

Calculated by Lambda Calculation Engine SAP Engine version v94.0.1.1

RRN: 9022-0225-2950-9275-1414
Address: CS14 Baseline;

1. Overall dwelling dimensions

Ground floor(main)	26.31	2.56	67.3536	(1b)–	(3b)
First floor(main)	26.31	2.68	70.5108	(1c)–	(3c)
Ground floor (extension 1)	10.85	3.13	33.9605	(1b)–	(3b)
Lowest floor (extension 2)(assumed at level 1)	45.96	2.12	97.4352	(1c)–	(3c)
Total floor area	155.3900				(4)
Dwelling volume (m³)			385.5389		(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)
	ach	
Infiltration due to chimneys, flues and fans	0.0519	(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	20	(14)
Window infiltration	0.2100	(15)
Infiltration rate	0.7619	(18)
Number of sides sheltered	2	(19)
Shelter factor	0.8500	(20)
Infiltration rate incorporating shelter factor	0.6476	(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	0.8257	0.8095	0.7933	0.7124	0.6962	0.6152	0.6152	0.5990	0.6476	0.6962	0.7285	0.7609	(22b)
Effective ach	0.8409	0.8276	0.8147	0.7537	0.7423	0.6892	0.6892	0.6794	0.7097	0.7423	0.7654	0.7895	(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)	8.7500	4.0268	35.2349			(27)
Windows(2)	0.0000	0.0000	0.0000			(27)
Ground Floor	26.3100	0.6600	17.3646			(28a)
Walls	62.2700	2.0200	125.7854			(29a)
Roof	26.3100	0.3000	7.8930			(30)
Element (extension 1)						
Windows(1)	1.8000	4.0268	7.2483			(27)
Windows(2)	0.0000	0.0000	0.0000			(27)
Ground Floor	10.8500	0.3900	4.2315			(28a)
Walls	15.0800	2.0400	30.7632			(29a)
Alternative wall	16.7400	1.5000	25.1100			(29b)
Roof	12.5300	2.3000	28.8190			(30)
Element (extension 2)						
Windows(1)	15.2800	4.0268	61.5302			(27)
Windows(2)	0.0000	0.0000	0.0000			(27)
Ground Floor	0.0000	0.0000	0.0000			(28a)
Exposed Floor	0.0000	0.0000	55.1520			(28b)
Walls	39.6300	2.0200	80.0526			(29a)
Roof	45.9600	0.3000	13.7880			(30)
Total area of elements (whole dwelling)	331.1700					(31)
Party wall (main)	0.0000	0.0000	0.0000			(32)
Party wall (extn 2)	34.3200	0.2500	8.5800			(32)
Fabric heat loss			512.6527			(33)
Thermal mass parameter			250.0000			(35)
Thermal bridges (0.15 × total area) (36)			49.6755			
Total fabric heat loss			562.3282			(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Vent loss	106.9828	105.2987	103.6480	95.8946	94.4440	87.6911	87.6911	86.4405	90.2922	94.4440	97.3786	100.4466	(38)
Heat transfer coeff	669.3110	667.6270	665.9762	658.2229	656.7722	650.0193	650.0193	648.7688	652.6204	656.7722	659.7068	662.7749	(39)
Heat transfer coeff (average)										658.2159			(39)
HLP	4.3073	4.2965	4.2858	4.2359	4.2266	4.1831	4.1831	4.1751	4.1999	4.2266	4.2455	4.2652	(40)
HLP (average)										4.2359			(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	2.9423	(42)
Average daily hot water use (litres/day)	109.5578	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.5135	116.1312	111.7489	107.3666	102.9843	98.6020	98.6020	102.9843	107.3666	111.7489	116.1312	120.5135	(44)
Energy content	178.7181	156.3080	161.2959	140.6216	134.9298	116.4342	107.8934	123.8092	125.2879	146.0110	159.3824	173.0789	(45)
Energy content(annual)										1723.7703			(45)
Distribution loss	26.8077	23.4462	24.1944	21.0932	20.2395	17.4651	16.1840	18.5714	18.7932	21.9016	23.9074	25.9618	(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	39.6158	35.7585	39.5357	38.1892	39.4144	38.0704	39.2831	39.3632	38.1186	39.4654	38.2755	39.5899	(61)
Total	218.3339	192.0665	200.8315	178.8108	174.3442	154.5046	147.1764	163.1724	163.4065	185.4763	197.6578	212.6688	(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	218.3339	192.0665	200.8315	178.8108	174.3442	154.5046	147.1764	163.1724	163.4065	185.4763	197.6578	212.6688	(64)
Output from water heater(annual)										2188.4499			(64)
Heat gains (kWh)	69.3277	60.9120	63.5148	56.3040	54.7178	48.2320	45.6953	51.0074	51.1879	58.4150	62.5635	67.4462	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic	176. 5386	176. 5386	176. 5386	176. 5386	176. 5386	176. 5386	176. 5386	176. 5386	176. 5386	176. 5386	176. 5386	176. 5386	(66)
Lighting	83. 0882	73. 7982	60. 0168	45. 4365	33. 9643	28. 6741	30. 9834	40. 2734	54. 0549	68. 6351	80. 1073	85. 3975	(67)
Appliances	487. 0542	492. 1083	479. 3721	452. 2583	418. 0320	385. 8642	364. 3740	359. 3199	372. 0561	399. 1699	433. 3962	465. 5641	(68)
Cooking	55. 5962	55. 5962	55. 5962	55. 5962	55. 5962	55. 5962	55. 5962	55. 5962	55. 5962	55. 5962	55. 5962	55. 5962	(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	-117. 6924	-117. 6924	-117. 6924	-117. 6924	-117. 6924	-117. 6924	-117. 6924	-117. 6924	-117. 6924	-117. 6924	-117. 6924	-117. 6924	(71)
Water heating	93. 1824	90. 6429	85. 3693	78. 2000	73. 5454	66. 9888	61. 4184	68. 5583	71. 0943	78. 5148	86. 8938	90. 6535	(72)
Total internal	787. 7672	780. 9918	749. 2006	700. 3372	649. 9842	605. 9695	581. 2183	592. 5940	621. 6477	670. 7621	724. 8396	766. 0575	(73)

6. Solar gains

(calculation for January)													
Orientation		Area				Gains[W]							
East/West (1) (main)		8.7500				70.8607				(76)			
East/West (2) (main)		0.0000				0.0000				(76)			
East/West (1) (extn 1)		1.8000				14.5771				(76)			
East/West (2) (extn 1)		0.0000				0.0000				(76)			
East/West (1) (extn 2)		15.2800				123.7431				(76)			
East/West (2) (extn 2)		0.0000				0.0000				(76)			
total:						209.1808				(83-1)			
Solar gains	209.1808	409.2021	673.8976	982.8395	1204.5067	1233.0269	1173.8919	1008.3558	783.7708	485.5528	260.8239	172.0202	(83)
Total gains	996.9481	1190.1939	1423.0982	1683.1767	1854.4908	1838.9964	1755.1102	1600.9498	1405.4185	1156.3149	985.6636	938.0776	(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	16.1225	16.1632	16.2032	16.3941	16.4303	16.6010	16.6010	16.6330	16.5348	16.4303	16.3572	16.2815
alpha	2.0748	2.0775	2.0802	2.0929	2.0954	2.1067	2.1067	2.1089	2.1023	2.0954	2.0905	2.0854
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	0.9939	0.9908	0.9841	0.9693	0.9412	0.8915	0.8231	0.8543	0.9389	0.9798	0.9916	0.9947
MIT 1	17.0912	17.3233	17.8240	18.5496	19.3103	20.0187	20.4489	20.3700	19.7630	18.7932	17.8337	17.0663
th2												
util rest	0.9914	0.9867	0.9763	0.9510	0.8949	0.7616	0.5090	0.5822	0.8617	0.9643	0.9870	0.9925
MIT 2	15.0381	15.2708	15.7704	16.4951	17.2356	17.8903	18.1989	18.1661	17.6831	16.7448	15.7880	15.0189
Living area fraction =											0.2100	
MIT	15.4692	15.7018	16.2017	16.9265	17.6712	18.3372	18.6714	18.6289	18.1199	17.1749	16.2176	15.4488
Temperature adjustment											0.0000	
adjusted MIT	15.4692	15.7018	16.2017	16.9265	17.6712	18.3372	18.6714	18.6289	18.1199	17.1749	16.2176	15.4488

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9867	0.9801	0.9662	0.9360	0.8783	0.7665	0.5850	0.6432	0.8539	0.9529	0.9809	0.9884	(94)
Useful gains W	983.7058	1166.5627	1374.9624	1575.3706	1628.7417	1409.5783	1026.7897	1029.7919	1200.1318	1101.8504	966.8031	927.1838	(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	7475.7017	7211.5838	6461.0774	5283.2354	3921.7463	2429.2721	1346.4636	1446.0407	2623.4672	4318.2291	6014.9184	7455.4515	(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	4830.0450	4062.2542	3784.0696	2669.6626	1705.9954	0.0000	0.0000	0.0000	0.0000	2392.9858	3634.6430	4857.0312	(98)
Space heating										27936.6869			(98)
Space heating per m2										179.7843			(99)

8c. Space cooling requirement

- not applicable

9. Energy requirements

[illegible]

	4862.4614	4089.5177	3809.4660	2687.5798	1717.4451	0.0000	0.0000	0.0000	0.0000	2409.0461	3659.0366	4889.6287	(211)
Space heating fuel (secondary)	805.0075	677.0424	630.6783	444.9438	284.3326	0.0000	0.0000	0.0000	0.0000	398.8310	605.7738	809.5052	(215)
Water heating requirement	218.3339	192.0665	200.8315	178.8108	174.3442	154.5046	147.1764	163.1724	163.4065	185.4763	197.6578	212.6688	(64)
Efficiency of water heater	89.2671	89.2613	89.2452	89.2076	89.1170	86.7000	86.7000	86.7000	86.7000	89.1798	89.2416	89.2710	(216)
Water heating fuel	244.5851	215.1734	225.0333	200.4435	195.6352	178.2060	169.7537	188.2035	188.4735	207.9802	221.4861	238.2283	(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											28124.1814		(211)
Space heating fuel – secondary											4656.1145		(215)
Water heating fuel											2473.2018		(219)
central heating pump											120.0000		(230c)
boiler flue fan											45.0000		(230e)
Electricity for pumps and fans											165.0000		(231)
Electricity for lighting											586.9457		(232)
Total delivered energy for all uses											36005.4433		(238)

10. Fuel costs

	Fuel	Fuel price	Fuel cost	
	kWh/year	p/kWh	£/year	
Space heating – main system	28124.1814	3.4800	978.7215	(240)
Water heating	2473.2018	3.4800	86.0674	(247)
Pumps and fans for heating	0.0000	165.0000	21.7635	(249)
Electricity for lighting	586.9457	13.1900	77.4181	(250)
Additional standing charges			120.0000	(251)
Total energy cost			1283.9706	(255)

11. SAP rating

Energy cost deflator	0.4200	(256)
Energy cost factor (ECF)	2.6911	(257)
SAP value	62.4593	
SAP rating	62	(258)
SAP BAND	D	

12. Carbon dioxide emissions

	Energy	Emission	Emissions	
	kWh/year	factor	kg/year	
Space heating – main system	28124.1814	0.2160	6074.8232	(261)
Water heating	2473.2018	0.2160	534.2116	(264)
Space and water heating			6609.0348	(265)
Pumps and fans	0.5190	165.0000	85.6350	(267)
Energy for lighting	586.9457	0.5190	304.6248	(268)
Total kg/year			6999.2946	(272)
			kg/m2/year	
CO2 emissions per m2			45.04	(273)
EI value			53.3981	
EI rating			53	(274)
EI band			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: 9022-0225-2950-9275-1414
Address: CS14 Baseline;

1. Overall dwelling dimensions

Ground floor(main)	26.31	2.56	67.3536	(1b)–	(3b)
First floor(main)	26.31	2.68	70.5108	(1c)–	(3c)
Ground floor (extension 1)	10.85	3.13	33.9605	(1b)–	(3b)
Lowest floor (extension 2) (assumed at level 1)	45.96	2.12	97.4352	(1c)–	(3c)
Total floor area	155.3900				(4)
Dwelling volume (m³)			385.5389		(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)
	ach	
Infiltration due to chimneys, flues and fans	0.0519	(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	0.6019	(18)

Number of sides sheltered	2	(19)
Shelter factor	0. 8500	(20)
Infiltration rate incorporating shelter factor	0. 5116	(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	0.6523	0.6395	0.6267	0.5628	0.5500	0.4860	0.4860	0.4732	0.5116	0.5500	0.5755	0.6011	(22b)
Effective ach	0.7127	0.7045	0.6964	0.6583	0.6512	0.6181	0.6181	0.6120	0.6309	0.6512	0.6656	0.6807	(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)					0.0000	4.0268		0.0000					(27)
Windows (2)					8.7500	1.5038		13.1579					(27)
Ground Floor					26.3100	0.6600		17.3646					(28a)
Walls					62.2700	0.3000		18.6810					(29a)
Roof					26.3100	0.3000		7.8930					(30)
Element (extension 1)													
Windows (1)					0.0000	4.0268		0.0000					(27)
Windows (2)					1.8000	1.5038		2.7068					(27)
Ground Floor					10.8500	0.3900		4.2315					(28a)
Walls					15.0800	0.3000		4.5240					(29a)
Alternative wall					16.7400	1.5000		25.1100					(29b)
Roof					12.5300	0.1800		2.2554					(30)
Element (extension 2)													
Windows (1)					0.0000	4.0268		0.0000					(27)
Windows (2)					15.2800	1.5038		22.9774					(27)
Ground Floor					0.0000	0.0000		0.0000					(28a)
Exposed Floor					0.0000	0.0000		11.4900					(28b)
Walls					39.6300	0.3000		11.8890					(29a)
Roof					45.9600	0.3000		13.7880					(30)
Total area of elements (whole dwelling)					331.1700								(31)
Party wall (main)					0.0000	0.0000		0.0000					(32)
Party wall (extn 2)					34.3200	0.2500		8.5800					(32)
Fabric heat loss								175.7486					(33)
Thermal mass parameter								250.0000					(35)
Thermal bridges (0.15 × total area)								49.6755					
(36)													
Total fabric heat loss								225.4241					(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Vent loss	90.6799	89.6289	88.5987	83.7599	82.8546	78.6402	78.6402	77.8597	80.2635	82.8546	84.6860	86.6007	(38)
Heat transfer coeff	316.1040	315.0530	314.0228	309.1840	308.2787	304.0643	304.0643	303.2838	305.6876	308.2787	310.1101	312.0248	(39)
Heat transfer coeff (average)										309.1797			(39)
HLP	2.0343	2.0275	2.0209	1.9897	1.9839	1.9568	1.9568	1.9518	1.9672	1.9839	1.9957	2.0080	(40)
HLP (average)										1.9897			(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											2.9423		(42)
Average daily hot water use (litres/day)											109.5578		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.5135	116.1312	111.7489	107.3666	102.9843	98.6020	98.6020	102.9843	107.3666	111.7489	116.1312	120.5135	(44)
Energy content	178.7181	156.3080	161.2959	140.6216	134.9298	116.4342	107.8934	123.8092	125.2879	146.0110	159.3824	173.0789	(45)
Energy content (annual)											1723.7703		(45)
Distribution loss	26.8077	23.4462	24.1944	21.0932	20.2395	17.4651	16.1840	18.5714	18.7932	21.9016	23.9074	25.9618	(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	39.6158	35.7585	39.5357	38.1892	39.4144	38.0704	39.2831	39.3632	38.1186	39.4654	38.2755	39.5899	(61)
Total	218.3339	192.0665	200.8315	178.8108	174.3442	154.5046	147.1764	163.1724	163.4065	185.4763	197.6578	212.6688	(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	(66)
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	218.3339	192.0665	200.8315	178.8108	174.3442	154.5046	147.1764	163.1724	163.4065	185.4763	197.6578	212.6688	(64)
Output from water heater(annual)											2188.4499		(64)
Heat gains (kWh)	69.3277	60.9120	63.5148	56.3040	54.7178	48.2320	45.6953	51.0074	51.1879	58.4150	62.5635	67.4462	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic	176.5386	176.5386	176.5386	176.5386	176.5386	176.5386	176.5386	176.5386	176.5386	176.5386	176.5386	176.5386	(66)
Lighting	84.7378	75.2634	61.2083	46.3386	34.6387	29.2434	31.5986	41.0730	55.1281	69.9978	81.6977	87.0930	(67)
Appliances	487.0542	492.1083	479.3721	452.2583	418.0320	385.8642	364.3740	359.3199	372.0561	399.1699	433.3962	465.5641	(68)
Cooking	55.5962	55.5962	55.5962	55.5962	55.5962	55.5962	55.5962	55.5962	55.5962	55.5962	55.5962	55.5962	(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	-117.6924	-117.6924	-117.6924	-117.6924	-117.6924	-117.6924	-117.6924	-117.6924	-117.6924	-117.6924	-117.6924	-117.6924	(71)
Water heating	93.1824	90.6429	85.3693	78.2000	73.5454	66.9888	61.4184	68.5583	71.0943	78.5148	86.8938	90.6535	(72)
Total internal	789.4168	782.4570	750.3922	701.2393	650.6585	606.5388	581.8334	593.3936	622.7209	672.1248	726.4301	767.7529	(73)

6. Solar gains

(calculation for January)			
Orientation	Area	Gains[W]	
East/West(1) (main)	0.0000	0.0000	(76)
East/West(2) (main)	8.7500	52.5203	(76)

East/West(1)(extn 1)	0.0000					0.0000								(76)
East/West(2)(extn 1)	1.8000					10.8042								(76)
East/West(1)(extn 2)	0.0000					0.0000								(76)
East/West(2)(extn 2)	15.2800					91.7154								(76)
total:						155.0399								(83-1)

Solar gains	155.0399	303.2910	499.4770	728.4575	892.7520	913.8905	870.0610	747.3696	580.9125	359.8803	193.3166	127.4973		(83)
Total gains	944.4568	1085.7480	1249.8692	1429.6968	1543.4105	1520.4293	1451.8945	1340.7632	1203.6333	1032.0051	919.7466	895.2502		(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	34.1374	34.2513	34.3637	34.9015	35.0040	35.4891	35.4891	35.5804	35.3007	35.0040	34.7972	34.5837		
alpha	3.2758	3.2834	3.2909	3.3268	3.3336	3.3659	3.3659	3.3720	3.3534	3.3336	3.3198	3.3056		
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	0.9971	0.9950	0.9897	0.9744	0.9371	0.8555	0.7385	0.7863	0.9283	0.9844	0.9953	0.9976		(86)
MIT 1	18.7422	18.9197	19.2700	19.7691	20.2546	20.6600	20.8600	20.8203	20.4782	19.8508	19.2219	18.7268		(87)
th2														(88)
util rest	0.9959	0.9931	0.9852	0.9618	0.8998	0.7518	0.5360	0.6012	0.8669	0.9745	0.9931	0.9967		(89)
MIT 2	17.3303	17.5103	17.8619	18.3689	18.8363	19.2016	19.3298	19.3165	19.0591	18.4574	17.8273	17.3271		(90)
Living area fraction =											0.2100			(91)
MIT	17.6268	17.8063	18.1576	18.6629	19.1341	19.5078	19.6511	19.6322	19.3571	18.7500	18.1202	17.6210		(92)
Temperature adjustment											0.0000			
adjusted MIT	17.6268	17.8063	18.1576	18.6629	19.1341	19.5078	19.6511	19.6322	19.3571	18.7500	18.1202	17.6210		(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9942	0.9904	0.9806	0.9544	0.8934	0.7637	0.5795	0.6394	0.8670	0.9690	0.9906	0.9952		(94)
Useful gains W	938.9812	1075.2900	1225.6631	1364.4913	1378.8189	1161.1558	841.3314	857.3332	1043.5194	1000.0086	911.1050	890.9527		(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	4212.6461	4066.1651	3660.7411	3018.5395	2291.7888	1492.2964	927.7265	980.2874	1607.0163	2512.4640	3417.4620	4187.6856		(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	2435.6067	2009.8681	1811.6981	1190.9147	679.2496	0.0000	0.0000	0.0000	0.0000	1125.2668	1804.5770	2452.7693		(98)
Space heating											13509.9503			(98)
Space heating per m2											86.9422			(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													89.4000	(206)
Efficiency of secondary heating system													60.0000	(208)
Space heating requirement													13600.6211	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	2435.6067	2009.8681	1811.6981	1190.9147	679.2496	0.0000	0.0000	0.0000	0.0000	1125.2668	1804.5770	2452.7693		(98)
Space heating efficiency (main heating system)	89.4000	89.4000	89.4000	89.4000	89.4000	0.0000	0.0000	0.0000	0.0000	89.4000	89.4000	89.4000		(210)
Space heating fuel (main heating system)	2451.9530	2023.3571	1823.8571	1198.9075	683.8083	0.0000	0.0000	0.0000	0.0000	1132.8189	1816.6883	2469.2308		(211)
Space heating fuel (secondary)	405.9344	334.9780	301.9497	198.4858	113.2083	0.0000	0.0000	0.0000	0.0000	187.5445	300.7628	408.7949		(215)
Water heating requirement	218.3339	192.0665	200.8315	178.8108	174.3442	154.5046	147.1764	163.1724	163.4065	185.4763	197.6578	212.6688		(64)
Efficiency of water heater	89.1485	89.1336	89.0957	89.0037	88.7864	86.7000	86.7000	86.7000	86.7000	88.9711	89.0990	89.1560		(216)
Water heating fuel	244.9103	215.4817	225.4109	200.9026	196.3635	178.2060	169.7537	188.2035	188.4735	208.4680	221.8408	238.5356		(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													13600.6211	(211)
Space heating fuel - secondary													2251.6584	(215)
Water heating fuel													2476.5502	(219)
central heating pump													120.0000	(230c)
boiler flue fan													45.0000	(230e)
Electricity for pumps and fans													165.0000	(231)
Electricity for lighting													598.5988	(232)
PV generation													-1727.2394	(233)
Wind generation													-3575.5408	(234)
Total delivered energy for all uses													13789.6482	(238)

10. Fuel costs

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system	13600.6211	3.4800	473.3016	(240)
Water heating	2476.5502	3.4800	86.1839	(247)
Pumps and fans for heating	0.0000	165.0000	21.7635	(249)
Electricity for lighting	598.5988	13.1900	78.9552	(250)
Additional standing charges			120.0000	(251)
Electricity generated - PVs	-1727.2394	13.1900	-227.8229	(252)
Electricity generated - wind	-3575.5408	13.1900	-471.6138	(252)
Total energy cost			80.7675	(255)

11. SAP rating

Energy cost deflator	0.4200	(256)
Energy cost factor (ECF)	0.1693	(257)

SAP value	97.6385	
SAP rating	98	(258)
SAP BAND	A	

12. Carbon dioxide emissions

	Energy kWh/year	Emission factor	Emissions kg/year	
Space heating – main system	13600.6211	0.2160	2937.7341	(261)
Water heating	2476.5502	0.2160	534.9348	(264)
Space and water heating			3472.6690	(265)
Pumps and fans	0.5190	165.0000	85.6350	(267)
Energy for lighting	598.5988	0.5190	310.6728	(268)
Electricity generated – PVs	-1727.2394	0.5190	-896.4372	(269)
Electricity generated – wind	-3575.5408	0.5190	-1855.7056	(269)
Total kg/year			1116.8339	(272)
CO2 emissions per m2			kg/m2/year	
EI value			7.19	(273)
EI rating			92.5318	
EI band			93	(274)
			A	