

Calculated by Lambda Calculation Engine SAP Engine version v94.0.1.1

RRN: 2643-8562-6706-2693-9401
Address: CS5 baseline;

1. Overall dwelling dimensions

Ground floor(main)	6.26	2.71	16.9646	(1b)-	(3b)
First floor(main)	6.26	2.78	17.4028	(1c)-	(3c)
Ground floor (extension 1)	12.64	2.39	30.2096	(1b)-	(3b)
Ground floor (extension 2)	24.58	2.7	66.366	(1b)-	(3b)
First floor (extension 2)	24.58	2.78	68.3324	(1c)-	(3c)
Ground floor (extension 3)	23.57	2.62	61.7534	(1b)-	(3b)
First floor (extension 3)	23.57	2.83	66.7031	(1c)-	(3c)
Total floor area	121.4600				(4)
Dwelling volume (m³)			327.7319		(5)

2. Ventilation rate

Number of chimneys	0	(6a)											
Number of open flues	0	(6b)											
Number of intermittent fans	0	(7a)											
Number of passive vents	0	(7b)											
Number of flueless gas fires	0	(7c)											
	ach												
Infiltration due to chimneys, flues and fans	0.0000	(8)											
Number of storeys	2	(9)											
Additional infiltration	0.1000	(10)											
Structural infiltration	0.3500	(11)											
Floor infiltration	0.0000	(12)											
0.05 if no draught lobby	0.0500	(13)											
% of windows and doors draught proofed	41	(14)											
Window infiltration	0.1680	(15)											
Infiltration rate	0.6680	(18)											
Number of sides sheltered	2	(19)											
Shelter factor	0.8500	(20)											
Infiltration rate incorporating shelter factor	0.5678	(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	0.7239	0.7098	0.6956	0.6246	0.6104	0.5394	0.5394	0.5252	0.5678	0.6104	0.6388	0.6672	(22b)
Effective ach	0.7620	0.7519	0.7419	0.6951	0.6863	0.6455	0.6455	0.6379	0.6612	0.6863	0.7040	0.7226	(25)

3. Heat losses and heat loss parameter

Element	Net	U-value	A x U	K-value	A x K								
Element						(Main)							
Doors	3.7000	3.0000	11.1000			(26)							
Windows (1)	1.3200	4.0268	5.3154			(27)							
Windows (2)	0.9200	2.1898	2.0146			(27)							
Ground Floor	6.2600	0.6000	3.7560			(28a)							
Walls	11.4100	1.8000	20.5380			(29a)							
Roof	6.2600	0.3000	1.8780			(30)							
Element (extension 1)													
Windows (1)	1.3300	4.0268	5.3557			(27)							
Windows (2)	0.9300	2.1898	2.0365			(27)							
Ground Floor	12.6400	0.8000	10.1120			(28a)							
Walls	20.9200	1.9800	41.4216			(29a)							
Alternative wall	0.0000	0.0000	0.0000			(29b)							
Roof	14.6000	2.3000	33.5800			(30)							
Element (extension 2)													
Windows (1)	5.1800	4.0268	20.8591			(27)							
Windows (2)	3.6000	2.1898	7.8832			(27)							
Ground Floor	24.5800	0.7600	18.6808			(28a)							
Walls	73.2600	1.8000	131.8680			(29a)							
Roof	24.5800	0.3000	7.3740			(30)							
Element (extension 3)													
Windows (1)	4.9700	4.0268	20.0134			(27)							
Windows (2)	3.4500	2.1898	7.5547			(27)							
Ground Floor	23.5700	0.5400	12.7278			(28a)							
Walls	59.2300	1.8000	106.6140			(29a)							
Roof	23.5700	0.3000	7.0710			(30)							
Total area of elements (whole dwelling)	326.2800					(31)							
Party wall (main)	0.0000	0.0000	0.0000			(32)							
Fabric heat loss			477.7539			(33)							
Thermal mass parameter			250.0000			(35)							
Thermal bridges (0.15 × total area)			48.9420			(36)							
Total fabric heat loss			526.6959			(37)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Vent loss	82.4167	81.3162	80.2374	75.1707	74.2228	69.8098	69.8098	68.9926	71.5096	74.2228	76.1405	78.1454	(38)
Heat transfer coeff	609.1125	608.0120	606.9333	601.8666	600.9186	596.5057	596.5057	595.6885	598.2055	600.9186	602.8364	604.8413	(39)
Heat transfer coeff (average)										601.8621			(39)
HLP	5.0149	5.0059	4.9970	4.9553	4.9475	4.9111	4.9111	4.9044	4.9251	4.9475	4.9633	4.9798	(40)
HLP (average)										4.9552			(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	2.8688											(42)	
Average daily hot water use (litres/day)	107.7196											(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.4915	114.1828	109.8740	105.5652	101.2564	96.9476	96.9476	101.2564	105.5652	109.8740	114.1828	118.4915	(44)
Energy content	175.7195	153.6854	158.5896	138.2622	132.6659	114.4806	106.0831	121.7319	123.1858	143.5611	156.7082	170.1750	(45)
Energy content(annual)	1694.8484											(45)	
Distribution loss	26.3579	23.0528	23.7884	20.7393	19.8999	17.1721	15.9125	18.2598	18.4779	21.5342	23.5062	25.5262	(46)
Cylinder volume	0.0000											(47)	
Energy lost from cylinder in kWh/day	0.0000											(55)	
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)
Net 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	(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	30.5807	27.6062	30.5293	29.4989	30.4516	29.4171	30.3621	30.4188	29.4537	30.4843	29.5542	30.5641	(61)
Total	206.3003	181.2916	189.1189	167.7611	163.1175	143.8977	136.4452	152.1507	152.6394	174.0454	186.2624	200.7391	(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	206.3003	181.2916	189.1189	167.7611	163.1175	143.8977	136.4452	152.1507	152.6394	174.0454	186.2624	200.7391	(64)
Output from water heater(annual)	2053.7693											(64)	
Heat gains (kWh)	66.0719	58.0020	60.3634	53.3469	51.7243	45.4191	42.8632	48.0806	48.3227	55.3551	59.4940	64.2242	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic	172.1270	172.1270	172.1270	172.1270	172.1270	172.1270	172.1270	172.1270	172.1270	172.1270	172.1270	172.1270	(66)
Lighting	97.1313	86.2712	70.1605	53.1160	39.7048	33.5205	36.2201	47.0802	63.1909	80.2354	93.6466	99.8309	(67)
Appliances	428.5103	432.9568	421.7516	397.8969	367.7846	339.4833	320.5763	316.1297	327.3349	351.1897	381.3019	409.6032	(68)
Cooking	55.0815	55.0815	55.0815	55.0815	55.0815	55.0815	55.0815	55.0815	55.0815	55.0815	55.0815	55.0815	(69)
Pumps, fans	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	(70)
Losses	-114.7513	-114.7513	-114.7513	-114.7513	-114.7513	-114.7513	-114.7513	-114.7513	-114.7513	-114.7513	-114.7513	-114.7513	(71)
Water heating	88.8063	86.3124	81.1336	74.0929	69.5219	63.0820	57.6118	64.6244	67.1148	74.4021	82.6306	86.3229	(72)
Total internal	736.9051	727.9976	695.5027	647.5629	599.4685	558.5429	536.8652	550.2914	580.0979	628.2843	680.0363	718.2142	(73)

6. Solar gains

(calculation for January)														
Orientation		Area				Gains[W]								
East/West(1) (main)		1.3200				10.6898								(76)
East/West(2) (main)		0.9200				6.6616								(76)
East/West(1) (extn 1)		1.3300				10.7708								(76)
East/West(2) (extn 1)		0.9300				6.7340								(76)
East/West(1) (extn 2)		5.1800				41.9495								(76)
East/West(2) (extn 2)		3.6000				26.0672								(76)
East/West(1) (extn 3)		4.9700				40.2489								(76)
East/West(2) (extn 3)		3.4500				24.9811								(76)
						total:		168.1031						(83-1)
Solar gains	168.1031	328.8453	541.5613	789.8349	967.9723	990.8919	943.3695	810.3404	629.8582	390.2026	209.6048	138.2398	(83)	
Total gains	905.0082	1056.8429	1237.0640	1437.3978	1567.4407	1549.4348	1480.2347	1360.6319	1209.9561	1018.4869	889.6410	856.4540	(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	13.8476	13.8726	13.8973	14.0143	14.0364	14.1402	14.1402	14.1596	14.1000	14.0364	13.9917	13.9453	
alpha	1.9232	1.9248	1.9265	1.9343	1.9358	1.9427	1.9427	1.9440	1.9400	1.9358	1.9328	1.9297	
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	0.9913	0.9877	0.9803	0.9649	0.9371	0.8891	0.8241	0.8521	0.9328	0.9749	0.9883	0.9923	(86)
MIT 1	16.8035	17.0391	17.5598	18.3142	19.1215	19.8828	20.3568	20.2756	19.6291	18.6032	17.5863	16.7700	(87)
th2													(88)
util rest	0.9877	0.9824	0.9708	0.9443	0.8875	0.7526	0.4878	0.5597	0.8476	0.9559	0.9821	0.9890	(89)
MIT 2	14.6873	14.9224	15.4408	16.1893	16.9751	17.6771	18.0201	17.9850	17.4723	16.4833	15.4720	14.6559	(90)
Living area fraction =											0.1600		(91)
MIT	15.0259	15.2610	15.7797	16.5292	17.3185	18.0300	18.3939	18.3514	17.8173	16.8224	15.8102	14.9941	(92)
Temperature adjustment											0.0000		
adjusted MIT	15.0259	15.2610	15.7797	16.5292	17.3185	18.0300	18.3939	18.3514	17.8173	16.8224	15.8102	14.9941	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9807	0.9731	0.9574	0.9249	0.8644	0.7469	0.5495	0.6073	0.8319	0.9400	0.9730	0.9827	(94)
Useful gains W	887.5401	1028.3804	1184.3793	1329.3857	1354.9678	1157.2299	813.4284	826.2726	1006.5978	957.3718	865.6097	841.6445	(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	6533.2548	6299.6129	5632.1885	4591.7725	3376.2561	2045.9973	1070.0594	1162.4293	2223.7143	3739.1847	5250.8243	6528.7162	(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	4200.4117	3542.2682	3309.1700	2348.9185	1503.8384	0.0000	0.0000	0.0000	0.0000	2069.6688	3157.3545	4231.1814	(98)
Space heating	24362.8116											(98)	
Space heating per m2	200.5830											(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 total space heat from main system 1	0.9000	(204)

Efficiency of main heating system l											90.2000		(206)
Efficiency of secondary heating system											72.0000		(208)
Space heating requirement											24308.7920		(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4200.4117	3542.2682	3309.1700	2348.9185	1503.8384	0.0000	0.0000	0.0000	0.0000	2069.6688	3157.3545	4231.1814	(98)
Space heating efficiency (main heating system)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	4191.0982	3534.4140	3301.8326	2343.7102	1500.5040	0.0000	0.0000	0.0000	0.0000	2065.0797	3150.3537	4221.7996	(211)
Space heating fuel (secondary)	583.3905	491.9817	459.6070	326.2387	208.8665	0.0000	0.0000	0.0000	0.0000	287.4540	438.5215	587.6641	(215)
Water heating requirement	206.3003	181.2916	189.1189	167.7611	163.1175	143.8977	136.4452	152.1507	152.6394	174.0454	186.2624	200.7391	(64)
Efficiency of water heater	90.0286	90.0218	90.0023	89.9567	89.8446	87.0000	87.0000	87.0000	87.0000	89.9174	90.0286	90.0342	(216)
Water heating fuel	229.1496	201.3863	210.1267	186.4909	181.5552	165.3996	156.8336	174.8858	175.4476	193.5615	206.9666	222.9588	(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											24308.7920		(211)
Space heating fuel - secondary											3383.7238		(215)
Water heating fuel											2304.7621		(219)
central heating pump											120.0000		(230c)
boiler flue fan											45.0000		(230e)
Electricity for pumps and fans											165.0000		(231)
Electricity for lighting											686.1479		(232)
Total delivered energy for all uses											30848.4259		(238)

10. Fuel costs

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system	24308.7920	3.4800	845.9460	(240)
Space heating - secondary	3383.7238	3.4800	117.7536	(242)
Water heating	2304.7621	3.4800	80.2057	(247)
Pumps and fans for heating	0.0000	165.0000	21.7635	(249)
Electricity for lighting	686.1479	13.1900	90.5029	(250)
Additional standing charges			120.0000	(251)
Total energy cost			1276.1717	(255)

11. SAP rating

Energy cost deflator	0.4200	(256)
Energy cost factor (ECF)	3.2199	(257)
SAP value	55.0818	
SAP rating	55	(258)
SAP BAND	D	

12. Carbon dioxide emissions

	Energy kWh/year	Emission factor	Emissions kg/year	
Space heating - main system	24308.7920	0.2160	5250.6991	(261)
Space heating - secondary	3383.7238	0.2160	730.8843	(263)
Water heating	2304.7621	0.2160	497.8286	(264)
Space and water heating			6479.4120	(265)
Pumps and fans	0.5190	165.0000	85.6350	(267)
Energy for lighting	686.1479	0.5190	356.1108	(268)
Total kg/year			6921.1578	(272)
CO2 emissions per m2			kg/m2/year	
EI value			56.98	(273)
EI rating			46.2075	
EI band			46	(274)
			E	

SAP 2012 WORKSHEET (Version 9.94, September 2019)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 15 Mar 2021

Calculated by Lambda Calculation Engine SAP Engine version v94.0.1.1

RRN: 2643-8562-6706-2693-9401
Address: CS5 baseline;

1. Overall dwelling dimensions

Ground floor(main)	6.26	2.71	16.9646	(1b)-	(3b)
First floor(main)	6.26	2.78	17.4028	(1c)-	(3c)
Ground floor (extension 1)	12.64	2.39	30.2096	(1b)-	(3b)
Ground floor (extension 2)	24.58	2.7	66.366	(1b)-	(3b)
First floor (extension 2)	24.58	2.78	68.3324	(1c)-	(3c)
Ground floor (extension 3)	23.57	2.62	61.7534	(1b)-	(3b)
First floor (extension 3)	23.57	2.83	66.7031	(1c)-	(3c)
Total floor area	121.4600				(4)
Dwelling volume (m³)			327.7319		(5)

2. Ventilation rate

Number of chimneys	0	(6a)
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Number of open flues	0	(6b)
Number of intermittent fans	0	(7a)
Number of passive vents	0	(7b)
Number of flueless gas fires	0	(7c)
	ach	
Infiltration due to chimneys, flues and fans	0.0000	(8)
Number of storeys	2	(9)
Additional infiltration	0.1000	(10)
Structural infiltration	0.3500	(11)
Floor infiltration	0.0000	(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	0.5500	(18)
Number of sides sheltered	2	(19)
Shelter factor	0.8500	(20)
Infiltration rate incorporating shelter factor	0.4675	(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	0.5961	0.5844	0.5727	0.5143	0.5026	0.4441	0.4441	0.4324	0.4675	0.5026	0.5259	0.5493	(22b)
Effective ach	0.6776	0.6707	0.6640	0.6322	0.6263	0.5986	0.5986	0.5935	0.6093	0.6263	0.6383	0.6509	(25)

3. Heat losses and heat loss parameter

Element	Net	U-value	A x U	K-value	A x K	
Element						(Main)
Doors	3.7000	3.0000	11.1000			(26)
Windows	0.9200	2.1898	2.0146			(27)
Windows	1.3200	1.5038	1.9850			(27)
Ground Floor	6.2600	0.2500	1.5650			(28a)
Walls	11.4100	0.3000	3.4230			(29a)
Roof	6.2600	0.3000	1.8780			(30)
Element (extension 1)						
Windows	0.9300	2.1898	2.0365			(27)
Windows	1.3300	1.5038	2.0000			(27)
Ground Floor	12.6400	0.2500	3.1600			(28a)
Walls	20.9200	0.3000	6.2760			(29a)
Alternative wall	0.0000	0.0000	0.0000			(29b)
Roof	14.6000	0.1800	2.6280			(30)
Element (extension 2)						
Windows	3.6000	2.1898	7.8832			(27)
Windows	5.1800	1.5038	7.7895			(27)
Ground Floor	24.5800	0.7600	18.6808			(28a)
Walls	73.2600	0.3000	21.9780			(29a)
Roof	24.5800	0.3000	7.3740			(30)
Element (extension 3)						
Windows	3.4500	2.1898	7.5547			(27)
Windows	4.9700	1.5038	7.4737			(27)
Ground Floor	23.5700	0.2500	5.8925			(28a)
Walls	59.2300	0.3000	17.7690			(29a)
Roof	23.5700	0.3000	7.0710			(30)
Total area of elements (whole dwelling)	326.2800					(31)
Party wall (main)	0.0000	0.0000	0.0000			(32)
Fabric heat loss			147.5325			(33)
Thermal mass parameter			250.0000			(35)
Thermal bridges (0.15 × total area)			48.9420			(36)
Total fabric heat loss			196.4745			(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Vent loss	73.2884	72.5423	71.8110	68.3763	67.7336	64.7420	64.7420	64.1880	65.8944	67.7336	69.0337	70.3928	(38)
Heat transfer coeff	269.7628	269.0168	268.2855	264.8507	264.2081	261.2165	261.2165	260.6625	262.3688	264.2081	265.5081	266.8673	(39)
Heat transfer coeff (average)										264.8477			(39)
HLP	2.2210	2.2149	2.2088	2.1806	2.1753	2.1506	2.1506	2.1461	2.1601	2.1753	2.1860	2.1972	(40)
HLP (average)										2.1805			(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											2.8688		(42)
Average daily hot water use (litres/day)											107.7196		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.4915	114.1828	109.8740	105.5652	101.2564	96.9476	96.9476	101.2564	105.5652	109.8740	114.1828	118.4915	(44)
Energy content	175.7195	153.6854	158.5896	138.2622	132.6659	114.4806	106.0831	121.7319	123.1858	143.5611	156.7082	170.1750	(45)
Energy content (annual)											1694.8484		(45)
Distribution loss	26.3579	23.0528	23.7884	20.7393	19.8999	17.1721	15.9125	18.2598	18.4779	21.5342	23.5062	25.5262	(46)
Cylinder volume											0.0000		(47)
Energy lost from cylinder in kWh/day											0.0000		(55)
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)
Net 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	(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	30.5807	27.6062	30.5293	29.4989	30.4516	29.4171	30.3621	30.4188	29.4537	30.4843	29.5542	30.5641	(61)
Total	206.3003	181.2916	189.1189	167.7611	163.1175	143.8977	136.4452	152.1507	152.6394	174.0454	186.2624	200.7391	(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	24.9957	41.7107	71.0381	95.2050	117.6178	115.6370	114.1088	99.6974	78.0831	53.3216	29.6485	20.9172	(63)
Solar input(sum of months)											861.9808		(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	181.3045	139.5810	118.0809	72.5561	45.4997	28.2607	22.3364	52.4532	74.5563	120.7238	156.6139	179.8219	(64)
Output from water heater(annual)											1191.7885		(64)
Heat gains (kWh)	66.0719	58.0020	60.3634	53.3469	51.7243	45.4191	42.8632	48.0806	48.3227	55.3551	59.4940	64.2242	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic	172. 1270	172. 1270	172. 1270	172. 1270	172. 1270	172. 1270	172. 1270	172. 1270	172. 1270	172. 1270	172. 1270	172. 1270	(66)
Lighting	65. 4337	58. 1176	47. 2644	35. 7822	26. 7476	22. 5815	24. 4001	31. 7161	42. 5693	54. 0515	63. 0861	67. 2523	(67)
Appliances	428. 5103	432. 9568	421. 7516	397. 8969	367. 7846	339. 4833	320. 5763	316. 1297	327. 3349	351. 1897	381. 3019	409. 6032	(68)
Cooking	55. 0815	55. 0815	55. 0815	55. 0815	55. 0815	55. 0815	55. 0815	55. 0815	55. 0815	55. 0815	55. 0815	55. 0815	(69)
Pumps, fans	10. 0000	10. 0000	10. 0000	10. 0000	10. 0000	10. 0000	10. 0000	10. 0000	10. 0000	10. 0000	10. 0000	10. 0000	(70)
Losses	-114. 7513	-114. 7513	-114. 7513	-114. 7513	-114. 7513	-114. 7513	-114. 7513	-114. 7513	-114. 7513	-114. 7513	-114. 7513	-114. 7513	(71)
Water heating	88. 8063	86. 3124	81. 1336	74. 0929	69. 5219	63. 0820	57. 6118	64. 6244	67. 1148	74. 4021	82. 6306	86. 3229	(72)
Total internal	705. 2074	699. 8440	672. 6067	630. 2291	586. 5113	547. 6039	525. 0453	534. 9273	559. 4763	602. 1004	649. 4758	685. 6355	(73)

6. Solar gains

(calculation for January)													
Orientation		Area				Gains[W]							
East		1. 3200				7. 9231				(76)			
East		0. 9200				6. 6616				(76)			
East		1. 3300				7. 9831				(76)			
East		0. 9300				6. 7340				(76)			
East		5. 1800				31. 0920				(76)			
East		3. 6000				26. 0672				(76)			
East		4. 9700				29. 8315				(76)			
East		3. 4500				24. 9811				(76)			
		total:				141. 2736				(83-1)			
Solar gains	141. 2736	276. 3612	455. 1276	663. 7764	813. 4829	832. 7446	792. 8068	681. 0093	529. 3322	327. 9259	176. 1516	116. 1766	(83)
Total gains	846. 4811	976. 2053	1127. 7343	1294. 0056	1399. 9942	1380. 3485	1317. 8520	1215. 9366	1088. 8085	930. 0263	825. 6275	801. 8121	(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	31.2672	31.3539	31.4393	31.8471	31.9245	32.2902	32.2902	32.3588	32.1483	31.9245	31.7682	31.6064	
alpha	3.0845	3.0903	3.0960	3.1231	3.1283	3.1527	3.1527	3.1573	3.1432	3.1283	3.1179	3.1071	
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	0.9953	0.9922	0.9845	0.9640	0.9179	0.8263	0.7050	0.7541	0.9082	0.9774	0.9927	0.9961	(86)
MIT 1	18.6303	18.8224	19.1981	19.7258	20.2363	20.6526	20.8559	20.8154	20.4635	19.8020	19.1325	18.6073	(87)
th2													(88)
util rest	0.9935	0.9892	0.9779	0.9465	0.8707	0.7073	0.4877	0.5515	0.8321	0.9632	0.9892	0.9946	(89)
MIT 2	17.1353	17.3290	17.7044	18.2344	18.7189	19.0815	19.2051	19.1925	18.9416	18.3190	17.6516	17.1227	(90)
Living area fraction =											0.1600		(91)
MIT	17.3744	17.5679	17.9434	18.4730	18.9617	19.3328	19.4691	19.4521	19.1851	18.5562	17.8885	17.3602	(92)
Temperature adjustment											0.0000		
adjusted MIT	17.3744	17.5679	17.9434	18.4730	18.9617	19.3328	19.4691	19.4521	19.1851	18.5562	17.8885	17.3602	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9907	0.9849	0.9710	0.9361	0.8614	0.7158	0.5229	0.5828	0.8294	0.9550	0.9852	0.9921	(94)
Useful gains W	838.5745	961.4907	1095.0710	1211.3059	1205.9575	988.1111	689.1316	708.5983	903.0708	888.1335	813.4020	795.5116	(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	3527.0004	3407.8784	3070.0851	2535.4098	1918.5871	1236.2975	749.4682	795.5769	1334.1632	2102.0905	2864.4395	3512.0141	(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	2000.1889	1643.9725	1469.4105	953.3548	530.1964	0.0000	0.0000	0.0000	0.0000	903.1840	1476.7470	2021.0779	(98)
Space heating										10998.1320			(98)
Space heating per m2										90.5494			(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 total space heat from main system 1											0.9000		(204)
Efficiency of main heating system 1											90.2000		(206)
Efficiency of secondary heating system											72.0000		(208)
Space heating requirement											10973.7459		(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2000.1889	1643.9725	1469.4105	953.3548	530.1964	0.0000	0.0000	0.0000	0.0000	903.1840	1476.7470	2021.0779	(98)
Space heating efficiency (main heating system)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	1995.7539	1640.3274	1466.1524	951.2409	529.0208	0.0000	0.0000	0.0000	0.0000	901.1814	1473.4726	2016.5966	(211)
Space heating fuel (secondary)	277.8040	228.3295	204.0848	132.4104	73.6384	0.0000	0.0000	0.0000	0.0000	125.4422	205.1038	280.7053	(215)
Water heating requirement	181.3045	139.5810	118.0809	72.5561	45.4997	28.2607	22.3364	52.4532	74.5563	120.7238	156.6139	179.8219	(64)
Efficiency of water heater	89.8974	89.9149	89.9289	89.9421	89.9121	87.0000	87.0000	87.0000	87.0000	89.7730	89.8516	89.9025	(216)
Water heating fuel	201.6793	155.2367	131.3047	80.6698	50.6047	32.4835	25.6740	60.2911	85.6969	134.4768	174.3028	200.0188	(217)
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	(219)
													(221)
Annual totals:											kWh/year		
Space heating fuel - main system											10973.7459		(211)
Space heating fuel - secondary											1527.5183		(215)
Water heating fuel											1332.4392		(219)
central heating pump											120.0000		(230c)
boiler flue fan											45.0000		(230e)
pump for solar water heating											50.0000		(230g)
Electricity for pumps and fans											215.0000		(231)
Electricity for lighting											462.2316		(232)
PV generation											-1727.2394		(233)
Total delivered energy for all uses											12783.6957		(238)

10. Fuel costs

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system	10973.7459	3.4800	381.8864	(240)
Space heating - secondary	1527.5183	3.4800	53.1576	(242)
Water heating	1332.4392	3.4800	46.3689	(247)
Pumps and fans for heating	0.0000	215.0000	28.3585	(249)
Electricity for lighting	462.2316	13.1900	60.9684	(250)
Additional standing charges			120.0000	(251)
Electricity generated - PVs	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			462.9169	(255)

11. SAP rating

Energy cost deflator	0.4200	(256)
Energy cost factor (ECF)	1.1680	(257)
SAP value	83.7064	
SAP rating	84	(258)
SAP BAND	B	

12. Carbon dioxide emissions

	Energy kWh/year	Emission factor	Emissions kg/year	
Space heating - main system	10973.7459	0.2160	2370.3291	(261)
Space heating - secondary	1527.5183	0.2160	329.9440	(263)
Water heating	1332.4392	0.2160	287.8069	(264)
Space and water heating			2988.0800	(265)
Pumps and fans	0.5190	215.0000	111.5850	(267)
Energy for lighting	462.2316	0.5190	239.8982	(268)
Electricity generated - PVs	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			2443.1260	(272)
CO2 emissions per m2			kg/m2/year	
EI value			20.11	(273)
EI rating			80.3329	
EI band			80	(274)
			C	