328.9690	327.5673	331.8845	336.5381	339.8273		343.2661	(39)
Heat transfer coeff (average)													338.1562	(39)
HLP	1.8072	1.7974	1.7879	1.7431	1.7347	1.6957	1.6957	1.6885	1.7107	1.7347	1.7517		1.7694	(40)
HLP (average)													1.7431	(40)
Days in month	31.0000	28.0000	31.0000	30.0000	31.0000	30.0000	31.0000	31.0000	30.0000	31.0000	30.0000		31.0000	(41)

4. Water heating energy requirements

Assumed occupancy 2.9941 (42)
Average daily hot water use (litres/day) 110.8527 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	121.9380	117.5039	113.0698	108.6357	104.2016	99.7674	99.7674	104.2016	108.6357	113.0698	117.5039		121.9380	(44)
Energy content	180.8305	158.1555	163.2023	142.2837	136.5246	117.8104	109.1686	125.2726	126.7688	147.7368	161.2662		175.1247	(45)
Energy content(annual)													1744.1449	(45)
Distribution loss	27.1246	23.7233	24.4803	21.3426	20.4787	17.6716	16.3753	18.7909	19.0153	22.1605	24.1899		26.2687	(46)
Cylinder volume													160.0000	(47)
Cylinder loss factor (kWh/litre/day)													0.0152	(51)
Volume factor													0.9086	(52)
Temperature factor													0.5400	(53)
Energy lost from cylinder in kWh/day													1.1920	(55)
Total storage loss	36.9530	33.3769	36.9530	35.7609	36.9530	35.7609	36.9530	36.9530	35.7609	36.9530	35.7609		36.9530	(56)
Net storage loss	24.7123	22.3208	24.7123	23.9151	24.7123	23.9151	24.7123	24.7123	23.9151	24.7123	23.9151		24.7123	(57)
Primary loss	64.5792	58.3296	60.7044	43.7472	29.0606	18.4430	19.0578	20.7903	31.8562	60.7044	62.4960		64.5792	(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	270.1220	238.8059	248.6191	209.9461	190.2976	160.1686	152.9387	170.7752	182.5400	233.1535	247.6774		264.4162	(62)
WW heat rec.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	(G10)
Solar input	25.9962	43.3801	73.8813	99.0156	122.3254	120.2653	118.6760	103.6878	81.2083	55.4557	30.8352		21.7544	(63)
Solar input(sum of months)													896.4814	(63)
Flue gas heat rec.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	(G6)
Fghrs PV	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	
Output from w/h	244.1258	195.4258	174.7377	110.9305	67.9722	39.9032	34.2628	67.0874	101.3317	177.6978	216.8422		242.6618	(64)
Output from water heater(annual)													1672.9789	(64)
Heat gains (kWh)	131.5593	117.1070	122.5982	101.4392	88.4128	73.0585	71.3147	78.0552	86.7676	117.4559	122.7499		129.6622	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Metabolic	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465	179.6465	(66)
Lighting	85.2117	75.6843	61.5506	46.5978	34.8324	29.4070	31.7752	41.3027	55.4364	70.3892	82.1546		87.5800	(67)
Appliances	545.2340	550.8918	536.6343	506.2817	467.9670	431.9566	407.8994	402.2416	416.4991	446.8517	485.1664		521.1768	(68)
Cooking	55.9588	55.9588	55.9588	55.9588	55.9588	55.9588	55.9588	55.9588	55.9588	55.9588	55.9588		55.9588	(69)
Pumps, fans	20.0000	20.0000	20.0000	20.0000	20.0000	20.0000	20.0000	20.0000	20.0000	20.0000	20.0000		20.0000	(70)
Losses	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643	-119.7643		119.7643	(71)
Water heating	176.8271	174.2664	164.7825	140.8878	118.8344	101.4701	95.8530	104.9130	120.5106	157.8708	170.4860		174.2771	(72)
Total internal	943.1137	936.6834	898.8083	829.6082	757.4747	698.6746	671.3686	684.2982	728.2870	810.9526	873.6479		918.8749	(73)

6. Solar gains

(calculation for January)

Orientation	Area	Gains[W]	
East	13.6100	81.6916	(76)
East	11.6000	83.9944	(76)
East	1.4400	8.6433	(76)
East	1.2300	8.9063	(76)
East	1.4400	8.6433	(76)
East	1.2300	8.9063	(76)
	total:	200.7852	(83-1)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Solar gains	200.7852	392.7785	646.8502	943.3925	1156.1629	1183.5385	1126.7769	967.8847	752.3136	466.0648	250.3556		165.1160	(83)
Total gains	1143.8989	1329.4619	1545.6585	1773.0007	1913.6376	1882.2131	1798.1455	1652.1829	1480.6006	1277.0174	1124.0035		1083.9909	(84)

7. Mean internal temperature

Living room temperature during heating periods Th1 ..... 21.0000 (85)
Heating system responsiveness 1.0000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	38.4270	38.6351	38.8411	39.8393	40.0318	40.9529	40.9529	41.1281	40.5931	40.0318			39.6443	39.2472
alpha	3.5618	3.5757	3.5894	3.6560	3.6688	3.7302	3.7302	3.7419	3.7062	3.6688	3.6430		3.6165	
external 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	
util living area	0.9976	0.9956	0.9899	0.9728	0.9289	0.8304	0.6960	0.7513	0.9194	0.9841	0.9959		0.9981	(86)
MIT 1	18.9620	19.1420	19.4823	19.9658	20.4084	20.7611	20.9138	20.8830	20.5921	20.0186	19.4275		18.9619	(87)
th2														(88)
util rest	0.9967	0.9939	0.9857	0.9601	0.8904	0.7276	0.5125	0.5793	0.8575	0.9745	0.9940		0.9974	(89)
MIT 2	17.3596	17.5734	17.9725	18.5495	19.0434	19.4120	19.5198	19.5108	19.2599	18.6202	17.9281		17.3775	(90)
Living area fraction =													0.1600	(91)
MIT	17.6160	17.8244	18.2141	18.7761	19.2618	19.6279	19.7428	19.7304	19.4730	18.8440	18.1680		17.6310	(92)
Temperature adjustment	0.0000													
adjusted MIT	17.6160	17.8244	18.2141	18.7761	19.2618	19.6279	19.7428	19.7304	19.4730	18.8440	18.1680		17.6310	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9950	0.9910	0.9805	0.9511	0.8815	0.7349	0.5415	0.6051	0.8539	0.9678	0.9914		0.9959	(94)
Useful gains W	1138.1242	1317.5025	1515.4755	1686.3081	1686.9452	1383.2840	973.7437	999.7744	1264.3543	1235.9179	1114.2933		1079.5707	(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	4668.4706	4506.7940	4063.0884	3339.7382	2544.8318	1654.0105	1033.8950	1090.9162	1783.2201	2774.4092	3761.2224		4610.3984	(97)
Month fraction	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000		1.0000	(97a)
Space heating kWh	2626.5777	2143.2039	1895.4240	1190.4697	638.2677	0.0000	0.0000	0.0000	0.0000	1144.6376	1905.7889		2626.9358	(98)
Space heating													14171.3053	(98)
Space heating per m2													73.0480	(99)

8c. Space cooling requirement

- not applicable

9. Energy requirements

Fraction of space heat from secondary	0.1000	(201)
Fraction of space heat from main system	0.9000	(202)
Fraction of main heating from main system 2	0.3000	(203)
Fraction of total space heat from main system 1	0.6300	(204)
Fraction of total space heat from main system 2	0.2700	(205)
Efficiency of main heating system 1	92.0000	(206)
Efficiency of main heating system 2	92.0000	(207)
Efficiency of secondary heating system	60.0000	(208)
Space heating requirement	9704.2634	(211)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement													
2626.5777	2143.2039	1895.4240	1190.4697	638.2677	0.0000	0.0000	0.0000	0.0000	1144.6376	1905.7889	2626.9358	(98)	Space heating efficiency (main heating system)
92.0000	92.0000	92.0000	92.0000	92.0000	0.0000	0.0000	0.0000	0.0000	92.0000	92.0000	92.0000	(210)	Space heating fuel (main heating system)
1798.6347	1467.6288	1297.9534	815.2130	437.0746	0.0000	0.0000	0.0000	0.0000	783.8279	1305.0511	1798.8800	(211)	Space heating efficiency (main heating system 2)
92.0000	92.0000	92.0000	92.0000	92.0000	0.0000	0.0000	0.0000	0.0000	92.0000	92.0000	92.0000	(212)	Space heating fuel (main heating system 2)
770.8435	628.9838	556.2657	349.3770	187.3177	0.0000	0.0000	0.0000	0.0000	335.9262	559.3076	770.9486	(213)	Space heating fuel (secondary)
437.7630	357.2006	315.9040	198.4116	106.3779	0.0000	0.0000	0.0000	0.0000	190.7729	317.6315	437.8226	(215)	Water heating requirement
244.1258	195.4258	174.7377	110.9305	67.9722	39.9032	34.2628	67.0874	101.3317	177.6978	216.8422	242.6618	(64)	Efficiency of water heater 90.3083 (216)
90.3083	90.3358	90.3201	90.3046	90.1017	80.3000	80.3000	80.3000	80.3000	89.4241	89.9941	90.3172	(217)	Water heating fuel
270.3248	216.3325	193.4649	122.8403	75.4394	49.6927	42.6684	83.5460	126.1914	198.7136	240.9515	268.6773	(219)	Space cooling fuel 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)

Annual totals: kWh/year

Space heating fuel - main system	9704.2634	(211)
Space heating fuel - main system 2	4158.9700	(213)
Space heating fuel - secondary	2361.8842	(215)
Water heating fuel	1888.8430	(219)
central heating pump	120.0000	(230c)
oil boiler pump	200.0000	(230d)
pump for solar water heating	50.0000	(230g)

Electricity for pumps and fans	370.0000	(231)
Electricity for lighting	601.9461	(232)
PV generation	1727.2394	(233)
Wind generation	3575.5408	(234)
Total delivered energy for all uses	13783.1266	(238)

10. Fuel costs

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year		
Space heating - main system	9704.2634	5.4400		527.9119	(240)
Space heating - main system 2	4158.9700	5.4400		226.2480	(241)
Space heating - secondary	2361.8842	3.9900		94.2392	(242)
Water heating	1888.8430	5.4400		102.7531	(247)
Pumps and fans for heating	0.0000	370.0000		48.8030	(249)
Electricity for lighting	601.9461	13.1900		79.3967	(250)
Additional standing charges				0.0000	(251)
Electricity generated - PVs	-1727.2394	13.1900		227.8229	(252)
Electricity generated - wind	-3575.5408	13.1900		471.6138	(252)
Total energy cost				379.9151	(255)

11. SAP rating

Energy cost deflator	0.4200	(256)
Energy cost factor (ECF)	0.6676	(257)
SAP value 90.6865		
SAP rating	91	(258) SAP BAND B

12. Carbon dioxide emissions

	Energy kWh/year	Emission factor	Emissions kg/year		
Space heating - main system	9704.2634	0.2980		2891.8705	(261)
Space heating - main system 2	4158.9700	0.2980		1239.3731	(262)
Space heating - secondary	2361.8842	0.2260		533.7858	(263)
Water heating	1888.8430	0.2980		562.8752	(264)
Space and water heating				5227.9046	(265)
Pumps and fans	0.5190	370.0000		192.0300	(267)
Energy for lighting	601.9461	0.5190		312.4100	(268)
Electricity generated - PVs	-1727.2394	0.5190		896.4372	(269)
Electricity generated - wind	-3575.5408	0.5190		1855.7056	(269)
Total kg/year				2980.2017	(272)

	kg/m2/year	
CO2 emissions per m2	15.36	(273)
EI value 83.2909		
EI rating	83	(274) EI band B