

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 1033 Plot 3			Issued on Date	07/12/2025
Assessment Reference	Rev A	Prop Type Ref			
Property					
SAP Rating	91 B	DER	8.92	TER	18.43
Environmental	94 A	% DER<TER	51.61		
CO ₂ Emissions (t/year)	0.41	DFEE	39.47	TFEE	53.39
General Requirements Compliance	Pass	% DFEE<TFEE	26.08		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

End-Terrace House, total floor area 83 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.43 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.92 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoFIT sustain 835 VUW 356/6-3 (H-GB)
Combi boiler
Efficiency: 89.3% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing East: 4.11 m², No overhang
Windows facing South: 0.84 m², No overhang
Windows facing West: 10.25 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.09 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.033 W/m²K
Photovoltaic array 1.32 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.2900 (1b)	x 2.4000 (2b)	= 99.0960 (1b) - (3b)
First floor	41.2900 (1c)	x 2.7000 (2c)	= 111.4830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.5790 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1900 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3900 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3315 (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	0.4226	0.4143	0.4060	0.3646	0.3563	0.3149	0.3149	0.3066	0.3315	0.3563	0.3729	0.3895 (22b)
Effective ac	0.5893	0.5858	0.5824	0.5665	0.5635	0.5496	0.5496	0.5470	0.5549	0.5635	0.5695	0.5758 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Fully Glazed Door/Win (Uw = 1.20)			15.2000	1.1450	17.4046		(27)
Heat Loss Floor 1			41.2900	0.1200	4.9548	75.0000	3096.7500 (28a)
External Wall 1	93.6900	17.3200	76.3700	0.1800	13.7466	43.4900	3321.3313 (29a)
External Roof 1	41.2900		41.2900	0.0900	3.7161	10.3700	428.1773 (30)
Total net area of external elements Aum(A, m ²)			176.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.1541		(33)
Party Wall 1			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Internal Wall 1			54.1900			9.0000	487.7100 (32c)
Internal Wall 2			74.4000			9.0000	669.6000 (32c)
Internal Floor 1			41.2900			18.0000	743.2200 (32d)
Internal Ceiling 1			41.2900			18.0000	743.2200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	14440.0086 (34)
	174.8608 (35)
	5.7742 (36)
(33) + (36) =	47.9283 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 40.9511 Feb 40.7101 Mar 40.4739 Apr 39.3645 May 39.1569 Jun 38.1907 Jul 38.1907 Aug 38.0117 Sep 38.5629 Oct 39.1569 Nov 39.5768 Dec 40.0158 (38)
Heat transfer coeff	88.8794 88.6384 88.4022 87.2928 87.0853 86.1190 86.1190 85.9401 86.4912 87.0853 87.5052 87.9442 (39)
Average = Sum(39)m / 12 =	87.2918 (39)

HLP	Jan 1.0763 Feb 1.0734 Mar 1.0705 Apr 1.0571 May 1.0546 Jun 1.0429 Jul 1.0429 Aug 1.0407 Sep 1.0474 Oct 1.0546 Nov 1.0596 Dec 1.0650 (40)
HLP (average)	1.0571 (40)
Days in month	31 28 31 30 31 30 31 31 30 31 30 31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5100 (42)
Average daily hot water use (litres/day)												93.8123 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.1936	99.4411	95.6886	91.9361	88.1836	84.4311	84.4311	88.1836	91.9361	95.6886	99.4411	103.1936 (44)
Energy conte	153.0331	133.8437	138.1147	120.4118	115.5380	99.7005	92.3872	106.0156	107.2818	125.0266	136.4763	148.2044 (45)
Energy content (annual)										Total = Sum(45)m =		1476.0336 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.9550	20.0766	20.7172	18.0618	17.3307	14.9551	13.8581	15.9023	16.0923	18.7540	20.4714	22.2307 (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)
Combi loss	0.6703	0.5989	0.5947	0.4982	0.4585	0.3788	0.3510	0.4207	0.4438	0.5384	0.6107	0.6492 (61)
Total heat required for water heating calculated for each month	153.7034	134.4427	138.7095	120.9099	115.9965	100.0793	92.7382	106.4363	107.7256	125.5649	137.0870	148.8536 (62)
WWHRS	-56.5252	-49.7334	-50.7602	-41.7741	-38.7933	-32.0062	-27.0945	-32.8030	-33.7569	-41.7231	-48.3206	-54.6319 eq. (G10)
Total of WWHRS savings												-507.9224
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)
Output from w/h	97.1783	84.7092	87.9492	79.1359	77.2032	68.0731	65.6436	73.6333	73.9687	83.8419	88.7663	94.2217 (64)
Heat gains from water heating, kWh/month	51.0511	44.6528	46.0718	40.1615	38.5310	33.2451	30.8065	35.3554	35.7821	41.7059	45.5310	49.4403 (65)
Solar input (sum of months) = Sum(63)m =												
Total per year (kWh/year) = Sum(64)m =												

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	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3937	18.1135	14.7309	11.1523	8.3364	7.0380	7.6048	9.8850	13.2676	16.8463	19.6621	20.9605 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.7481	227.0802	221.2032	208.6917	192.8982	178.0546	168.1381	165.8059	171.6829	184.1944	199.9879	214.8316 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997 (71)
Water heating gains (Table 5)	68.6171	66.4476	61.9245	55.7798	51.7890	46.1738	41.4066	47.5207	49.6974	56.0563	63.2376	66.4520 (72)
Total internal gains	377.4088	375.2913	361.5086	339.2737	316.6736	294.9162	280.7993	286.8614	298.2979	320.7469	346.5375	365.8940 (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	
East				4.1100	19.6403	0.6300	0.7000		0.7700		24.6695 (76)	
South				0.8400	46.7521	0.6300	0.7000		0.7700		12.0020 (78)	
West				10.2500	19.6403	0.6300	0.7000		0.7700		61.5238 (80)	
Solar gains	98.1953	188.2685	302.7190	433.2794	525.8081	536.4500	511.4324	442.4227	349.1096	221.2738	121.6993	81.2520 (83)
Total gains	475.6040	563.5598	664.2276	772.5531	842.4816	831.3663	792.2317	729.2841	647.4075	542.0207	468.2368	447.1460 (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	45.1298	45.2525	45.3734	45.9501	46.0596	46.5764	46.5764	46.6734	46.3760	46.0596	45.8386	45.6098
alpha	4.0087	4.0168	4.0249	4.0633	4.0706	4.1051	4.1051	4.1116	4.0917	4.0706	4.0559	4.0407
util living area	0.9929	0.9854	0.9645	0.9052	0.7866	0.6158	0.4659	0.5211	0.7696	0.9464	0.9871	0.9944 (86)
MIT	19.4632	19.6753	20.0250	20.4555	20.7754	20.9400	20.9850	20.9766	20.8493	20.4005	19.8502	19.4274 (87)
Th 2	20.0202	20.0226	20.0250	20.0360	20.0381	20.0478	20.0478	20.0496	20.0441	20.0381	20.0339	20.0296 (88)
util rest of house	0.9912	0.9819	0.9560	0.8826	0.7391	0.5395	0.3706	0.4223	0.7020	0.9288	0.9835	0.9931 (89)
MIT 2	18.6145	18.8267	19.1725	19.5933	19.8802	20.0162	20.0427	20.0409	19.9528	19.5520	19.0105	18.5860 (90)
Living area fraction									fLA = Living area / (4) =			0.2865 (91)
MIT	18.8577	19.0698	19.4168	19.8403	20.1367	20.2809	20.3127	20.3090	20.2097	19.7951	19.2511	18.8271 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8577	19.0698	19.4168	19.8403	20.1367	20.2809	20.3127	20.3090	20.2097	19.7951	19.2511	18.8271 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9885	0.9776	0.9494	0.8774	0.7444	0.5590	0.3977	0.4502	0.7148	0.9234	0.9796	0.9908 (94)
Ext temp.	470.1238	550.9081	630.6333	677.8050	627.1321	464.7632	315.0868	328.3129	462.7769	500.5185	458.6726	443.0462 (95)
Heat loss rate W	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)
Month fracti	1293.8757	1255.9902	1141.8695	955.0106	734.7093	489.2316	319.7309	335.9404	528.4330	800.7556	1063.2812	1286.3646 (97)
Space heating kWh	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	612.8714	473.8152	380.3598	199.5880	80.0374	0.0000	0.0000	0.0000	0.0000	223.3764	435.3182	627.4289 (98)
Space heating per m2												3032.7953 (98)
										(98) / (4) =		36.7255 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3362.3008 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	612.8714	473.8152	380.3598	199.5880	80.0374	0.0000	0.0000	0.0000	0.0000	223.3764	435.3182	627.4289	(98)
Space heating efficiency (main heating system 1)	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)	679.4583	525.2940	421.6849	221.2727	88.7333	0.0000	0.0000	0.0000	0.0000	247.6457	482.6144	695.5974	(211)
Water heating requirement	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	97.1783	84.7092	87.9492	79.1359	77.2032	68.0731	65.6436	73.6333	73.9687	83.8419	88.7663	94.2217	(64)
Efficiency of water heater (217)m	88.0240	87.7948	87.2406	85.7998	82.8522	76.4000	76.4000	76.4000	76.4000	85.9625	87.5224	76.4000	(216)
Fuel for water heating, kWh/month	110.3998	96.4854	100.8123	92.2332	93.1819	89.1009	85.9210	96.3787	96.8176	97.5331	101.4213	106.9221	(219)
Water heating fuel used												1167.2072	(219)
Annual totals kWh/year													
Space heating fuel - main system													3362.3008 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													360.1597 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.32 * 853 * 1.00) =													-900.7996
Total delivered energy for all uses													-900.7996 (233)
													4063.8681 (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	3362.3008	0.2160	726.2570	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1167.2072	0.2160	252.1168	(264)
Space and water heating			978.3737	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	360.1597	0.5190	186.9229	(268)
Energy saving/generation technologies				
PV Unit	-900.7996	0.5190	-467.5150	(269)
Total CO2, kg/year			736.7066	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.9200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER			8.9200	ZC1
Total Floor Area		TFA	82.5800	
Assumed number of occupants		N	2.5100	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.1275	ZC2
CO2 emissions from cooking, equation (L16)			2.1705	ZC3
Total CO2 emissions			27.2180	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			27.2180	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.2900 (1b)	x 2.4000 (2b)	= 99.0960 (1b) - (3b)
First floor	41.2900 (1c)	x 2.7000 (2c)	= 111.4830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.5790 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1425 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3925 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3336 (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	0.4253	0.4170	0.4087	0.3670	0.3586	0.3169	0.3169	0.3086	0.3336	0.3586	0.3753	0.3920 (22b)
Effective ac	0.5905	0.5869	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			15.2000	1.3258	20.1515		(27)
Heat Loss Floor 1			41.2900	0.1300	5.3677		(28a)
External Wall 1	93.6900	17.3200	76.3700	0.1800	13.7466		(29a)
External Roof 1	41.2900		41.2900	0.1300	5.3677		(30)
Total net area of external elements Aum(A, m ²)			176.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.1775		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3748 (36)
Total fabric heat loss						(33) + (36) =	56.5523 (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	41.0313	40.7872	40.5480	39.4242	39.2140	38.2352	38.2352	38.0540	38.6122	39.2140	39.6393	40.0840 (38)
Heat transfer coeff	97.5836	97.3395	97.1003	95.9765	95.7663	94.7875	94.7875	94.6063	95.1645	95.7663	96.1916	96.6363 (39)
Average = Sum(39)m / 12 =												95.9755 (39)
HLP	1.1817	1.1787	1.1758	1.1622	1.1597	1.1478	1.1478	1.1456	1.1524	1.1597	1.1648	1.1702 (40)
HLP (average)												1.1622 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5100 (42)
Average daily hot water use (litres/day)												93.8123 (43)
Daily hot water use	103.1936	99.4411	95.6886	91.9361	88.1836	84.4311	84.4311	88.1836	91.9361	95.6886	99.4411	103.1936 (44)
Energy conte	153.0331	133.8437	138.1147	120.4118	115.5380	99.7005	92.3872	106.0156	107.2818	125.0266	136.4763	148.2044 (45)
Energy content (annual)										Total = Sum(45)m =		1476.0336 (45)
Distribution loss (46)m = 0.15 x (45)m	22.9550	20.0766	20.7172	18.0618	17.3307	14.9551	13.8581	15.9023	16.0923	18.7540	20.4714	22.2307 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 (57)
Total heat required for water heating calculated for each month	50.9589	45.7701	48.7619	45.3384	44.9374	41.6373	43.0252	44.9374	45.3384	48.7619	49.0394	50.9589 (61)
Solar input	203.9920	179.6139	186.8766	165.7501	160.4754	141.3377	135.4123	150.9530	152.6201	173.7884	185.5157	199.1633 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	203.9920	179.6139	186.8766	165.7501	160.4754	141.3377	135.4123	150.9530	152.6201	173.7884	185.5157	199.1633 (64)
	63.6232	55.9456	58.1136	51.3715	49.6507	43.5597	41.4750	46.4845	47.0058	53.7618	57.6382	62.0177 (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	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3937	18.1135	14.7309	11.1523	8.3364	7.0380	7.6048	9.8850	13.2676	16.8463	19.6621	20.9605	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.7481	227.0802	221.2032	208.6917	192.8982	178.0546	168.1381	165.8059	171.6829	184.1944	199.9879	214.8316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	(71)
Water heating gains (Table 5)	85.5151	83.2523	78.1097	71.3493	66.7348	60.4996	55.7460	62.4792	65.2858	72.2605	80.0531	83.3571	(72)
Total internal gains	394.3068	392.0960	377.6937	354.8432	331.6194	309.2421	295.1388	301.8200	313.8862	336.9511	363.3530	382.7991	(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
East			4.1100		19.6403		0.6300		0.7000		0.7700		24.6695 (76)
South			0.8400		46.7521		0.6300		0.7000		0.7700		12.0020 (78)
West			10.2500		19.6403		0.6300		0.7000		0.7700		61.5238 (80)
Solar gains	98.1953	188.2685	302.7190	433.2794	525.8081	536.4500	511.4324	442.4227	349.1096	221.2738	121.6993	81.2520	(83)
Total gains	492.5021	580.3645	680.4128	788.1227	857.4275	845.6921	806.5711	744.2427	662.9958	558.2248	485.0523	464.0511	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.7673	58.9146	59.0598	59.7513	59.8825	60.5008	60.5008	60.6167	60.2611	59.8825	59.6177	59.3434	
alpha	4.9178	4.9276	4.9373	4.9834	4.9922	5.0334	5.0334	5.0411	5.0174	4.9922	4.9745	4.9562	
util living area	0.9981	0.9953	0.9856	0.9484	0.8485	0.6733	0.5079	0.5678	0.8298	0.9748	0.9959	0.9986	(86)
MIT	19.7131	19.8805	20.1653	20.5303	20.8149	20.9576	20.9916	20.9857	20.8789	20.4871	20.0314	19.6855	(87)
Th 2	19.9347	19.9371	19.9394	19.9503	19.9524	19.9620	19.9620	19.9637	19.9583	19.9524	19.9482	19.9439	(88)
util rest of house	0.9974	0.9936	0.9804	0.9296	0.7974	0.5816	0.3929	0.4484	0.7543	0.9622	0.9942	0.9981	(89)
MIT 2	18.2214	18.4672	18.8818	19.4053	19.7752	19.9347	19.9590	19.9580	19.8627	19.3563	18.6962	18.1876	(90)
Living area fraction	18.6488	18.8721	19.2495	19.7276	20.0731	20.2278	20.2548	20.2525	20.1538	19.6803	19.0788	18.6168	(91)
MIT	18.6488	18.8721	19.2495	19.7276	20.0731	20.2278	20.2548	20.2525	20.1538	19.6803	19.0788	18.6168	(92)
Temperature adjustment	18.6488	18.8721	19.2495	19.7276	20.0731	20.2278	20.2548	20.2525	20.1538	19.6803	19.0788	18.6168	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	490.6252	575.3253	663.9861	728.7895	689.3853	512.7928	343.6043	359.3105	510.7139	534.7079	481.2351	462.7178	(94)
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	1400.2095	1360.0415	1237.9841	1039.1983	801.8573	533.4406	346.4301	364.4662	576.1110	869.5820	1152.2575	1393.1812	(97)
Month fracti	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	676.7307	527.3293	427.0545	223.4944	83.6792	0.0000	0.0000	0.0000	0.0000	249.1463	483.1361	692.2648	(98)
Space heating												3362.8352	(98)
Space heating per m2												40.7222	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3600.4660 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	676.7307	527.3293	427.0545	223.4944	83.6792	0.0000	0.0000	0.0000	0.0000	249.1463	483.1361	692.2648	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	724.5510	564.5924	457.2318	239.2873	89.5923	0.0000	0.0000	0.0000	0.0000	266.7520	517.2763	741.1829	(211)
Water heating requirement	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 requirement	203.9920	179.6139	186.8766	165.7501	160.4754	141.3377	135.4123	150.9530	152.6201	173.7884	185.5157	199.1633	(64)
Efficiency of water heater (217)m	87.8410	87.6006	87.0666	85.8044	83.4973	80.3000	80.3000	80.3000	80.3000	85.9574	87.3517	80.3000	(216)
Fuel for water heating, kWh/month	232.2288	205.0373	214.6365	193.1722	192.1924	176.0121	168.6330	187.9863	190.0624	202.1797	212.3779	226.5045	(219)
Water heating fuel used												2401.0231	(219)
Annual totals kWh/year													
Space heating fuel - main system												3600.4660	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												360.1597	(232)
Total delivered energy for all uses												6436.6489	(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	3600.4660	0.2160	777.7007 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2401.0231	0.2160	518.6210 (264)
Space and water heating			1296.3216 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	360.1597	0.5190	186.9229 (268)
Total CO2, kg/m2/year			1522.1696 (272)
Emissions per m2 for space and water heating			15.6978 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2635 (272b)
Emissions per m2 for pumps and fans			0.4714 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6978 * 1.00) + 2.2635 + 0.4714, rounded to 2 d.p.			18.4300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.2900 (1b)	x 2.4000 (2b)	= 99.0960 (1b) - (3b)
First floor	41.2900 (1c)	x 2.7000 (2c)	= 111.4830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.5790 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1425 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3425 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2911 (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	0.3711	0.3639	0.3566	0.3202	0.3129	0.2765	0.2765	0.2693	0.2911	0.3129	0.3275	0.3420 (22b)
Effective ac	0.5689	0.5662	0.5636	0.5513	0.5490	0.5382	0.5382	0.5363	0.5424	0.5490	0.5536	0.5585 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Fully Glazed Door/Win (Uw = 1.20)			15.2000	1.1450	17.4046		(27)
Heat Loss Floor 1			41.2900	0.1200	4.9548	75.0000	3096.7500 (28a)
External Wall 1	93.6900	17.3200	76.3700	0.1800	13.7466	43.4900	3321.3313 (29a)
External Roof 1	41.2900		41.2900	0.0900	3.7161	10.3700	428.1773 (30)
Total net area of external elements Aum(A, m ²)			176.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.1541		(33)
Party Wall 1			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Internal Wall 1			54.1900			9.0000	487.7100 (32c)
Internal Wall 2			74.4000			9.0000	669.6000 (32c)
Internal Floor 1			41.2900			18.0000	743.2200 (32d)
Internal Ceiling 1			41.2900			9.0000	371.6100 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	14068.3986 (34)
	170.3608 (35)
	5.7742 (36)
(33) + (36) =	47.9283 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 39.5317 Feb 39.3459 Mar 39.1637 Apr 38.3080 May 38.1479 Jun 37.4027 Jul 37.4027 Aug 37.2647 Sep 37.6897 Oct 38.1479 Nov 38.4718 Dec 38.8104 (38)
Heat transfer coeff	87.4600 87.2742 87.0920 86.2363 86.0762 85.3310 85.3310 85.1930 85.6180 86.0762 86.4001 86.7387 (39)
Average = Sum(39)m / 12 =	86.2356 (39)

HLP	Jan 1.0591 Feb 1.0568 Mar 1.0546 Apr 1.0443 May 1.0423 Jun 1.0333 Jul 1.0333 Aug 1.0316 Sep 1.0368 Oct 1.0423 Nov 1.0463 Dec 1.0504 (40)
HLP (average)	1.0443 (40)
Days in month	31 28 31 30 31 30 31 31 30 31 30 31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5100 (42)
Average daily hot water use (litres/day)												93.8123 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	103.1936	99.4411	95.6886	91.9361	88.1836	84.4311	84.4311	88.1836	91.9361	95.6886	99.4411	103.1936 (44)
Energy conte	153.0331	133.8437	138.1147	120.4118	115.5380	99.7005	92.3872	106.0156	107.2818	125.0266	136.4763	148.2044 (45)
Energy content (annual)												Total = Sum(45)m = 1476.0336 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
Heat gains from water heating, kWh/month	32.5195	28.4418	29.3494	25.5875	24.5518	21.1864	19.6323	22.5283	22.7974	26.5681	29.0012	31.4934 (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	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3937	18.1135	14.7309	11.1523	8.3364	7.0380	7.6048	9.8850	13.2676	16.8463	19.6621	20.9605	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.7481	227.0802	221.2032	208.6917	192.8982	178.0546	168.1381	165.8059	171.6829	184.1944	199.9879	214.8316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	(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)	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	(71)
Water heating gains (Table 5)	43.7091	42.3241	39.4481	35.5382	32.9998	29.4255	26.3875	30.2800	31.6630	35.7099	40.2795	42.3299	(72)
Total internal gains	349.5008	348.1678	336.0321	316.0321	294.8843	275.1679	262.7802	266.6208	277.2635	297.4005	320.5794	338.7719	(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
East			4.1100		19.6403		0.6300		0.7000		0.7700		24.6695 (76)
South			0.8400		46.7521		0.6300		0.7000		0.7700		12.0020 (78)
West			10.2500		19.6403		0.6300		0.7000		0.7700		61.5238 (80)
Solar gains	98.1953	188.2685	302.7190	433.2794	525.8081	536.4500	511.4324	442.4227	349.1096	221.2738	121.6993	81.2520	(83)
Total gains	447.6960	536.4363	638.7512	749.3115	820.6924	811.6180	774.2126	709.0434	626.3731	518.6742	442.2787	420.0239	(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	44.6820	44.7772	44.8708	45.3160	45.4003	45.7968	45.7968	45.8710	45.6433	45.4003	45.2301	45.0536	
alpha	3.9788	3.9851	3.9914	4.0211	4.0267	4.0531	4.0531	4.0581	4.0429	4.0267	4.0153	4.0036	
util living area	0.9937	0.9866	0.9663	0.9081	0.7910	0.6218	0.4713	0.5292	0.7776	0.9501	0.9885	0.9951	(86)
MIT	19.4211	19.6377	19.9953	20.4337	20.7637	20.9351	20.9835	20.9740	20.8379	20.3718	19.8089	19.3810	(87)
Th 2	20.0344	20.0362	20.0381	20.0466	20.0482	20.0557	20.0557	20.0570	20.0528	20.0482	20.0450	20.0416	(88)
util rest of house	0.9922	0.9834	0.9584	0.8865	0.7446	0.5462	0.3761	0.4305	0.7118	0.9339	0.9853	0.9939	(89)
MIT 2	18.5857	18.8021	19.1558	19.5833	19.8804	20.0209	20.0499	20.0472	19.9530	19.5348	18.9804	18.5513	(90)
Living area fraction	18.8251	19.0415	19.3964	19.8269	20.1335	20.2829	20.3174	20.3127	20.2065	19.7746	19.2177	18.7890	(91)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(92)
adjusted MIT	18.8251	19.0415	19.3964	19.8269	20.1335	20.2829	20.3174	20.3127	20.2065	19.7746	19.2177	18.7890	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	443.0985	525.3028	607.9524	659.9776	614.8203	458.7845	312.1200	324.8924	453.2121	481.4165	434.1429	416.6177	(94)
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	1270.3641	1234.1911	1123.1702	942.2975	725.9245	484.9241	317.2082	333.3357	522.8304	789.7182	1046.9747	1265.4340	(97)
Month fracti	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	615.4856	476.3729	383.3220	203.2703	82.6615	0.0000	0.0000	0.0000	0.0000	229.3764	441.2389	631.5194	(98)
Space heating												3063.2471	(98)
Space heating per m2												37.0943	(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	802.1113	631.4493	647.4666	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8915	0.9360	0.9149	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	715.0455	591.0612	592.3630	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1042.5629	996.8997	922.3512	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	235.8125	301.9438	245.5112	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												783.2675 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	58.9531	75.4860	61.3778	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												195.8169 (107)
Space cooling per m2												2.3712 (108)
Energy for space heating												37.0943 (99)
Energy for space cooling												2.3712 (108)
Total												39.4655 (109)
Dwelling Fabric Energy Efficiency (DFEE)												39.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.2900 (1b)	x 2.4000 (2b)	= 99.0960 (1b) - (3b)
First floor	41.2900 (1c)	x 2.7000 (2c)	= 111.4830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.5790 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (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)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1425 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3925 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3336 (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	0.4253	0.4170	0.4087	0.3670	0.3586	0.3169	0.3169	0.3086	0.3336	0.3586	0.3753	0.3920	(22b)				
Effective ac	0.5905	0.5869	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768	(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 Semi-glazed door			2.1200	1.2000	2.5440			(26a)				
TER Opening Type (Uw = 1.40)			15.2000	1.3258	20.1515			(27)				
Heat Loss Floor 1			41.2900	0.1300	5.3677			(28a)				
External Wall 1	93.6900	17.3200	76.3700	0.1800	13.7466			(29a)				
External Roof 1	41.2900		41.2900	0.1300	5.3677			(30)				
Total net area of external elements Aum(A, m2)			176.2700					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		47.1775			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.3748 (36)				
Total fabric heat loss						(33) + (36) =		56.5523 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0313	Feb 40.7872	Mar 40.5480	Apr 39.4242	May 39.2140	Jun 38.2352	Jul 38.2352	Aug 38.0540	Sep 38.6122	Oct 39.2140	Nov 39.6393	Dec 40.0840 (38)
Heat transfer coeff	97.5836	97.3395	97.1003	95.9765	95.7663	94.7875	94.7875	94.6063	95.1645	95.7663	96.1916	96.6363 (39)
Average = Sum(39)m / 12 =												95.9755 (39)
HLP	Jan 1.1817	Feb 1.1787	Mar 1.1758	Apr 1.1622	May 1.1597	Jun 1.1478	Jul 1.1478	Aug 1.1456	Sep 1.1524	Oct 1.1597	Nov 1.1648	Dec 1.1702 (40)
HLP (average)												1.1622 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5100 (42)
Average daily hot water use (litres/day)												93.8123 (43)
Daily hot water use	Jan 103.1936	Feb 99.4411	Mar 95.6886	Apr 91.9361	May 88.1836	Jun 84.4311	Jul 84.4311	Aug 88.1836	Sep 91.9361	Oct 95.6886	Nov 99.4411	Dec 103.1936 (44)
Energy conte	153.0331	133.8437	138.1147	120.4118	115.5380	99.7005	92.3872	106.0156	107.2818	125.0266	136.4763	148.2044 (45)
Energy content (annual)										Total = Sum(45)m =		1476.0336 (45)
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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (57)
Heat gains from water heating, kWh/month	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)
	32.5195	28.4418	29.3494	25.5875	24.5518	21.1864	19.6323	22.5283	22.7974	26.5681	29.0012	31.4934 (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	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	125.4997	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3937	18.1135	14.7309	11.1523	8.3364	7.0380	7.6048	9.8850	13.2676	16.8463	19.6621	20.9605	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	224.7481	227.0802	221.2032	208.6917	192.8982	178.0546	168.1381	165.8059	171.6829	184.1944	199.9879	214.8316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	35.5500	(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)	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	(71)
Water heating gains (Table 5)	43.7091	42.3241	39.4481	35.5382	32.9998	29.4255	26.3875	30.2800	31.6630	35.7099	40.2795	42.3299	(72)
Total internal gains	349.5008	348.1678	336.0321	316.0321	294.8843	275.1679	262.7802	266.6208	277.2635	297.4005	320.5794	338.7719	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East	4.1100	19.6403	0.6300		0.7000	0.7700	24.6695 (76)
South	0.8400	46.7521	0.6300		0.7000	0.7700	12.0020 (78)
West	10.2500	19.6403	0.6300		0.7000	0.7700	61.5238 (80)

Solar gains	98.1953	188.2685	302.7190	433.2794	525.8081	536.4500	511.4324	442.4227	349.1096	221.2738	121.6993	81.2520 (83)
Total gains	447.6960	536.4363	638.7512	749.3115	820.6924	811.6180	774.2126	709.0434	626.3731	518.6742	442.2787	420.0239 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.7673	58.9146	59.0598	59.7513	59.8825	60.5008	60.5008	60.6167	60.2611	59.8825	59.6177	59.3434	
alpha	4.9178	4.9276	4.9373	4.9834	4.9922	5.0334	5.0334	5.0411	5.0174	4.9922	4.9745	4.9562	
util living area	0.9987	0.9967	0.9889	0.9569	0.8652	0.6947	0.5274	0.5924	0.8528	0.9812	0.9973	0.9991	(86)
MIT	19.6629	19.8319	20.1213	20.4958	20.7951	20.9513	20.9900	20.9828	20.8608	20.4471	19.9838	19.6359	(87)
Th 2	19.9347	19.9371	19.9394	19.9503	19.9524	19.9620	19.9620	19.9637	19.9583	19.9524	19.9482	19.9439	(88)
util rest of house	0.9983	0.9955	0.9848	0.9406	0.8170	0.6026	0.4088	0.4696	0.7818	0.9714	0.9961	0.9988	(89)
MIT 2	18.7149	18.8853	19.1743	19.5466	19.8164	19.9402	19.9595	19.9589	19.8812	19.5076	19.0462	18.6953	(90)
Living area fraction									fLA = Living area / (4) =			0.2865	(91)
MIT	18.9865	19.1565	19.4456	19.8186	20.0968	20.2299	20.2548	20.2523	20.1619	19.7767	19.3148	18.9648	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9865	19.1565	19.4456	19.8186	20.0968	20.2299	20.2548	20.2523	20.1619	19.7767	19.3148	18.9648	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9977	0.9943	0.9823	0.9381	0.8245	0.6279	0.4431	0.5051	0.7977	0.9692	0.9952	0.9984	(94)
Ext temp.	446.6874	533.3828	627.4424	702.9458	676.6684	509.5781	343.0572	358.1534	499.6645	502.7129	440.1356	419.3322	(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	1433.1607	1387.7171	1257.0194	1047.9284	804.1298	533.6427	346.4260	364.4496	576.8741	878.8230	1174.9611	1426.8157	(97)
Month fracti	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	733.9362	574.1127	468.4053	248.3875	94.8313	0.0000	0.0000	0.0000	0.0000	279.8259	529.0743	749.5677	(98)
Space heating												3678.1409	(98)
Space heating per m2												44.5403	(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	891.0027	701.4277	719.0077	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8923	0.9426	0.9192	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	795.0776	661.1666	660.9458	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1042.5629	996.8997	922.3512	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	178.1894	249.7854	194.4856	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												622.4604	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	44.5473	62.4464	48.6214	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												155.6151 (107)
Space cooling per m2												1.8844 (108)
Energy for space heating												44.5403 (99)
Energy for space cooling												1.8844 (108)
Total												46.4248 (109)
Target Fabric Energy Efficiency (TFEE)												53.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.2900 (1b)	x 2.4000 (2b)	= 99.0960 (1b) - (3b)
First floor	41.2900 (1c)	x 2.7000 (2c)	= 111.4830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.5790 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent 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)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1900 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3900 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3315 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4226	0.3895	0.3812	0.3563	0.3563	0.3315	0.3315	0.3232	0.3315	0.3729	0.3646	0.3895 (22b)
Effective ac	0.5893	0.5758	0.5726	0.5635	0.5635	0.5549	0.5549	0.5522	0.5549	0.5695	0.5665	0.5758 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Fully Glazed Door/Win (Uw = 1.20)			15.2000	1.1450	17.4046		(27)
Heat Loss Floor 1			41.2900	0.1200	4.9548	75.0000	3096.7500 (28a)
External Wall 1	93.6900	17.3200	76.3700	0.1800	13.7466	43.4900	3321.3313 (29a)
External Roof 1	41.2900		41.2900	0.0900	3.7161	10.3700	428.1773 (30)
Total net area of external elements Aum(A, m ²)			176.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.1541		(33)
Party Wall 1			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Internal Wall 1			54.1900			9.0000	487.7100 (32c)
Internal Wall 2			74.4000			9.0000	669.6000 (32c)
Internal Floor 1			41.2900			18.0000	743.2200 (32d)
Internal Ceiling 1			41.2900			18.0000	743.2200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	40.9511	40.0158	39.7940	39.1569	39.1569	38.5629	38.5629	38.3744	38.5629	39.5768	39.3645	40.0158 (38)
Heat transfer coeff	88.8794	87.9442	87.7223	87.0853	87.0853	86.4912	86.4912	86.3027	86.4912	87.5052	87.2928	87.9442 (39)
Average = Sum(39)m / 12 =												87.2696 (39)

HLP	1.0763	1.0650	1.0623	1.0546	1.0546	1.0474	1.0474	1.0451	1.0474	1.0596	1.0571	1.0650 (40)
HLP (average)												1.0568 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5100 (42)
Average daily hot water use (litres/day)												93.8123 (43)
Daily hot water use	103.1936	99.4411	95.6886	91.9361	88.1836	84.4311	84.4311	88.1836	91.9361	95.6886	99.4411	103.1936 (44)
Energy conte	153.0331	133.8437	138.1147	120.4118	115.5380	99.7005	92.3872	106.0156	107.2818	125.0266	136.4763	148.2044 (45)
Energy content (annual)										Total = Sum(45)m =		1476.0336 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.9550	20.0766	20.7172	18.0618	17.3307	14.9551	13.8581	15.9023	16.0923	18.7540	20.4714	22.2307 (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)
Combi loss	0.6703	0.5989	0.5947	0.4982	0.4585	0.3788	0.3510	0.4207	0.4438	0.5384	0.6107	0.6492 (61)
Total heat required for water heating calculated for each month	153.7034	134.4427	138.7095	120.9099	115.9965	100.0793	92.7382	106.4363	107.7256	125.5649	137.0870	148.8536 (62)
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)
Output from w/h	153.7034	134.4427	138.7095	120.9099	115.9965	100.0793	92.7382	106.4363	107.7256	125.5649	137.0870	148.8536 (64)
RHI water heating demand	51.0511	44.6528	46.0718	40.1615	38.5310	33.2451	30.8065	35.3554	35.7821	41.7059	45.5310	49.4403 (65)
Heat gains from water heating, kWh/month												
	51.0511	44.6528	46.0718	40.1615	38.5310	33.2451	30.8065	35.3554	35.7821	41.7059	45.5310	49.4403 (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	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.9843	45.2838	36.8273	27.8806	20.8411	17.5949	19.0119	24.7124	33.1690	42.1157	49.1552	52.4014 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	335.4449	338.9257	330.1541	311.4802	287.9078	265.7531	250.9524	247.4715	256.2432	274.9170	298.4894	320.6442 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997 (71)
Water heating gains (Table 5)	68.6171	66.4476	61.9245	55.7798	51.7890	46.1738	41.4066	47.5207	49.6974	56.0563	63.2376	66.4520 (72)
Total internal gains	560.8161	556.4270	534.6757	500.9105	466.3077	435.2916	417.1407	425.4744	444.8794	478.8589	516.6520	545.2673 (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
East			4.1100		25.9136		0.6300		0.7000		0.7700		32.5493 (76)
South			0.8400		58.2505		0.6300		0.7000		0.7700		14.9538 (78)
West			10.2500		25.9136		0.6300		0.7000		0.7700		81.1754 (80)
Solar gains	128.6785	210.8156	336.4277	488.5694	565.0122	623.3625	580.2472	513.5114	410.7984	261.8993	158.0342	101.6536	(83)
Total gains	689.4946	767.2426	871.1034	989.4799	1031.3199	1058.6541	997.3880	938.9858	855.6778	740.7582	674.6862	646.9209	(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	45.1298	45.6098	45.7251	46.0596	46.0596	46.3760	46.3760	46.4773	46.3760	45.8386	45.9501	45.6098
alpha	4.0087	4.0407	4.0483	4.0706	4.0706	4.0917	4.0917	4.0985	4.0917	4.0559	4.0633	4.0407
util living area	0.9685	0.9528	0.9069	0.8041	0.6475	0.4472	0.3188	0.3374	0.5730	0.8341	0.9421	0.9735 (86)
MIT	19.9086	20.0643	20.3725	20.6991	20.9028	20.9833	20.9968	20.9961	20.9562	20.7146	20.2917	19.8834 (87)
Th 2	20.0202	20.0296	20.0318	20.0381	20.0381	20.0441	20.0441	20.0459	20.0441	20.0339	20.0360	20.0296 (88)
util rest of house	0.9614	0.9426	0.8874	0.7673	0.5892	0.3749	0.2374	0.2517	0.4934	0.7909	0.9271	0.9674 (89)
MIT 2	19.0536	19.2119	19.5079	19.8096	19.9770	20.0368	20.0433	20.0450	20.0226	19.8287	19.4407	19.0368 (90)
Living area fraction	19.2986	19.4561	19.7556	20.0644	20.2422	20.3080	20.3165	20.3175	20.2901	20.0825	19.6845	19.2794 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2986	19.4561	19.7556	20.0644	20.2422	20.3080	20.3165	20.3175	20.2901	20.0825	19.6845	19.2794 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	658.3988	717.6803	767.5337	760.3529	621.0064	418.3924	260.0999	259.4343	440.4051	587.6879	621.1309	621.9914 (95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000 (96)
Heat loss rate W	1235.2997	1209.7728	1092.6377	911.2965	665.5236	424.4954	260.8983	260.4170	457.5452	724.7635	985.0593	1211.8168 (97)
Month fracti	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	429.2143	330.6861	241.8774	108.6794	33.1208	0.0000	0.0000	0.0000	0.0000	101.9842	262.0285	438.8301 (98)
Space heating												1946.4208 (98)
RHI space heating demand												1946 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.2900 (1b)	x 2.4000 (2b)	= 99.0960 (1b) - (3b)
First floor	41.2900 (1c)	x 2.7000 (2c)	= 111.4830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.5790 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1900 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3900 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3315 (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	0.4226	0.4143	0.4060	0.3646	0.3563	0.3149	0.3149	0.3066	0.3315	0.3563	0.3729	0.3895 (22b)
Effective ac	0.5893	0.5858	0.5824	0.5665	0.5635	0.5496	0.5496	0.5470	0.5549	0.5635	0.5695	0.5758 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Fully Glazed Door/Win (Uw = 1.20)			15.2000	1.1450	17.4046		(27)
Heat Loss Floor 1			41.2900	0.1200	4.9548	75.0000	3096.7500 (28a)
External Wall 1	93.6900	17.3200	76.3700	0.1800	13.7466	43.4900	3321.3313 (29a)
External Roof 1	41.2900		41.2900	0.0900	3.7161	10.3700	428.1773 (30)
Total net area of external elements Aum(A, m ²)			176.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.1541		(33)
Party Wall 1			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Internal Wall 1			54.1900			9.0000	487.7100 (32c)
Internal Wall 2			74.4000			9.0000	669.6000 (32c)
Internal Floor 1			41.2900			18.0000	743.2200 (32d)
Internal Ceiling 1			41.2900			18.0000	743.2200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	14440.0086 (34)
	174.8608 (35)
	5.7742 (36)
(33) + (36) =	47.9283 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 40.9511 Feb 40.7101 Mar 40.4739 Apr 39.3645 May 39.1569 Jun 38.1907 Jul 38.1907 Aug 38.0117 Sep 38.5629 Oct 39.1569 Nov 39.5768 Dec 40.0158 (38)
Heat transfer coeff	88.8794 88.6384 88.4022 87.2928 87.0853 86.1190 86.1190 85.9401 86.4912 87.0853 87.5052 87.9442 (39)
Average = Sum(39)m / 12 =	87.2918 (39)
HLP	Jan 1.0763 Feb 1.0734 Mar 1.0705 Apr 1.0571 May 1.0546 Jun 1.0429 Jul 1.0429 Aug 1.0407 Sep 1.0474 Oct 1.0546 Nov 1.0596 Dec 1.0650 (40)
HLP (average)	1.0571 (40)
Days in month	31 28 31 30 31 30 31 31 30 31 30 31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5100 (42)
Average daily hot water use (litres/day)												93.8123 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	103.1936	99.4411	95.6886	91.9361	88.1836	84.4311	84.4311	88.1836	91.9361	95.6886	99.4411	103.1936 (44)
Energy conte	153.0331	133.8437	138.1147	120.4118	115.5380	99.7005	92.3872	106.0156	107.2818	125.0266	136.4763	148.2044 (45)
Energy content (annual)												Total = Sum(45)m = 1476.0336 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.9550	20.0766	20.7172	18.0618	17.3307	14.9551	13.8581	15.9023	16.0923	18.7540	20.4714	22.2307 (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 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)
Combi loss	0.6703	0.5989	0.5947	0.4982	0.4585	0.3788	0.3510	0.4207	0.4438	0.5384	0.6107	0.6492 (61)
Total heat required for water heating calculated for each month	153.7034	134.4427	138.7095	120.9099	115.9965	100.0793	92.7382	106.4363	107.7256	125.5649	137.0870	148.8536 (62)
WWHRS	-56.5252	-49.7334	-50.7602	-41.7741	-38.7933	-32.0062	-27.0945	-32.8030	-33.7569	-41.7231	-48.3206	-54.6319 eq. (G10)
Total of WWHRS savings												-507.9224
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)
Output from w/h	97.1783	84.7092	87.9492	79.1359	77.2032	68.0731	65.6436	73.6333	73.9687	83.8419	88.7663	94.2217 (64)
Heat gains from water heating, kWh/month	51.0511	44.6528	46.0718	40.1615	38.5310	33.2451	30.8065	35.3554	35.7821	41.7059	45.5310	49.4403 (65)
Solar input (sum of months) = Sum(63)m =												
Total per year (kWh/year) = Sum(64)m =												

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	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.9843	45.2838	36.8273	27.8806	20.8411	17.5949	19.0119	24.7124	33.1690	42.1157	49.1552	52.4014 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	335.4449	338.9257	330.1541	311.4802	287.9078	265.7531	250.9524	247.4715	256.2432	274.9170	298.4894	320.6442 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997 (71)
Water heating gains (Table 5)	68.6171	66.4476	61.9245	55.7798	51.7890	46.1738	41.4066	47.5207	49.6974	56.0563	63.2376	66.4520 (72)
Total internal gains	560.8161	556.4270	534.6757	500.9105	466.3077	435.2916	417.1407	425.4744	444.8794	478.8589	516.6520	545.2673 (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		
East				4.1100	19.6403	0.6300	0.7000	0.7700	24.6695 (76)			
South				0.8400	46.7521	0.6300	0.7000	0.7700	12.0020 (78)			
West				10.2500	19.6403	0.6300	0.7000	0.7700	61.5238 (80)			

Solar gains	98.1953	188.2685	302.7190	433.2794	525.8081	536.4500	511.4324	442.4227	349.1096	221.2738	121.6993	81.2520 (83)
Total gains	659.0114	744.6955	837.3947	934.1899	992.1158	971.7417	928.5731	867.8971	793.9890	700.1327	638.3513	626.5193 (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	45.1298	45.2525	45.3734	45.9501	46.0596	46.5764	46.5764	46.6734	46.3760	46.0596	45.8386	45.6098
alpha	4.0087	4.0168	4.0249	4.0633	4.0706	4.1051	4.1051	4.1116	4.0917	4.0706	4.0559	4.0407
util living area	0.9782	0.9635	0.9292	0.8485	0.7142	0.5419	0.4019	0.4455	0.6759	0.8908	0.9638	0.9818 (86)
MIT	19.7250	19.9218	20.2340	20.5978	20.8453	20.9623	20.9912	20.9868	20.9080	20.5695	20.0836	19.6869 (87)
Th 2	20.0202	20.0226	20.0250	20.0360	20.0381	20.0478	20.0478	20.0496	20.0441	20.0381	20.0339	20.0296 (88)
util rest of house	0.9734	0.9558	0.9142	0.8181	0.6626	0.4699	0.3177	0.3579	0.6042	0.8614	0.9548	0.9778 (89)
MIT 2	18.8727	19.0673	19.3710	19.7190	19.9331	20.0286	20.0449	20.0449	19.9915	19.7041	19.2376	18.8426 (90)
Living area fraction									fLA = Living area / (4) =			0.2865 (91)
MIT	19.1169	19.3122	19.6183	19.9708	20.1945	20.2961	20.3160	20.3147	20.2541	19.9520	19.4800	19.0845 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1169	19.3122	19.6183	19.9708	20.1945	20.2961	20.3160	20.3147	20.2541	19.9520	19.4800	19.0845 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	637.8280	706.6134	759.4592	762.1718	666.1679	475.4013	317.3643	332.2137	492.9883	600.9847	605.3868	609.4676 (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	1316.9187	1277.4704	1159.6848	966.4021	739.7445	490.5445	320.0212	336.4321	532.2748	814.4248	1083.3139	1309.0063 (97)
Month fracti	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	505.2435	383.6159	297.7679	147.0458	54.7410	0.0000	0.0000	0.0000	0.0000	158.7994	344.1076	520.4567 (98)
Space heating												2411.7778 (98)
Space heating per m2												(98) / (4) = 29.2054 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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 %)												90.2000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2673.8113	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	505.2435	383.6159	297.7679	147.0458	54.7410	0.0000	0.0000	0.0000	0.0000	158.7994	344.1076	520.4567	(98)
Space heating efficiency (main heating system 1)	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)	560.1369	425.2948	330.1196	163.0220	60.6885	0.0000	0.0000	0.0000	0.0000	176.0525	381.4940	577.0030	(211)
Water heating requirement	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	97.1783	84.7092	87.9492	79.1359	77.2032	68.0731	65.6436	73.6333	73.9687	83.8419	88.7663	94.2217	(64)
Efficiency of water heater (217)m	87.6462	87.3463	86.6320	84.8384	81.5781	76.4000	76.4000	76.4000	76.4000	84.9010	86.9783	76.4000	(216)
Fuel for water heating, kWh/month	110.8756	96.9809	101.5205	93.2784	94.6372	89.1009	85.9210	96.3787	96.8176	98.7525	102.0557	107.3508	(219)
Water heating fuel used												1173.6699	(219)
Annual totals kWh/year													
Space heating fuel - main system												2673.8113	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												360.1597	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.32 * 853 * 1.00) =										-900.7996		-900.7996	(233)
Total delivered energy for all uses												3381.8413	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2673.8113	3.4800	93.0486 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1173.6699	3.4800	40.8437 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	360.1597	13.1900	47.5051 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-900.7996	13.1900	-118.8155 (252)
Total energy cost			192.4744 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.6336 (257)
SAP value	91.1608	
SAP rating (Section 12)	91	(258)
SAP band	B	

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	2673.8113	0.2160	577.5432 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1173.6699	0.2160	253.5127 (264)
Space and water heating			831.0559 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	360.1597	0.5190	186.9229 (268)
Energy saving/generation technologies			
PV Unit	-900.7996	0.5190	-467.5150 (269)
Total kg/year			589.3888 (272)
CO2 emissions per m2			7.1400 (273)
EI value			93.8095
EI rating			94
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency	$3.48 / 0.8277 = 4.204$, stars = 5
Water heating environmental impact	$0.216 / 0.8277 = 0.2610$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.2900 (1b)	x 2.4000 (2b)	= 99.0960 (1b) - (3b)
First floor	41.2900 (1c)	x 2.7000 (2c)	= 111.4830 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.5790 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1900 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3900 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3315 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4226	0.3895	0.3812	0.3563	0.3563	0.3315	0.3315	0.3232	0.3315	0.3729	0.3646	0.3895 (22b)
Effective ac	0.5893	0.5758	0.5726	0.5635	0.5635	0.5549	0.5549	0.5522	0.5549	0.5695	0.5665	0.5758 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Fully Glazed Door/Win (Uw = 1.20)			15.2000	1.1450	17.4046		(27)
Heat Loss Floor 1			41.2900	0.1200	4.9548	75.0000	3096.7500 (28a)
External Wall 1	93.6900	17.3200	76.3700	0.1800	13.7466	43.4900	3321.3313 (29a)
External Roof 1	41.2900		41.2900	0.0900	3.7161	10.3700	428.1773 (30)
Total net area of external elements Aum(A, m ²)			176.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.1541		(33)
Party Wall 1			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Internal Wall 1			54.1900			9.0000	487.7100 (32c)
Internal Wall 2			74.4000			9.0000	669.6000 (32c)
Internal Floor 1			41.2900			18.0000	743.2200 (32d)
Internal Ceiling 1			41.2900			18.0000	743.2200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14440.0086 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							174.8608 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7742 (36)
Total fabric heat loss						(33) + (36) =	47.9283 (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	40.9511	40.0158	39.7940	39.1569	39.1569	38.5629	38.5629	38.3744	38.5629	39.5768	39.3645	40.0158 (38)
Heat transfer coeff	88.8794	87.9442	87.7223	87.0853	87.0853	86.4912	86.4912	86.3027	86.4912	87.5052	87.2928	87.9442 (39)
Average = Sum(39)m / 12 =												87.2696 (39)
HLP	1.0763	1.0650	1.0623	1.0546	1.0546	1.0474	1.0474	1.0451	1.0474	1.0596	1.0571	1.0650 (40)
HLP (average)												1.0568 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5100 (42)
Average daily hot water use (litres/day)												93.8123 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.1936	99.4411	95.6886	91.9361	88.1836	84.4311	84.4311	88.1836	91.9361	95.6886	99.4411	103.1936 (44)
Energy conte	153.0331	133.8437	138.1147	120.4118	115.5380	99.7005	92.3872	106.0156	107.2818	125.0266	136.4763	148.2044 (45)
Energy content (annual)										Total = Sum(45)m =		1476.0336 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.9550	20.0766	20.7172	18.0618	17.3307	14.9551	13.8581	15.9023	16.0923	18.7540	20.4714	22.2307 (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)
Combi loss	0.6703	0.5989	0.5947	0.4982	0.4585	0.3788	0.3510	0.4207	0.4438	0.5384	0.6107	0.6492 (61)
Total heat required for water heating calculated for each month	153.7034	134.4427	138.7095	120.9099	115.9965	100.0793	92.7382	106.4363	107.7256	125.5649	137.0870	148.8536 (62)
WWHRS	-56.5252	-49.7334	-50.7602	-41.7741	-38.7933	-32.0062	-27.0945	-32.8030	-33.7569	-41.7231	-48.3206	-54.6319 eq. (G10)
Total of WWHRS savings												-507.9224
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)
Output from w/h	97.1783	84.7092	87.9492	79.1359	77.2032	68.0731	65.6436	73.6333	73.9687	83.8419	88.7663	94.2217 (64)
Heat gains from water heating, kWh/month	51.0511	44.6528	46.0718	40.1615	38.5310	33.2451	30.8065	35.3554	35.7821	41.7059	45.5310	49.4403 (65)
Solar input (sum of months) = Sum(63)m =												
Total per year (kWh/year) = Sum(64)m =												

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	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996	150.5996 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.9843	45.2838	36.8273	27.8806	20.8411	17.5949	19.0119	24.7124	33.1690	42.1157	49.1552	52.4014 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	335.4449	338.9257	330.1541	311.4802	287.9078	265.7531	250.9524	247.4715	256.2432	274.9170	298.4894	320.6442 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700	52.5700 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997	-100.3997 (71)
Water heating gains (Table 5)	68.6171	66.4476	61.9245	55.7798	51.7890	46.1738	41.4066	47.5207	49.6974	56.0563	63.2376	66.4520 (72)
Total internal gains	560.8161	556.4270	534.6757	500.9105	466.3077	435.2916	417.1407	425.4744	444.8794	478.8589	516.6520	545.2673 (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		
East				4.1100	25.9136	0.6300	0.7000		0.7700	32.5493 (76)		
South				0.8400	58.2505	0.6300	0.7000		0.7700	14.9538 (78)		
West				10.2500	25.9136	0.6300	0.7000		0.7700	81.1754 (80)		
Solar gains	128.6785	210.8156	336.4277	488.5694	565.0122	623.3625	580.2472	513.5114	410.7984	261.8993	158.0342	101.6536 (83)
Total gains	689.4946	767.2426	871.1034	989.4799	1031.3199	1058.6541	997.3880	938.9858	855.6778	740.7582	674.6862	646.9209 (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	45.1298	45.6098	45.7251	46.0596	46.0596	46.3760	46.3760	46.4773	46.3760	45.8386	45.9501	45.6098
alpha	4.0087	4.0407	4.0483	4.0706	4.0706	4.0917	4.0917	4.0985	4.0917	4.0559	4.0633	4.0407
util living area	0.9685	0.9528	0.9069	0.8041	0.6475	0.4472	0.3188	0.3374	0.5730	0.8341	0.9421	0.9735 (86)
MIT	19.9086	20.0643	20.3725	20.6991	20.9028	20.9833	20.9968	20.9961	20.9562	20.7146	20.2917	19.8834 (87)
Th 2	20.0202	20.0296	20.0318	20.0381	20.0381	20.0441	20.0441	20.0459	20.0441	20.0339	20.0360	20.0296 (88)
util rest of house	0.9614	0.9426	0.8874	0.7673	0.5892	0.3749	0.2374	0.2517	0.4934	0.7909	0.9271	0.9674 (89)
MIT 2	19.0536	19.2119	19.5079	19.8096	19.9770	20.0368	20.0433	20.0450	20.0226	19.8287	19.4407	19.0368 (90)
Living area fraction									fLA = Living area / (4) =			0.2865 (91)
MIT	19.2986	19.4561	19.7556	20.0644	20.2422	20.3080	20.3165	20.3175	20.2901	20.0825	19.6845	19.2794 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2986	19.4561	19.7556	20.0644	20.2422	20.3080	20.3165	20.3175	20.2901	20.0825	19.6845	19.2794 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9549	0.9354	0.8811	0.7684	0.6021	0.3952	0.2608	0.2763	0.5147	0.7934	0.9206	0.9615 (94)
Ext temp.	658.3988	717.6803	767.5337	760.3529	621.0064	418.3924	260.0999	259.4343	440.4051	587.6879	621.1309	621.9914 (95)
Heat loss rate W	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000 (96)
Month fracti	1235.2997	1209.7728	1092.6377	911.2965	665.5236	424.4954	260.8983	260.4170	457.5452	724.7635	985.0593	1211.8168 (97)
Space heating kWh	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	429.2143	330.6861	241.8774	108.6794	33.1208	0.0000	0.0000	0.0000	0.0000	101.9842	262.0285	438.8301 (98)
Space heating per m2												1946.4208 (98)
										(98) / (4) =		23.5701 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Not applicable

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 %)												90.2000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2157.8944	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	429.2143	330.6861	241.8774	108.6794	33.1208	0.0000	0.0000	0.0000	0.0000	101.9842	262.0285	438.8301	(98)
Space heating efficiency (main heating system 1)	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)	475.8473	366.6143	268.1568	120.4871	36.7193	0.0000	0.0000	0.0000	0.0000	113.0646	290.4972	486.5079	(211)
Water heating requirement	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	97.1783	84.7092	87.9492	79.1359	77.2032	68.0731	65.6436	73.6333	73.9687	83.8419	88.7663	94.2217	(64)
Efficiency of water heater (217)m	87.2892	86.9956	86.0551	83.8206	80.0780	76.4000	76.4000	76.4000	76.4000	83.4029	86.2574	76.4000	(216)
Fuel for water heating, kWh/month	111.3290	97.3719	102.2010	94.4110	96.4099	89.1009	85.9210	96.3787	96.8176	100.5263	102.9086	107.7937	(219)
Water heating fuel used												1181.1696	(219)
Annual totals kWh/year													
Space heating fuel - main system												2157.8944	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												360.1597	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.32 * 989 * 1.00) =										-1043.9974		-1043.9974	(233)
Total delivered energy for all uses												2730.2264	(238)

10a. Fuel costs - using BEDF prices (587)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2157.8944	6.3300	136.5947 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1181.1696	6.3300	74.7680 (247)
Pumps and fans for heating	75.0000	26.0600	19.5450 (249)
Energy for lighting	360.1597	26.0600	93.8576 (250)
Additional standing charges			113.0000 (251)
Energy saving/generation technologies			
PV Unit	-1043.9974	26.0600	-272.0657 (252)
Total energy cost			165.6997 (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	2157.8944	0.2160	466.1052 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1181.1696	0.2160	255.1326 (264)
Space and water heating			721.2378 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	360.1597	0.5190	186.9229 (268)
Energy saving/generation technologies			
PV Unit	-1043.9974	0.5190	-541.8347 (269)
Total kg/year			405.2511 (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	2157.8944	1.2200	2632.6312 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1181.1696	1.2200	1441.0270 (264)
Space and water heating			4073.6582 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	360.1597	3.0700	1105.6904 (268)
Energy saving/generation technologies			
PV Unit	-1043.9974	3.0700	-3205.0721 (269)
Primary energy kWh/year			2204.5265 (272)
Primary energy kWh/m2/year			26.6956 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 91
Current environmental impact rating: A 94

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	SAP increase too small
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

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

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.9 -£ 35 -137 kg (33.7%)

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

Potential energy efficiency rating: B 91
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 587 TEST (28 Nov 2025)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£113	£113	£0
Mains gas	£324	£324	£0
Space heating	£269	£269	£0
Water heating	£75	£75	£0
Lighting	£94	£94	£0
Generated (PV)	-£272	-£272	£0
Total cost of fuels	£165	£165	£0
Total cost of uses	£166	£166	£0
Delivered energy	33 kWh/m²	33 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	27 kWh/m²	27 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable