

PREDICTED ENERGY ASSESSMENT

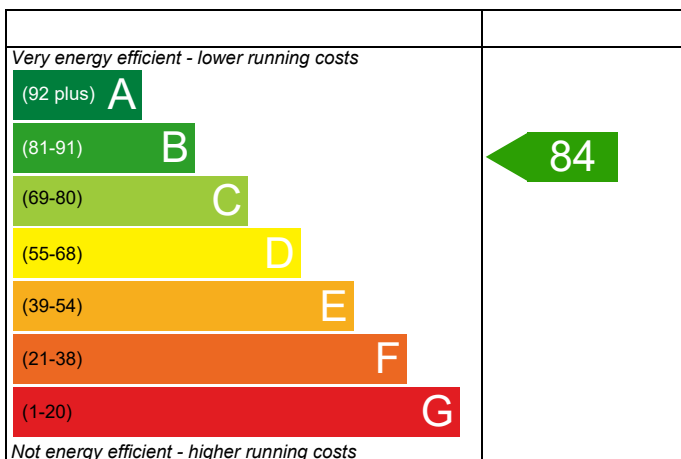
158,
xx0 0xx

Dwelling type: House, End-Terrace
Date of assessment: 07/07/2022
Produced by: Briary Energy Limited
Total floor area: 93.0999984741211 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating

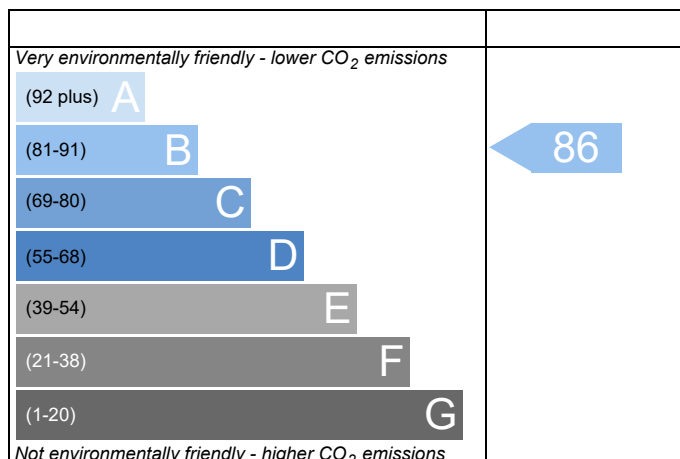


England

EU Directive
2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	199 - PRJ010169			Issued on Date	07/07/2022
Assessment Reference	199	Prop Type Ref	HT10 - ET		
Property	158, xx0 0xx				
SAP Rating	84 B	DER	17.17	TER	17.88
Environmental	86 B	% DER<TER	3.98		
CO ₂ Emissions (t/year)	1.33	DFEE	46.53	TFEE	53.10
General Requirements Compliance	Pass	% DFEE<TFEE	12.38		
Assessor Details	Chris Nicholls , Tel: ,			Assessor ID	4299-0004
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 93 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) 17.88 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.17 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.36 (max. 2.00)	1.40 (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: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
Combi boiler
Efficiency: 89.6% 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 (South East England): Slight OK

Based on:

Overshading: Average
Windows facing North: 3.24 m², No overhang
Windows facing East: 5.94 m², No overhang
Windows facing West: 5.78 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 1.09 W/m²K

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	46.5500 (1b)	x 2.3900 (2b)	= 111.2545 (1b) - (3b)
First floor	46.5500 (1c)	x 2.6900 (2c)	= 125.2195 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.4740 (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) = 0.1269 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3774 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3491 (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	0.4451	0.4363	0.4276	0.3840	0.3752	0.3316	0.3316	0.3229	0.3491	0.3752	0.3927	0.4101 (22b)
Effective ac	0.5990	0.5952	0.5914	0.5737	0.5704	0.5550	0.5550	0.5521	0.5609	0.5704	0.5771	0.5841 (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
Solid Door			1.9700	1.0900	2.1473		(26)
Windows (Uw = 1.40)			14.9600	1.3258	19.8333		(27)
Ground Floor			46.5500	0.1600	7.4480	75.0000	3491.2499 (28a)
Brick	98.1900	16.9300	81.2600	0.2500	20.3150	52.6000	4274.2760 (29a)
Ins Joist	46.5500		46.5500	0.1100	5.1205	9.0000	418.9500 (30)
Total net area of external elements Aum(A, m ²)			191.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.8641		(33)
Party Wall			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
Ground Floor Stud			84.0200			9.0000	756.1800 (32c)
1st Floor Stud			105.8000			9.0000	952.2000 (32c)
Int Floors			46.5500			18.0000	837.9000 (32d)
Int Ceilings			46.5500			9.0000	418.9500 (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) =	13172.4559 (34)
	141.4872 (35)
	9.0934 (36)
(33) + (36) =	63.9575 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 46.7466 Feb 46.4465 Mar 46.1524 Apr 44.7707 May 44.5122 Jun 43.3088 Jul 43.3088 Aug 43.0860 Sep 43.7723 Oct 44.5122 Nov 45.0352 Dec 45.5819 (38)
Heat transfer coeff	110.7042 110.4041 110.1099 108.7282 108.4697 107.2663 107.2663 107.0435 107.7299 108.4697 108.9927 109.5394 (39)
Average = Sum(39)m / 12 =	108.7270 (39)
HLP	Jan 1.1891 Feb 1.1859 Mar 1.1827 Apr 1.1679 May 1.1651 Jun 1.1522 Jul 1.1522 Aug 1.1498 Sep 1.1571 Oct 1.1651 Nov 1.1707 Dec 1.1766 (40)
HLP (average)	1.1679 (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												2.6658 (42)
Average daily hot water use (litres/day)												97.5132 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2645	103.3640	99.4635	95.5629	91.6624	87.7619	87.7619	91.6624	95.5629	99.4635	103.3640	107.2645 (44)
Energy conte	159.0702	139.1238	143.5633	125.1620	120.0959	103.6336	96.0318	110.1979	111.5140	129.9588	141.8602	154.0510 (45)
Energy content (annual)										Total = Sum(45)m =		1534.2625 (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	23.8605	20.8686	21.5345	18.7743	18.0144	15.5450	14.4048	16.5297	16.7271	19.4938	21.2790	23.1076 (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	14.6941	13.2585	14.6453	14.1171	14.5472	14.0312	14.4697	14.5199	14.0780	14.6047	14.1839	14.6791 (61)
Total heat required for water heating calculated for each month	173.7643	152.3823	158.2086	139.2791	134.6431	117.6648	110.5015	124.7178	125.5920	144.5635	156.0441	168.7301 (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	173.7643	152.3823	158.2086	139.2791	134.6431	117.6648	110.5015	124.7178	125.5920	144.5635	156.0441	168.7301 (64)
Heat gains from water heating, kWh/month	56.5644	49.5733	51.3961	45.1456	43.5687	37.9660	35.5480	40.2708	40.5979	46.8625	50.7145	54.8917 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1706.0911 (64)												

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	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.6139	20.0855	16.3346	12.3663	9.2440	7.8042	8.4327	10.9611	14.7120	18.6802	21.8026	23.2424	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.6667	247.2056	240.8077	227.1874	209.9942	193.8350	183.0396	180.5007	186.8986	200.5190	217.7122	233.8714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	(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)	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	(71)
Water heating gains (Table 5)	76.0274	73.7698	69.0808	62.7023	58.5600	52.7305	47.7796	54.1274	56.3860	62.9872	70.4368	73.7792	(72)
Total internal gains	409.2953	407.0481	392.2104	368.2433	343.7855	320.3569	305.2392	311.5765	323.9839	348.1737	375.9389	396.8803	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				3.2400	10.6334	0.7600	0.7200			0.7700			13.0646 (74)
East				5.9400	19.6403	0.7600	0.7200			0.7700			44.2398 (76)
West				5.7800	19.6403	0.7600	0.7200			0.7700			43.0481 (80)
Solar gains	100.3525	195.7209	323.6323	478.2696	594.4207	612.7963	581.5976	493.5637	378.0644	232.3338	124.9547	82.6727	(83)
Total gains	509.6479	602.7690	715.8428	846.5129	938.2062	933.1532	886.8367	805.1402	702.0482	580.5075	500.8935	479.5530	(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	33.0522	33.1420	33.2306	33.6529	33.7331	34.1115	34.1115	34.1825	33.9647	33.7331	33.5712	33.4036	
alpha	3.2035	3.2095	3.2154	3.2435	3.2489	3.2741	3.2741	3.2788	3.2643	3.2489	3.2381	3.2269	
util living area	0.9883	0.9792	0.9567	0.8992	0.7916	0.6383	0.4983	0.5576	0.7869	0.9404	0.9812	0.9903	(86)
MIT	18.9565	19.1947	19.6124	20.1527	20.5930	20.8605	20.9539	20.9333	20.7074	20.1097	19.4372	18.9185	(87)
Th 2	19.9287	19.9313	19.9339	19.9458	19.9480	19.9585	19.9585	19.9604	19.9544	19.9480	19.9435	19.9388	(88)
util rest of house	0.9859	0.9750	0.9475	0.8773	0.7462	0.5606	0.3933	0.4510	0.7230	0.9230	0.9767	0.9883	(89)
MIT 2	18.0635	18.3015	18.7149	19.2453	19.6504	19.8791	19.9409	19.9327	19.7657	19.2167	18.5530	18.0331	(90)
Living area fraction									fLA = Living area / (4) =			0.1998	(91)
MIT	18.2419	18.4799	18.8942	19.4266	19.8387	20.0752	20.1433	20.1326	19.9538	19.3951	18.7296	18.2100	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.0919	18.3299	18.7442	19.2766	19.6887	19.9252	19.9933	19.9826	19.8038	19.2451	18.5796	18.0600	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	499.4456	582.4042	668.7224	728.3464	688.0909	520.5779	352.0975	365.0778	499.9991	526.9680	485.0692	471.5313	(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	1526.8214	1482.7184	1348.2087	1128.2301	866.5358	571.2142	363.9850	383.4964	614.4725	937.7344	1251.1964	1518.2139	(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	764.3676	605.0111	505.5378	287.9163	132.7630	0.0000	0.0000	0.0000	0.0000	305.6102	551.6115	778.7318	(98)
Space heating												3931.5494	(98)
Space heating per m2												(98) / (4) =	42.2293 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4344.2534 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	764.3676	605.0111	505.5378	287.9163	132.7630	0.0000	0.0000	0.0000	0.0000	305.6102	551.6115	778.7318	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	844.6051	668.5206	558.6053	318.1395	146.6995	0.0000	0.0000	0.0000	0.0000	337.6908	609.5155	860.4772	(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	173.7643	152.3823	158.2086	139.2791	134.6431	117.6648	110.5015	124.7178	125.5920	144.5635	156.0441	168.7301	(64)
Efficiency of water heater (217)m	89.8897	89.8375	89.7161	89.4312	88.8600	87.3000	87.3000	87.3000	87.3000	89.4471	89.7744	87.3000	(216)
Fuel for water heating, kWh/month	193.3084	169.6199	176.3435	155.7388	151.5227	134.7821	126.5768	142.8612	143.8625	161.6190	173.8181	187.6591	(219)
Water heating fuel used												1917.7121	(219)
Annual totals kWh/year													
Space heating fuel - main system												4344.2534	(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)												399.3687	(232)
Total delivered energy for all uses												6736.3342	(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	4344.2534	0.2160	938.3587	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1917.7121	0.2160	414.2258	(264)
Space and water heating			1352.5846	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	399.3687	0.5190	207.2724	(268)
Total CO2, kg/year			1598.7819	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.1700	(273)

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

DER			17.1700	ZC1
Total Floor Area		TFA	93.1000	
Assumed number of occupants		N	2.6658	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.5730	ZC2
CO2 emissions from cooking, equation (L16)			1.9654	ZC3
Total CO2 emissions			34.7084	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			34.7084	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	46.5500 (1b)	x 2.3900 (2b)	= 111.2545 (1b) - (3b)
First floor	46.5500 (1c)	x 2.6900 (2c)	= 125.2195 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.4740 (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) = 0.1269 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3769 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3486 (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	0.4445	0.4357	0.4270	0.3835	0.3747	0.3312	0.3312	0.3225	0.3486	0.3747	0.3922	0.4096 (22b)
Effective ac	0.5988	0.5949	0.5912	0.5735	0.5702	0.5548	0.5548	0.5520	0.5608	0.5702	0.5769	0.5839 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9700	1.0000	1.9700		(26)					
TER Opening Type (Uw = 1.40)			14.9600	1.3258	19.8333		(27)					
Ground Floor			46.5500	0.1300	6.0515		(28a)					
Brick	98.1900	16.9300	81.2600	0.1800	14.6268		(29a)					
Ins Joist	46.5500		46.5500	0.1300	6.0515		(30)					
Total net area of external elements Aum(A, m2)			191.2900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		48.5331		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2384 (36)					
Total fabric heat loss						(33) + (36) =	58.7715 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	46.7262	46.4269	46.1335	44.7555	44.4977	43.2975	43.2975	43.0752	43.7598	44.4977	45.0192	45.5645 (38)
Heat transfer coeff	105.4977	105.1984	104.9050	103.5270	103.2692	102.0690	102.0690	101.8467	102.5313	103.2692	103.7908	104.3360 (39)
Average = Sum(39)m / 12 =												103.5258 (39)
HLP	Jan 1.1332	Feb 1.1300	Mar 1.1268	Apr 1.1120	May 1.1092	Jun 1.0963	Jul 1.0963	Aug 1.0939	Sep 1.1013	Oct 1.1092	Nov 1.1148	Dec 1.1207 (40)
HLP (average)												1.1120 (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												2.6658 (42)
Average daily hot water use (litres/day)												97.5132 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2645	103.3640	99.4635	95.5629	91.6624	87.7619	87.7619	91.6624	95.5629	99.4635	103.3640	107.2645 (44)
Energy conte	159.0702	139.1238	143.5633	125.1620	120.0959	103.6336	96.0318	110.1979	111.5140	129.9588	141.8602	154.0510 (45)
Energy content (annual)											Total = Sum(45)m =	1534.2625 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.8605	20.8686	21.5345	18.7743	18.0144	15.5450	14.4048	16.5297	16.7271	19.4938	21.2790	23.1076 (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	46.0274	50.6855	47.1269	46.7102	43.2798	44.7225	46.7102	47.1269	50.6855	49.3151	50.9589 (61)
Solar input	210.0291	185.1512	194.2488	172.2889	166.8061	146.9135	140.7543	156.9080	158.6409	180.6443	191.1753	205.0099 (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	210.0291	185.1512	194.2488	172.2889	166.8061	146.9135	140.7543	156.9080	158.6409	180.6443	191.1753	205.0099 (64)
	65.6306	57.7655	60.4062	53.3981	51.6094	45.2781	43.1112	48.3183	48.8601	55.8827	59.4973	63.9617 (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	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	(66)
Lighting gains (calculated in Appendix L, equation L19 or L9a), also see Table 5	22.7371	20.1949	16.4236	12.4337	9.2943	7.8467	8.4786	11.0208	14.7921	18.7820	21.9213	23.3690	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.6667	247.2056	240.8077	227.1874	209.9942	193.8350	183.0396	180.5007	186.8986	200.5190	217.7122	233.8714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	(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)	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	(71)
Water heating gains (Table 5)	88.2131	85.9606	81.1911	74.1640	69.3675	62.8863	57.9452	64.9440	67.8613	75.1111	82.6351	85.9700	(72)
Total internal gains	421.6042	419.3483	404.4097	379.7724	354.6433	330.5552	315.4507	322.4528	335.5393	360.3993	388.2559	409.1977	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF			Access factor Table 6d	Gains W
North				3.2400	10.6334		0.6300		0.7000			0.7700	10.5290 (74)
East				5.9400	19.6403		0.6300		0.7000			0.7700	35.6538 (76)
West				5.7800	19.6403		0.6300		0.7000			0.7700	34.6934 (80)
Solar gains	80.8762	157.7356	260.8221	385.4475	479.0562	493.8654	468.7217	397.7734	304.6900	187.2427	100.7036		66.6276 (83)
Total gains	502.4804	577.0839	665.2318	765.2199	833.6995	824.4207	784.1724	720.2262	640.2293	547.6420	488.9595		475.8253 (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	61.2836	61.4579	61.6298	62.4502	62.6061	63.3422	63.3422	63.4805	63.0566	62.6061	62.2915	61.9659	
alpha	5.0856	5.0972	5.1087	5.1633	5.1737	5.2228	5.2228	5.2320	5.2038	5.1737	5.1528	5.1311	
util living area	0.9988	0.9973	0.9917	0.9679	0.8911	0.7286	0.5590	0.6248	0.8776	0.9847	0.9975	0.9991	(86)
MIT	19.7251	19.8679	20.1274	20.4799	20.7789	20.9464	20.9890	20.9811	20.8518	20.4566	20.0305	19.7044	(87)
Th 2	19.9738	19.9764	19.9790	19.9910	19.9933	20.0038	20.0038	20.0058	19.9998	19.9933	19.9887	19.9840	(88)
util rest of house	0.9984	0.9963	0.9886	0.9553	0.8491	0.6395	0.4395	0.5024	0.8141	0.9767	0.9964	0.9988	(89)
MIT 2	18.2667	18.4771	18.8568	19.3703	19.7722	19.9675	19.9997	19.9977	19.8750	19.3456	18.7240	18.2437	(90)
Living area fraction	18.5581	18.7550	19.1106	19.5920	19.9733	20.1630	20.1973	20.1942	20.0701	19.5675	18.9850	18.5355	(92)
Temperature adjustment	18.5581	18.7550	19.1106	19.5920	19.9733	20.1630	20.1973	20.1942	20.0701	19.5675	18.9850	18.5355	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	501.2115	573.9732	655.2137	726.0835	707.0704	539.8611	363.4328	379.3898	524.6088	532.2690	486.4437	474.9147	(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	1504.1938	1457.5233	1322.9183	1106.9114	854.3774	567.8146	367.1771	386.4270	612.1271	926.0687	1233.5561	1495.7107	(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	746.2188	593.7457	496.7722	274.1961	109.5964	0.0000	0.0000	0.0000	0.0000	292.9870	537.9209	759.4722	(98)
Space heating												3810.9093	(98)
Space heating per m2												40.9335	(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												4080.2027 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	746.2188	593.7457	496.7722	274.1961	109.5964	0.0000	0.0000	0.0000	0.0000	292.9870	537.9209	759.4722 (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)	798.9495	635.7020	531.8760	293.5718	117.3409	0.0000	0.0000	0.0000	0.0000	313.6905	575.9325	813.1394 (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	210.0291	185.1512	194.2488	172.2889	166.8061	146.9135	140.7543	156.9080	158.6409	180.6443	191.1753	205.0099 (64)
Efficiency of water heater	87.9698	87.7756	87.3129	86.2155	84.0222	80.3000	80.3000	80.3000	80.3000	86.2618	87.5138	80.3000 (216)
(217)m	87.9698	87.7756	87.3129	86.2155	84.0222	80.3000	80.3000	80.3000	80.3000	86.2618	87.5138	88.0461 (217)
Fuel for water heating, kWh/month	238.7515	210.9369	222.4744	199.8351	198.5261	182.9557	175.2855	195.4023	197.5603	209.4139	218.4516	232.8439 (219)
Water heating fuel used	238.7515	210.9369	222.4744	199.8351	198.5261	182.9557	175.2855	195.4023	197.5603	209.4139	218.4516	2482.4374 (219)
Annual totals kWh/year												
Space heating fuel - main system												4080.2027 (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)												401.5435 (232)
Total delivered energy for all uses												7039.1836 (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	4080.2027	0.2160	881.3238 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2482.4374	0.2160	536.2065 (264)
Space and water heating			1417.5303 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	401.5435	0.5190	208.4011 (268)
Total CO2, kg/m2/year			1664.8563 (272)
Emissions per m2 for space and water heating			15.2259 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2385 (272b)
Emissions per m2 for pumps and fans			0.4181 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2259 * 1.00) + 2.2385 + 0.4181, rounded to 2 d.p.			17.8800 (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	46.5500 (1b)	x 2.3900 (2b)	= 111.2545 (1b) - (3b)
First floor	46.5500 (1c)	x 2.6900 (2c)	= 125.2195 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.4740 (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) = 0.1269 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3774 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3491 (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	0.4451	0.4363	0.4276	0.3840	0.3752	0.3316	0.3316	0.3229	0.3491	0.3752	0.3927	0.4101 (22b)
Effective ac	0.5990	0.5952	0.5914	0.5737	0.5704	0.5550	0.5550	0.5521	0.5609	0.5704	0.5771	0.5841 (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
Solid Door			1.9700	1.0900	2.1473		(26)
Windows (Uw = 1.40)			14.9600	1.3258	19.8333		(27)
Ground Floor			46.5500	0.1600	7.4480	75.0000	3491.2499 (28a)
Brick	98.1900	16.9300	81.2600	0.2500	20.3150	52.6000	4274.2760 (29a)
Ins Joist	46.5500		46.5500	0.1100	5.1205	9.0000	418.9500 (30)
Total net area of external elements Aum(A, m ²)			191.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.8641		(33)
Party Wall			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
Ground Floor Stud			84.0200			9.0000	756.1800 (32c)
1st Floor Stud			105.8000			9.0000	952.2000 (32c)
Int Floors			46.5500			18.0000	837.9000 (32d)
Int Ceilings			46.5500			9.0000	418.9500 (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) =	13172.4559 (34)
	141.4872 (35)
	9.0934 (36)
(33) + (36) =	63.9575 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 46.7466 Feb 46.4465 Mar 46.1524 Apr 44.7707 May 44.5122 Jun 43.3088 Jul 43.3088 Aug 43.0860 Sep 43.7723 Oct 44.5122 Nov 45.0352 Dec 45.5819 (38)
Heat transfer coeff	110.7042 110.4041 110.1099 108.7282 108.4697 107.2663 107.2663 107.0435 107.7299 108.4697 108.9927 109.5394 (39)
Average = Sum(39)m / 12 =	108.7270 (39)

HLP	Jan 1.1891 Feb 1.1859 Mar 1.1827 Apr 1.1679 May 1.1651 Jun 1.1522 Jul 1.1522 Aug 1.1498 Sep 1.1571 Oct 1.1651 Nov 1.1707 Dec 1.1766 (40)
HLP (average)	1.1679 (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												2.6658 (42)
Average daily hot water use (litres/day)												97.5132 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2645	103.3640	99.4635	95.5629	91.6624	87.7619	87.7619	91.6624	95.5629	99.4635	103.3640	107.2645 (44)
Energy conte	159.0702	139.1238	143.5633	125.1620	120.0959	103.6336	96.0318	110.1979	111.5140	129.9588	141.8602	154.0510 (45)
Energy content (annual)										Total = Sum(45)m =	1534.2625 (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	33.8024	29.5638	30.5072	26.5969	25.5204	22.0221	20.4068	23.4170	23.6967	27.6162	30.1453	32.7358 (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	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.6139	20.0855	16.3346	12.3663	9.2440	7.8042	8.4327	10.9611	14.7120	18.6802	21.8026	23.2424	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.6667	247.2056	240.8077	227.1874	209.9942	193.8350	183.0396	180.5007	186.8986	200.5190	217.7122	233.8714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	(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)	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	(71)
Water heating gains (Table 5)	45.4334	43.9938	41.0043	36.9402	34.3016	30.5863	27.4284	31.4745	32.9121	37.1186	41.8685	43.9998	(72)
Total internal gains	375.7013	374.2721	361.1339	339.4812	316.5270	295.2127	281.8880	285.9237	297.5100	319.3051	344.3705	364.1009	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				3.2400	10.6334	0.7600	0.7200	0.7700	13.0646 (74)			
East				5.9400	19.6403	0.7600	0.7200	0.7700	44.2398 (76)			
West				5.7800	19.6403	0.7600	0.7200	0.7700	43.0481 (80)			
Solar gains	100.3525	195.7209	323.6323	478.2696	594.4207	612.7963	581.5976	493.5637	378.0644	232.3338	124.9547	82.6727 (83)
Total gains	476.0538	569.9930	684.7663	817.7508	910.9477	908.0090	863.4856	779.4874	675.5744	551.6389	469.3252	446.7735 (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	33.0522	33.1420	33.2306	33.6529	33.7331	34.1115	34.1115	34.1825	33.9647	33.7331	33.5712	33.4036	
alpha	3.2035	3.2095	3.2154	3.2435	3.2489	3.2741	3.2741	3.2788	3.2643	3.2489	3.2381	3.2269	
util living area	0.9903	0.9822	0.9614	0.9066	0.8020	0.6502	0.5095	0.5717	0.8007	0.9475	0.9844	0.9921	(86)
MIT	18.9075	19.1484	19.5720	20.1225	20.5746	20.8525	20.9508	20.9282	20.6898	20.0741	19.3921	18.8703	(87)
Th 2	19.9287	19.9313	19.9339	19.9458	19.9480	19.9585	19.9585	19.9604	19.9544	19.9480	19.9435	19.9388	(88)
util rest of house	0.9883	0.9785	0.9530	0.8859	0.7577	0.5725	0.4030	0.4638	0.7385	0.9318	0.9805	0.9905	(89)
MIT 2	18.0150	18.2559	18.6758	19.2176	19.6354	19.8741	19.9396	19.9303	19.7525	19.1834	18.5087	17.9852	(90)
Living area fraction									fLA = Living area / (4) =				0.1998 (91)
MIT	18.1933	18.4343	18.8549	19.3984	19.8230	20.0695	20.1416	20.1297	19.9397	19.3613	18.6852	18.1620	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1933	18.4343	18.8549	19.3984	19.8230	20.0695	20.1416	20.1297	19.9397	19.3613	18.6852	18.1620	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9838	0.9714	0.9422	0.8730	0.7518	0.5814	0.4227	0.4826	0.7375	0.9204	0.9741	0.9866	(94)
Ext temp.	468.3202	553.7190	645.1613	713.9161	684.8073	527.9224	364.9841	376.2106	498.2572	507.7545	457.1790	440.7772	(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	1538.0462	1494.2364	1360.3953	1141.4727	881.1026	586.6964	379.8973	399.2399	629.1149	950.3412	1262.6976	1529.3878	(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	795.8761	632.0277	532.1341	307.8407	146.0437	0.0000	0.0000	0.0000	0.0000	329.2846	579.9734	809.9263	(98)
Space heating per m2												4133.1066	(98)
										(98) / (4) =		44.3943	(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	1008.3036	793.7709	813.5305	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8174	0.8748	0.8421	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	824.1526	694.4159	685.0961	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1162.6352	1108.4701	1012.1511	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	243.7075	308.0563	243.3289	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												795.0926 (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	60.9269	77.0141	60.8322	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												198.7732 (107)
Space cooling per m2												2.1351 (108)
Energy for space heating												44.3943 (99)
Energy for space cooling												2.1351 (108)
Total												46.5293 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.5 (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	46.5500 (1b)	x 2.3900 (2b)	= 111.2545 (1b) - (3b)
First floor	46.5500 (1c)	x 2.6900 (2c)	= 125.2195 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.4740 (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) = 0.1269 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3769 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3486 (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	0.4445	0.4357	0.4270	0.3835	0.3747	0.3312	0.3312	0.3225	0.3486	0.3747	0.3922	0.4096 (22b)
Effective ac	0.5988	0.5949	0.5912	0.5735	0.5702	0.5548	0.5548	0.5520	0.5608	0.5702	0.5769	0.5839 (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 Opaque door			1.9700	1.0000	1.9700		(26)
TER Opening Type (Uw = 1.40)			14.9600	1.3258	19.8333		(27)
Ground Floor			46.5500	0.1300	6.0515		(28a)
Brick	98.1900	16.9300	81.2600	0.1800	14.6268		(29a)
Ins Joist	46.5500		46.5500	0.1300	6.0515		(30)
Total net area of external elements Aum(A, m ²)			191.2900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5331		(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)							10.2384 (36)
Total fabric heat loss						(33) + (36) =	58.7715 (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	46.7262	46.4269	46.1335	44.7555	44.4977	43.2975	43.2975	43.0752	43.7598	44.4977	45.0192	45.5645 (38)
Heat transfer coeff	105.4977	105.1984	104.9050	103.5270	103.2692	102.0690	102.0690	101.8467	102.5313	103.2692	103.7908	104.3360 (39)
Average = Sum(39)m / 12 =												103.5258 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1332	1.1300	1.1268	1.1120	1.1092	1.0963	1.0963	1.0939	1.1013	1.1092	1.1148	1.1207 (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												2.6658 (42)
Average daily hot water use (litres/day)												97.5132 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2645	103.3640	99.4635	95.5629	91.6624	87.7619	87.7619	91.6624	95.5629	99.4635	103.3640	107.2645 (44)
Energy conte	159.0702	139.1238	143.5633	125.1620	120.0959	103.6336	96.0318	110.1979	111.5140	129.9588	141.8602	154.0510 (45)
Energy content (annual)										Total = Sum(45)m =		1534.2625 (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 (46)
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)
	33.8024	29.5638	30.5072	26.5969	25.5204	22.0221	20.4068	23.4170	23.6967	27.6162	30.1453	32.7358 (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	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	133.2910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.7371	20.1949	16.4236	12.4337	9.2943	7.8467	8.4786	11.0208	14.7921	18.7820	21.9213	23.3690	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.6667	247.2056	240.8077	227.1874	209.9942	193.8350	183.0396	180.5007	186.8986	200.5190	217.7122	233.8714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	36.3291	(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)	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	(71)
Water heating gains (Table 5)	45.4334	43.9938	41.0043	36.9402	34.3016	30.5863	27.4284	31.4745	32.9121	37.1186	41.8685	43.9998	(72)
Total internal gains	375.8244	374.3815	361.2229	339.5485	316.5774	295.2552	281.9339	285.9834	297.5901	319.4068	344.4893	364.2275	(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	
North	3.2400	10.6334	0.6300		0.7000	0.7700	10.5290	(74)
East	5.9400	19.6403	0.6300		0.7000	0.7700	35.6538	(76)
West	5.7800	19.6403	0.6300		0.7000	0.7700	34.6934	(80)

Solar gains	80.8762	157.7356	260.8221	385.4475	479.0562	493.8654	468.7217	397.7734	304.6900	187.2427	100.7036	66.6276	(83)
Total gains	456.7007	532.1171	622.0450	724.9961	795.6335	789.1207	750.6557	683.7567	602.2801	506.6495	445.1929	430.8551	(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	61.2836	61.4579	61.6298	62.4502	62.6061	63.3422	63.3422	63.4805	63.0566	62.6061	62.2915	61.9659	
alpha	5.0856	5.0972	5.1087	5.1633	5.1737	5.2228	5.2228	5.2320	5.2038	5.1737	5.1528	5.1311	
util living area	0.9992	0.9981	0.9938	0.9741	0.9057	0.7510	0.5812	0.6522	0.8981	0.9891	0.9984	0.9994	(86)
MIT	19.6790	19.8229	20.0853	20.4449	20.7563	20.9382	20.9869	20.9770	20.8305	20.4178	19.9865	19.6590	(87)
Th 2	19.9738	19.9764	19.9790	19.9910	19.9933	20.0038	20.0038	20.0058	19.9998	19.9933	19.9887	19.9840	(88)
util rest of house	0.9990	0.9975	0.9915	0.9635	0.8672	0.6626	0.4583	0.5273	0.8406	0.9831	0.9977	0.9992	(89)
MIT 2	18.7623	18.9080	19.1714	19.5343	19.8241	19.9746	20.0004	19.9989	19.8994	19.5137	19.0815	18.7504	(90)
Living area fraction									fLA = Living area / (4) =			0.1998	(91)
MIT	18.9455	19.0908	19.3539	19.7162	20.0104	20.1671	20.1975	20.1943	20.0854	19.6943	19.2623	18.9319	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9455	19.0908	19.3539	19.7162	20.0104	20.1671	20.1975	20.1943	20.0854	19.6943	19.2623	18.9319	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9986	0.9966	0.9896	0.9599	0.8680	0.6784	0.4831	0.5524	0.8466	0.9807	0.9970	0.9989	(94)
Ext temp.	456.0463	530.3314	615.5517	695.9143	690.6139	535.3505	362.6591	377.7038	509.8759	496.8554	443.8498	430.4007	(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	1545.0618	1492.8522	1348.4435	1119.7703	858.2061	568.2326	367.1917	386.4412	613.6927	939.1594	1262.3383	1537.0725	(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	810.2275	646.8140	545.2715	305.1763	124.6886	0.0000	0.0000	0.0000	0.0000	329.0741	589.3118	823.3639	(98)
Space heating per m2												4173.9277	(98)
										(98) / (4) =		44.8327	(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	959.4485	755.3105	774.0351	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8652	0.9258	0.8957	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	830.1423	699.2666	693.3345	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1023.7313	976.6521	900.3377	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	139.3841	206.3748	154.0103	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												499.7692	(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	34.8460	51.5937	38.5026	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												124.9423 (107)
Space cooling per m2												1.3420 (108)
Energy for space heating												44.8327 (99)
Energy for space cooling												1.3420 (108)
Total												46.1748 (109)
Target Fabric Energy Efficiency (TFEE)												53.1 (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	46.5500 (1b)	x 2.3900 (2b)	= 111.2545 (1b) - (3b)
First floor	46.5500 (1c)	x 2.6900 (2c)	= 125.2195 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.4740 (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) = 0.1269 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3774 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3491 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate	0.4189	0.3927	0.3840	0.3403	0.3403	0.3142	0.3229	0.3054	0.3229	0.3491	0.3578	0.3840 (22b)
Effective ac	0.5877	0.5771	0.5737	0.5579	0.5579	0.5493	0.5521	0.5466	0.5521	0.5609	0.5640	0.5737 (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
Solid Door			1.9700	1.0900	2.1473		(26)
Windows (Uw = 1.40)			14.9600	1.3258	19.8333		(27)
Ground Floor			46.5500	0.1600	7.4480	75.0000	3491.2499 (28a)
Brick	98.1900	16.9300	81.2600	0.2500	20.3150	52.6000	4274.2760 (29a)
Ins Joist	46.5500		46.5500	0.1100	5.1205	9.0000	418.9500 (30)
Total net area of external elements Aum(A, m ²)			191.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.8641		(33)
Party Wall			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
Ground Floor Stud			84.0200			9.0000	756.1800 (32c)
1st Floor Stud			105.8000			9.0000	952.2000 (32c)
Int Floors			46.5500			18.0000	837.9000 (32d)
Int Ceilings			46.5500			9.0000	418.9500 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13172.4559 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							141.4872 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0934 (36)
Total fabric heat loss						(33) + (36) =	63.9575 (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	45.8642	45.0352	44.7707	43.5376	43.5376	42.8691	43.0860	42.6581	43.0860	43.7723	44.0130	44.7707 (38)
Heat transfer coeff	109.8217	108.9927	108.7282	107.4951	107.4951	106.8266	107.0435	106.6156	107.0435	107.7299	107.9705	108.7282 (39)
Average = Sum(39)m / 12 =												107.8742 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1796	1.1707	1.1679	1.1546	1.1546	1.1474	1.1498	1.1452	1.1498	1.1571	1.1597	1.1679 (40)
HLP (average)												1.1587 (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												2.6658 (42)
Average daily hot water use (litres/day)												97.5132 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2645	103.3640	99.4635	95.5629	91.6624	87.7619	87.7619	91.6624	95.5629	99.4635	103.3640	107.2645 (44)
Energy conte	159.0702	139.1238	143.5633	125.1620	120.0959	103.6336	96.0318	110.1979	111.5140	129.9588	141.8602	154.0510 (45)
Energy content (annual)										Total = Sum(45)m =		1534.2625 (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	23.8605	20.8686	21.5345	18.7743	18.0144	15.5450	14.4048	16.5297	16.7271	19.4938	21.2790	23.1076 (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	14.6941	13.2585	14.6453	14.1171	14.5472	14.0312	14.4697	14.5199	14.0780	14.6047	14.1839	14.6791 (61)
Total heat required for water heating calculated for each month	173.7643	152.3823	158.2086	139.2791	134.6431	117.6648	110.5015	124.7178	125.5920	144.5635	156.0441	168.7301 (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	173.7643	152.3823	158.2086	139.2791	134.6431	117.6648	110.5015	124.7178	125.5920	144.5635	156.0441	168.7301 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	56.5644	49.5733	51.3961	45.1456	43.5687	37.9660	35.5480	40.2708	40.5979	46.8625	50.7145	54.8917 (65)
												1706 (64)
												1706 (64)

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	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.5348	50.2137	40.8365	30.9159	23.1100	19.5104	21.0817	27.4028	36.7799	46.7006	54.5065	58.1060	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.1742	368.9636	359.4145	339.0857	313.4241	289.3059	273.1935	269.4041	278.9532	299.2820	324.9436	349.0618	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	(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)	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	(71)
Water heating gains (Table 5)	76.0274	73.7698	69.0808	62.7023	58.5600	52.7305	47.7796	54.1274	56.3860	62.9872	70.4368	73.7792	(72)
Total internal gains	607.7135	602.9242	579.3090	542.6809	505.0713	471.5240	452.0318	460.9114	482.0962	518.9469	559.8640	590.9242	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North					3.2400	12.7054	0.7600	0.7200	0.7700		15.6103 (74)		
East					5.9400	23.7288	0.7600	0.7200	0.7700		53.4493 (76)		
West					5.7800	23.7288	0.7600	0.7200	0.7700		52.0095 (80)		
Solar gains	121.0691	210.1568	345.9792	537.2061	640.0650	704.3333	661.1134	567.8045	432.2500	266.7811	152.2843	96.4112	(83)
Total gains	728.7826	813.0810	925.2882	1079.8870	1145.1363	1175.8572	1113.1452	1028.7159	914.3462	785.7280	712.1483	687.3354	(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	33.3178	33.5712	33.6529	34.0389	34.0389	34.2519	34.1825	34.3197	34.1825	33.9647	33.8890	33.6529	
alpha	3.2212	3.2381	3.2435	3.2693	3.2693	3.2835	3.2788	3.2880	3.2788	3.2643	3.2593	3.2435	
util living area	0.9648	0.9499	0.9098	0.8146	0.6682	0.4800	0.3391	0.3544	0.6182	0.8488	0.9418	0.9686	(86)
MIT	19.3945	19.5831	19.9769	20.4533	20.7887	20.9480	20.9879	20.9868	20.8817	20.4866	19.8940	19.3922	(87)
Th 2	19.9363	19.9435	19.9458	19.9565	19.9565	19.9623	19.9604	19.9641	19.9604	19.9544	19.9524	19.9458	(88)
util rest of house	0.9579	0.9404	0.8925	0.7809	0.6104	0.4007	0.2443	0.2532	0.5353	0.8105	0.9284	0.9623	(89)
MIT 2	18.5011	18.6906	19.0734	19.5258	19.8156	19.9374	19.9572	19.9607	19.8966	19.5675	19.0050	18.5065	(90)
Living area fraction	18.6796	18.6889	19.2539	19.7111	20.0100	20.1393	20.1631	20.1657	20.0934	19.7511	19.1826	18.6835	(91)
MIT	18.6796	18.6889	19.2539	19.7111	20.0100	20.1393	20.1631	20.1657	20.0934	19.7511	19.1826	18.6835	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5296	18.7189	19.1039	19.5611	19.8600	19.9893	20.0131	20.0157	19.9434	19.6011	19.0326	18.5335	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9460	0.9264	0.8758	0.7663	0.6046	0.4029	0.2492	0.2584	0.5338	0.7951	0.9135	0.9512	(94)
Ext temp.	689.4075	753.2012	810.3340	827.5672	692.3200	473.6996	277.4494	265.8207	488.1098	624.7708	650.5743	653.8023	(95)
Heat loss rate W	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000	(96)
Month fracti	1485.8431	1451.6661	1305.1630	1081.5216	780.4166	490.2580	279.7165	268.2145	529.1615	851.1886	1180.4027	1449.7241	(97)
Space heating kWh	592.5480	469.3684	368.1528	182.8471	65.5439	0.0000	0.0000	0.0000	0.0000	168.4548	381.4764	592.1658	(98)
Space heating												2820.5574	(98)
RHI space heating demand												2821	(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	46.5500 (1b)	x 2.3900 (2b)	= 111.2545 (1b) - (3b)
First floor	46.5500 (1c)	x 2.6900 (2c)	= 125.2195 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.4740 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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) = 0.1269 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3774 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3491 (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	0.4451	0.4363	0.4276	0.3840	0.3752	0.3316	0.3316	0.3229	0.3491	0.3752	0.3927	0.4101 (22b)
Effective ac	0.5990	0.5952	0.5914	0.5737	0.5704	0.5550	0.5550	0.5521	0.5609	0.5704	0.5771	0.5841 (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
Solid Door			1.9700	1.0900	2.1473		(26)
Windows (Uw = 1.40)			14.9600	1.3258	19.8333		(27)
Ground Floor			46.5500	0.1600	7.4480	75.0000	3491.2499 (28a)
Brick	98.1900	16.9300	81.2600	0.2500	20.3150	52.6000	4274.2760 (29a)
Ins Joist	46.5500		46.5500	0.1100	5.1205	9.0000	418.9500 (30)
Total net area of external elements Aum(A, m ²)			191.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.8641		(33)
Party Wall			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
Ground Floor Stud			84.0200			9.0000	756.1800 (32c)
1st Floor Stud			105.8000			9.0000	952.2000 (32c)
Int Floors			46.5500			18.0000	837.9000 (32d)
Int Ceilings			46.5500			9.0000	418.9500 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13172.4559 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 141.4872 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.0934 (36)
Total fabric heat loss (33) + (36) = 63.9575 (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	46.7466	46.4465	46.1524	44.7707	44.5122	43.3088	43.3088	43.0860	43.7723	44.5122	45.0352	45.5819 (38)
Heat transfer coeff	110.7042	110.4041	110.1099	108.7282	108.4697	107.2663	107.2663	107.0435	107.7299	108.4697	108.9927	109.5394 (39)
Average = Sum(39)m / 12 =												108.7270 (39)
HLP	1.1891	1.1859	1.1827	1.1679	1.1651	1.1522	1.1522	1.1498	1.1571	1.1651	1.1707	1.1766 (40)
HLP (average)												1.1679 (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												2.6658 (42)
Average daily hot water use (litres/day)												97.5132 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2645	103.3640	99.4635	95.5629	91.6624	87.7619	87.7619	91.6624	95.5629	99.4635	103.3640	107.2645 (44)
Energy conte	159.0702	139.1238	143.5633	125.1620	120.0959	103.6336	96.0318	110.1979	111.5140	129.9588	141.8602	154.0510 (45)
Energy content (annual)										Total = Sum(45)m =		1534.2625 (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	23.8605	20.8686	21.5345	18.7743	18.0144	15.5450	14.4048	16.5297	16.7271	19.4938	21.2790	23.1076 (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	14.6941	13.2585	14.6453	14.1171	14.5472	14.0312	14.4697	14.5199	14.0780	14.6047	14.1839	14.6791 (61)
Total heat required for water heating calculated for each month	173.7643	152.3823	158.2086	139.2791	134.6431	117.6648	110.5015	124.7178	125.5920	144.5635	156.0441	168.7301 (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	173.7643	152.3823	158.2086	139.2791	134.6431	117.6648	110.5015	124.7178	125.5920	144.5635	156.0441	168.7301 (64)
Heat gains from water heating, kWh/month	56.5644	49.5733	51.3961	45.1456	43.5687	37.9660	35.5480	40.2708	40.5979	46.8625	50.7145	54.8917 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1706.0911 (64)												

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	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.5348	50.2137	40.8365	30.9159	23.1100	19.5104	21.0817	27.4028	36.7799	46.7006	54.5065	58.1060	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.1742	368.9636	359.4145	339.0857	313.4241	289.3059	273.1935	269.4041	278.9532	299.2820	324.9436	349.0618	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	(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)	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	(71)
Water heating gains (Table 5)	76.0274	73.7698	69.0808	62.7023	58.5600	52.7305	47.7796	54.1274	56.3860	62.9872	70.4368	73.7792	(72)
Total internal gains	607.7135	602.9242	579.3090	542.6809	505.0713	471.5240	452.0318	460.9114	482.0962	518.9469	559.8640	590.9242	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				3.2400	10.6334	0.7600	0.7200			0.7700			13.0646 (74)
East				5.9400	19.6403	0.7600	0.7200			0.7700			44.2398 (76)
West				5.7800	19.6403	0.7600	0.7200			0.7700			43.0481 (80)
Solar gains	100.3525	195.7209	323.6323	478.2696	594.4207	612.7963	581.5976	493.5637	378.0644	232.3338	124.9547	82.6727	(83)
Total gains	708.0661	798.6450	902.9413	1020.9505	1099.4920	1084.3203	1033.6294	954.4751	860.1606	751.2807	684.8186	673.5968	(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	33.0522	33.1420	33.2306	33.6529	33.7331	34.1115	34.1115	34.1825	33.9647	33.7331	33.5712	33.4036	
alpha	3.2035	3.2095	3.2154	3.2435	3.2489	3.2741	3.2741	3.2788	3.2643	3.2489	3.2381	3.2269	
util living area	0.9710	0.9562	0.9236	0.8507	0.7307	0.5725	0.4369	0.4856	0.7069	0.8915	0.9566	0.9749	(86)
MIT	19.2358	19.4584	19.8393	20.3168	20.6860	20.8992	20.9687	20.9556	20.7926	20.2991	19.6870	19.1956	(87)
Th 2	19.9287	19.9313	19.9339	19.9458	19.9480	19.9585	19.9585	19.9604	19.9544	19.9480	19.9435	19.9388	(88)
util rest of house	0.9654	0.9480	0.9090	0.8223	0.6807	0.4967	0.3412	0.3872	0.6364	0.8642	0.9470	0.9701	(89)
MIT 2	18.3387	18.5591	18.9317	19.3934	19.7245	19.9029	19.9469	19.9427	19.8268	19.3903	18.7963	18.3067	(90)
Living area fraction									fLA = Living area / (4) =			0.1998	(91)
MIT	18.5179	18.7388	19.1130	19.5778	19.9166	20.1019	20.1510	20.1451	20.0198	19.5719	18.9742	18.4843	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3679	18.5888	18.9630	19.4278	19.7666	19.9519	20.0010	19.9951	19.8698	19.4219	18.8242	18.3343	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	675.9862	746.4579	805.9395	822.9366	738.0088	538.0245	356.9239	372.8999	541.9430	636.7400	639.4252	646.8590	(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	1557.3790	1511.2982	1372.3050	1144.6731	874.9769	574.0815	364.8174	384.8294	621.5756	956.9044	1277.8534	1548.2625	(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	655.7562	513.9726	421.3759	231.6503	101.9042	0.0000	0.0000	0.0000	0.0000	238.2023	459.6683	670.6442	(98)
Space heating												3293.1741	(98)
Space heating per m2												(98) / (4) =	35.3724 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3638.8664 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	655.7562	513.9726	421.3759	231.6503	101.9042	0.0000	0.0000	0.0000	0.0000	238.2023	459.6683	670.6442 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	724.5925	567.9256	465.6087	255.9672	112.6014	0.0000	0.0000	0.0000	0.0000	263.2070	507.9208	741.0433 (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	173.7643	152.3823	158.2086	139.2791	134.6431	117.6648	110.5015	124.7178	125.5920	144.5635	156.0441	168.7301 (64)
Efficiency of water heater (217)m	89.8104	89.7477	89.6035	89.2713	88.6504	87.3000	87.3000	87.3000	87.3000	89.2642	89.6670	87.3000 (216)
Fuel for water heating, kWh/month	193.4791	169.7896	176.5653	156.0178	151.8810	134.7821	126.5768	142.8612	143.8625	161.9501	174.0262	187.8158 (219)
Water heating fuel used												1919.6074 (219)
Annual totals kWh/year												
Space heating fuel - main system												3638.8664 (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)												399.3687 (232)
Total delivered energy for all uses												6032.8425 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3638.8664	3.4800	126.6326 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1919.6074	3.4800	66.8023 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	399.3687	13.1900	52.6767 (250)
Additional standing charges			120.0000 (251)
Total energy cost			376.0041 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1435 (257)
SAP value		84.0477
SAP rating (Section 12)		84 (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	3638.8664	0.2160	785.9951 (261)
Space heating - secondary	0.0000	0.2160	0.0000 (263)
Water heating (other fuel)	1919.6074	0.2160	414.6352 (264)
Space and water heating			1200.6303 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	399.3687	0.5190	207.2724 (268)
Total kg/year			1446.8277 (272)
CO2 emissions per m2			15.5400 (273)
EI value			85.9613
EI rating			86 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8875 = 3.921$, stars = 4
Water heating environmental impact	$0.216 / 0.8875 = 0.2434$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	46.5500 (1b)	x 2.3900 (2b)	= 111.2545 (1b) - (3b)
First floor	46.5500 (1c)	x 2.6900 (2c)	= 125.2195 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.4740 (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) =	0.1269 (8)
Pressure test										Yes							
Measured/design AP50										5.0100							
Infiltration rate										0.3774 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3491 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000	(22)				
Adj infilt rate	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000	(22a)				
	0.4189	0.3927	0.3840	0.3403	0.3403	0.3142	0.3229	0.3054	0.3229	0.3491	0.3578	0.3840	(22b)				
Effective ac	0.5877	0.5771	0.5737	0.5579	0.5579	0.5493	0.5521	0.5466	0.5521	0.5609	0.5640	0.5737	(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
Solid Door			1.9700	1.0900	2.1473		(26)
Windows (Uw = 1.40)			14.9600	1.3258	19.8333		(27)
Ground Floor			46.5500	0.1600	7.4480	75.0000	3491.2499 (28a)
Brick	98.1900	16.9300	81.2600	0.2500	20.3150	52.6000	4274.2760 (29a)
Ins Joist	46.5500		46.5500	0.1100	5.1205	9.0000	418.9500 (30)
Total net area of external elements Aum(A, m ²)			191.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.8641		(33)
Party Wall			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
Ground Floor Stud			84.0200			9.0000	756.1800 (32c)
1st Floor Stud			105.8000			9.0000	952.2000 (32c)
Int Floors			46.5500			18.0000	837.9000 (32d)
Int Ceilings			46.5500			9.0000	418.9500 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13172.4559 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 141.4872 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.0934 (36)
Total fabric heat loss (33) + (36) = 63.9575 (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	45.8642	45.0352	44.7707	43.5376	43.5376	42.8691	43.0860	42.6581	43.0860	43.7723	44.0130	44.7707 (38)
Heat transfer coeff	109.8217	108.9927	108.7282	107.4951	107.4951	106.8266	107.0435	106.6156	107.0435	107.7299	107.9705	108.7282 (39)
Average = Sum(39)m / 12 =												107.8742 (39)
HLP	1.1796	1.1707	1.1679	1.1546	1.1546	1.1474	1.1498	1.1452	1.1498	1.1571	1.1597	1.1679 (40)
HLP (average)												1.1587 (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												2.6658 (42)
Average daily hot water use (litres/day)												97.5132 (43)
Daily hot water use	107.2645	103.3640	99.4635	95.5629	91.6624	87.7619	87.7619	91.6624	95.5629	99.4635	103.3640	107.2645 (44)
Energy conte	159.0702	139.1238	143.5633	125.1620	120.0959	103.6336	96.0318	110.1979	111.5140	129.9588	141.8602	154.0510 (45)
Energy content (annual)										Total = Sum(45)m =		1534.2625 (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	23.8605	20.8686	21.5345	18.7743	18.0144	15.5450	14.4048	16.5297	16.7271	19.4938	21.2790	23.1076 (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	14.6941	13.2585	14.6453	14.1171	14.5472	14.0312	14.4697	14.5199	14.0780	14.6047	14.1839	14.6791 (61)
Total heat required for water heating calculated for each month	173.7643	152.3823	158.2086	139.2791	134.6431	117.6648	110.5015	124.7178	125.5920	144.5635	156.0441	168.7301 (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	173.7643	152.3823	158.2086	139.2791	134.6431	117.6648	110.5015	124.7178	125.5920	144.5635	156.0441	168.7301 (64)
Heat gains from water heating, kWh/month	56.5644	49.5733	51.3961	45.1456	43.5687	37.9660	35.5480	40.2708	40.5979	46.8625	50.7145	54.8917 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1706.0911 (64)												

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	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.5348	50.2137	40.8365	30.9159	23.1100	19.5104	21.0817	27.4028	36.7799	46.7006	54.5065	58.1060 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.1742	368.9636	359.4145	339.0857	313.4241	289.3059	273.1935	269.4041	278.9532	299.2820	324.9436	349.0618 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607 (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)	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328 (71)
Water heating gains (Table 5)	76.0274	73.7698	69.0808	62.7023	58.5600	52.7305	47.7796	54.1274	56.3860	62.9872	70.4368	73.7792 (72)
Total internal gains	607.7135	602.9242	579.3090	542.6809	505.0713	471.5240	452.0318	460.9114	482.0962	518.9469	559.8640	590.9242 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				3.2400	12.7054	0.7600	0.7200		0.7700		15.6103 (74)	
East				5.9400	23.7288	0.7600	0.7200		0.7700		53.4493 (76)	
West				5.7800	23.7288	0.7600	0.7200		0.7700		52.0095 (80)	
Solar gains	121.0691	210.1568	345.9792	537.2061	640.0650	704.3333	661.1134	567.8045	432.2500	266.7811	152.2843	96.4112 (83)
Total gains	728.7826	813.0810	925.2882	1079.8870	1145.1363	1175.8572	1113.1452	1028.7159	914.3462	785.7280	712.1483	687.3354 (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	33.3178	33.5712	33.6529	34.0389	34.0389	34.2519	34.1825	34.3197	34.1825	33.9647	33.8890	33.6529
alpha	3.2212	3.2381	3.2435	3.2693	3.2693	3.2835	3.2788	3.2880	3.2788	3.2643	3.2593	3.2435
util living area	0.9648	0.9499	0.9098	0.8146	0.6682	0.4800	0.3391	0.3544	0.6182	0.8488	0.9418	0.9686 (86)
MIT	19.3945	19.5831	19.9769	20.4533	20.7887	20.9480	20.9879	20.9868	20.8817	20.4866	19.8940	19.3922 (87)
Th 2	19.9363	19.9435	19.9458	19.9565	19.9565	19.9623	19.9604	19.9641	19.9604	19.9544	19.9524	19.9458 (88)
util rest of house	0.9579	0.9404	0.8925	0.7809	0.6104	0.4007	0.2443	0.2532	0.5353	0.8105	0.9284	0.9623 (89)
MIT 2	18.5011	18.6906	19.0734	19.5258	19.8156	19.9374	19.9572	19.9607	19.8966	19.5675	19.0050	18.5065 (90)
Living area fraction									fLA = Living area / (4) =			0.1998 (91)
MIT	18.6796	18.8689	19.2539	19.7111	20.0100	20.1393	20.1631	20.1657	20.0934	19.7511	19.1826	18.6835 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5296	18.7189	19.1039	19.5611	19.8600	19.9893	20.0131	20.0157	19.9434	19.6011	19.0326	18.5335 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9460	0.9264	0.8758	0.7663	0.6046	0.4029	0.2492	0.2584	0.5338	0.7951	0.9135	0.9512 (94)
Ext temp.	689.4075	753.2012	810.3340	827.5672	692.3200	473.6996	277.4494	265.8207	488.1098	624.7708	650.5743	653.8023 (95)
Heat loss rate W	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)
Month fracti	1485.8431	1451.6661	1305.1630	1081.5216	780.4166	490.2580	279.7165	268.2145	529.1615	851.1886	1180.4027	1449.7241 (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	592.5480	469.3684	368.1528	182.8471	65.5439	0.0000	0.0000	0.0000	0.0000	168.4548	381.4764	592.1658 (98)
Space heating per m2												2820.5574 (98)
										(98) / (4) =		30.2960 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3116.6380 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	592.5480	469.3684	368.1528	182.8471	65.5439	0.0000	0.0000	0.0000	0.0000	168.4548	381.4764	592.1658	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	654.7492	518.6391	406.7987	202.0410	72.4242	0.0000	0.0000	0.0000	0.0000	186.1379	421.5209	654.3269	(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	173.7643	152.3823	158.2086	139.2791	134.6431	117.6648	110.5015	124.7178	125.5920	144.5635	156.0441	168.7301	(64)
Efficiency of water heater (217)m	89.7540	89.6942	89.5138	89.0881	88.3225	87.3000	87.3000	87.3000	87.3000	88.9935	89.5471	87.3000	(216)
Fuel for water heating, kWh/month	193.6007	169.8908	176.7422	156.3387	152.4448	134.7821	126.5768	142.8612	143.8625	162.4428	174.2592	187.9575	(219)
Water heating fuel used												1921.7593	(219)
Annual totals kWh/year													
Space heating fuel - main system												3116.6380	(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)												399.3687	(232)
Total delivered energy for all uses												5512.7660	(238)

10a. Fuel costs - using BEDF prices (500)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3116.6380	3.6300	113.1340	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1921.7593	3.6300	69.7599	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	399.3687	19.4400	77.6373	(250)
Additional standing charges			95.0000	(251)
Total energy cost			370.1111	(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	3116.6380	0.2160	673.1938	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1921.7593	0.2160	415.1000	(264)
Space and water heating			1088.2938	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	399.3687	0.5190	207.2724	(268)
Total kg/year			1334.4912	(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	3116.6380	1.2200	3802.2984	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1921.7593	1.2200	2344.5463	(264)
Space and water heating			6146.8447	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	399.3687	3.0700	1226.0619	(268)
Primary energy kWh/year			7603.1566	(272)
Primary energy kWh/m2/year			81.6666	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 86

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(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	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
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
N Solar water heating	+ 1.2	-£ 27	-190 kg (14.3%)
U Solar photovoltaic panels	+ 9.7	-£ 375	-1000 kg (87.4%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£27	2.04 kg/m²	B 85	B 88
Solar photovoltaic panels	£375	10.75 kg/m²	A 95	A 96
Total Savings	£401	12.79 kg/m²		

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 500 TEST (30 Jun 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£92	£102	-£10
Mains gas	£278	£242	£36
Space heating	£223	£223	£0
Water heating	£70	£43	£27
Lighting	£78	£78	£0
Generated (PV)	-£0	-£375	£375
Total cost of fuels	£370	-£31	£401
Total cost of uses	£371	-£31	£402
Delivered energy	59 kWh/m²	28 kWh/m²	31 kWh/m²
Carbon dioxide emissions	1.3 tonnes	0.1 tonnes	1.2 tonnes
CO2 emissions per m²	14 kg/m²	2 kg/m²	13 kg/m²
Primary energy	82 kWh/m²	7 kWh/m²	75 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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.5500 (1b)	x 2.3900 (2b)	= 111.2545 (1b) - (3b)
First floor	46.5500 (1c)	x 2.6900 (2c)	= 125.2195 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.4740 (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) = 0.1269 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3774 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3491 (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	0.4451	0.4363	0.4276	0.3840	0.3752	0.3316	0.3316	0.3229	0.3491	0.3752	0.3927	0.4101 (22b)
Effective ac	0.5990	0.5952	0.5914	0.5737	0.5704	0.5550	0.5550	0.5521	0.5609	0.5704	0.5771	0.5841 (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
Solid Door			1.9700	1.0900	2.1473		(26)
Windows (Uw = 1.40)			14.9600	1.3258	19.8333		(27)
Ground Floor			46.5500	0.1600	7.4480	75.0000	3491.2499 (28a)
Brick	98.1900	16.9300	81.2600	0.2500	20.3150	52.6000	4274.2760 (29a)
Ins Joist	46.5500		46.5500	0.1100	5.1205	9.0000	418.9500 (30)
Total net area of external elements Aum(A, m ²)			191.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.8641		(33)
Party Wall			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
Ground Floor Stud			84.0200			9.0000	756.1800 (32c)
1st Floor Stud			105.8000			9.0000	952.2000 (32c)
Int Floors			46.5500			18.0000	837.9000 (32d)
Int Ceilings			46.5500			9.0000	418.9500 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13172.4559 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 141.4872 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.0934 (36)
Total fabric heat loss (33) + (36) = 63.9575 (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	46.7466	46.4465	46.1524	44.7707	44.5122	43.3088	43.3088	43.0860	43.7723	44.5122	45.0352	45.5819 (38)
Heat transfer coeff	110.7042	110.4041	110.1099	108.7282	108.4697	107.2663	107.2663	107.0435	107.7299	108.4697	108.9927	109.5394 (39)
Average = Sum(39)m / 12 =												108.7270 (39)
HLP	1.1891	1.1859	1.1827	1.1679	1.1651	1.1522	1.1522	1.1498	1.1571	1.1651	1.1707	1.1766 (40)
HLP (average)												1.1679 (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												2.6658 (42)
Average daily hot water use (litres/day)												97.5132 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2645	103.3640	99.4635	95.5629	91.6624	87.7619	87.7619	91.6624	95.5629	99.4635	103.3640	107.2645 (44)
Energy conte	159.0702	139.1238	143.5633	125.1620	120.0959	103.6336	96.0318	110.1979	111.5140	129.9588	141.8602	154.0510 (45)
Energy content (annual)										Total = Sum(45)m =		1534.2625 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.8605	20.8686	21.5345	18.7743	18.0144	15.5450	14.4048	16.5297	16.7271	19.4938	21.2790	23.1076 (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	14.6941	13.2585	14.6453	14.1171	14.5472	14.0312	14.4697	14.5199	14.0780	14.6047	14.1839	14.6791 (61)
Total heat required for water heating calculated for each month	173.7643	152.3823	158.2086	139.2791	134.6431	117.6648	110.5015	124.7178	125.5920	144.5635	156.0441	168.7301 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1821 (H8)
Utilisation factor												0.5709 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.5132 (H14)
Volume ratio Veff/V												0.7691 (H15)
Solar storage volume factor												0.9475 (H16)
Solar input												-862.5528 (H17)
Solar input	-25.0123	-41.7384	-71.0852	-95.2682	-117.6958	-115.7137	-114.1845	-99.7636	-78.1349	-53.3569	-29.6682	-20.9310 (63)
Solar input (sum of months) = Sum (63)m =												-862.5528 (63)
Output from w/h	148.7520	110.6439	87.1234	44.0109	16.9472	1.9511	0.0000	24.9542	47.4571	91.2066	126.3759	147.7990 (64)
Total per year (kWh/year) = Sum (64)m =												847.2213 (64)
Heat gains from water heating, kWh/month	56.5644	49.5733	51.3961	45.1456	43.5687	37.9660	35.5480	40.2708	40.5979	46.8625	50.7145	54.8917 (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)
(66)m	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.5348	50.2137	40.8365	30.9159	23.1100	19.5104	21.0817	27.4028	36.7799	46.7006	54.5065	58.1060	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.1742	368.9636	359.4145	339.0857	313.4241	289.3059	273.1935	269.4041	278.9532	299.2820	324.9436	349.0618	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	(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)	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	(71)
Water heating gains (Table 5)	76.0274	73.7698	69.0808	62.7023	58.5600	52.7305	47.7796	54.1274	56.3860	62.9872	70.4368	73.7792	(72)
Total internal gains	607.7135	602.9242	579.3090	542.6809	505.0713	471.5240	452.0318	460.9114	482.0962	518.9469	559.8640	590.9242	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				3.2400	10.6334	0.7600	0.7200	0.7700	13.0646 (74)			
East				5.9400	19.6403	0.7600	0.7200	0.7700	44.2398 (76)			
West				5.7800	19.6403	0.7600	0.7200	0.7700	43.0481 (80)			
Solar gains	100.3525	195.7209	323.6323	478.2696	594.4207	612.7963	581.5976	493.5637	378.0644	232.3338	124.9547	82.6727 (83)
Total gains	708.0661	798.6450	902.9413	1020.9505	1099.4920	1084.3203	1033.6294	954.4751	860.1606	751.2807	684.8186	673.5968 (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	33.0522	33.1420	33.2306	33.6529	33.7331	34.1115	34.1115	34.1825	33.9647	33.7331	33.5712	33.4036	
alpha	3.2035	3.2095	3.2154	3.2435	3.2489	3.2741	3.2741	3.2788	3.2643	3.2489	3.2381	3.2269	
util living area	0.9710	0.9562	0.9236	0.8507	0.7307	0.5725	0.4369	0.4856	0.7069	0.8915	0.9566	0.9749	(86)
MIT	19.2358	19.4584	19.8393	20.3168	20.6860	20.8992	20.9687	20.9556	20.7926	20.2991	19.6870	19.1956	(87)
Th 2	19.9287	19.9313	19.9339	19.9458	19.9480	19.9585	19.9585	19.9604	19.9544	19.9480	19.9435	19.9388	(88)
util rest of house	0.9654	0.9480	0.9090	0.8223	0.6807	0.4967	0.3412	0.3872	0.6364	0.8642	0.9470	0.9701	(89)
MIT 2	18.3387	18.5591	18.9317	19.3934	19.7245	19.9029	19.9469	19.9427	19.8268	19.3903	18.7963	18.3067	(90)
Living area fraction									fLA = Living area / (4) =			0.1998	(91)
MIT	18.5179	18.7388	19.1130	19.5778	19.9166	20.1019	20.1510	20.1451	20.0198	19.5719	18.9742	18.4843	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3679	18.5888	18.9630	19.4278	19.7666	19.9519	20.0010	19.9951	19.8698	19.4219	18.8242	18.3343	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9547	0.9347	0.8926	0.8060	0.6712	0.4962	0.3453	0.3907	0.6300	0.8475	0.9337	0.9603	(94)
Useful gains	675.9862	746.4579	805.9395	822.9366	738.0088	538.0245	356.9239	372.8999	541.9430	636.7400	639.4252	646.8590	(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	1557.3790	1511.2982	1372.3050	1144.6731	874.9769	574.0815	364.8174	384.8294	621.5756	956.9044	1277.8534	1548.2625	(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	655.7562	513.9726	421.3759	231.6503	101.9042	0.0000	0.0000	0.0000	0.0000	238.2023	459.6683	670.6442	(98)
Space heating												3293.1741	(98)
Space heating per m2											(98) / (4) =	35.3724	(99)

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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3638.8664	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	655.7562	513.9726	421.3759	231.6503	101.9042	0.0000	0.0000	0.0000	0.0000	238.2023	459.6683	670.6442	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	724.5925	567.9256	465.6087	255.9672	112.6014	0.0000	0.0000	0.0000	0.0000	263.2070	507.9208	741.0433	(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	148.7520	110.6439	87.1234	44.0109	16.9472	1.9511	0.0000	24.9542	47.4571	91.2066	126.3759	147.7990	(64)	
Efficiency of water heater	89.8908	89.9162	89.9352	89.9735	90.0294	87.3000	87.3000	87.3000	87.3000	89.5907	89.7903	89.9049	(217)	
Fuel for water heating, kWh/month	165.4808	123.0523	96.8735	48.9155	18.8241	2.2349	0.0000	28.5845	54.3609	101.8036	140.7456	164.3949	(219)	
Water heating fuel used												945.2706	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3638.8664	(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)	
pump for solar water heating												50.0000	(230g)	
Total electricity for the above, kWh/year												125.0000	(231)	
Electricity for lighting (calculated in Appendix L)												399.3687	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)	
Total delivered energy for all uses												3381.2663	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3638.8664	3.4800	126.6326	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	945.2706	3.4800	32.8954	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	399.3687	13.1900	52.6767	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			120.8693	(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] =	0.3676	(257)
SAP value			94.8720	
SAP rating (Section 12)			95	(258)
SAP band			A	

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3638.8664	0.2160	785.9951 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	945.2706	0.2160	204.1784 (264)
Space and water heating			990.1736 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	399.3687	0.5190	207.2724 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			365.8837 (272)
CO2 emissions per m2			3.9300 (273)
EI value			96.4498
EI rating			96 (274)
EI band			A

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.5500 (1b)	x 2.3900 (2b)	= 111.2545 (1b) - (3b)
First floor	46.5500 (1c)	x 2.6900 (2c)	= 125.2195 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.4740 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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) = 0.1269 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3774 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3491 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate	0.4189	0.3927	0.3840	0.3403	0.3403	0.3142	0.3229	0.3054	0.3229	0.3491	0.3578	0.3840 (22b)
Effective ac	0.5877	0.5771	0.5737	0.5579	0.5579	0.5493	0.5521	0.5466	0.5521	0.5609	0.5640	0.5737 (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
Solid Door			1.9700	1.0900	2.1473		(26)
Windows (Uw = 1.40)			14.9600	1.3258	19.8333		(27)
Ground Floor			46.5500	0.1600	7.4480	75.0000	3491.2499 (28a)
Brick	98.1900	16.9300	81.2600	0.2500	20.3150	52.6000	4274.2760 (29a)
Ins Joist	46.5500		46.5500	0.1100	5.1205	9.0000	418.9500 (30)
Total net area of external elements Aum(A, m ²)			191.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.8641		(33)
Party Wall			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
Ground Floor Stud			84.0200			9.0000	756.1800 (32c)
1st Floor Stud			105.8000			9.0000	952.2000 (32c)
Int Floors			46.5500			18.0000	837.9000 (32d)
Int Ceilings			46.5500			9.0000	418.9500 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13172.4559 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 141.4872 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.0934 (36)
Total fabric heat loss (33) + (36) = 63.9575 (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	45.8642	45.0352	44.7707	43.5376	43.5376	42.8691	43.0860	42.6581	43.0860	43.7723	44.0130	44.7707 (38)
Heat transfer coeff	109.8217	108.9927	108.7282	107.4951	107.4951	106.8266	107.0435	106.6156	107.0435	107.7299	107.9705	108.7282 (39)
Average = Sum(39)m / 12 =												107.8742 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1796	1.1707	1.1679	1.1546	1.1546	1.1474	1.1498	1.1452	1.1498	1.1571	1.1597	1.1679 (40)
HLP (average)												1.1587 (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												2.6658 (42)
Average daily hot water use (litres/day)												97.5132 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2645	103.3640	99.4635	95.5629	91.6624	87.7619	87.7619	91.6624	95.5629	99.4635	103.3640	107.2645 (44)
Energy conte	159.0702	139.1238	143.5633	125.1620	120.0959	103.6336	96.0318	110.1979	111.5140	129.9588	141.8602	154.0510 (45)
Energy content (annual)										Total = Sum(45)m =		1534.2625 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	23.8605	20.8686	21.5345	18.7743	18.0144	15.5450	14.4048	16.5297	16.7271	19.4938	21.2790	23.1076 (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	14.6941	13.2585	14.6453	14.1171	14.5472	14.0312	14.4697	14.5199	14.0780	14.6047	14.1839	14.6791 (61)
Total heat required for water heating calculated for each month	173.7643	152.3823	158.2086	139.2791	134.6431	117.6648	110.5015	124.7178	125.5920	144.5635	156.0441	168.7301 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1204.7564 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2023.9908 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3192 (H8)
Utilisation factor												0.5314 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.5132 (H14)
Volume ratio Veff/V												0.7691 (H15)
Solar storage volume factor												0.9475 (H16)
Solar input	-27.6323	-41.0463	-69.7155	-98.4831	-116.9801	-122.9327	-119.9000	-105.7598	-82.0486	-56.1373	-33.1083	-896.0982 (H17)
Solar input (sum of months) = Sum (63)m =												-896.0982 (63)
Output from w/h	146.1320	111.3360	88.4931	40.7960	17.6629	0.0000	0.0000	18.9580	43.5434	88.4262	122.9358	146.3758 (64)
Total per year (kWh/year) = Sum (64)m =												824.6592 (64)
Heat gains from water heating, kWh/month	56.5644	49.5733	51.3961	45.1456	43.5687	37.9660	35.5480	40.2708	40.5979	46.8625	50.7145	54.8917 (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)
(66)m	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	159.9492	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.5348	50.2137	40.8365	30.9159	23.1100	19.5104	21.0817	27.4028	36.7799	46.7006	54.5065	58.1060	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.1742	368.9636	359.4145	339.0857	313.4241	289.3059	273.1935	269.4041	278.9532	299.2820	324.9436	349.0618	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	53.6607	(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)	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	-106.6328	(71)
Water heating gains (Table 5)	76.0274	73.7698	69.0808	62.7023	58.5600	52.7305	47.7796	54.1274	56.3860	62.9872	70.4368	73.7792	(72)
Total internal gains	607.7135	602.9242	579.3090	542.6809	505.0713	471.5240	452.0318	460.9114	482.0962	518.9469	559.8640	590.9242	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					3.2400	12.7054		0.7600	0.7200	0.7700		15.6103 (74)	
East					5.9400	23.7288		0.7600	0.7200	0.7700		53.4493 (76)	
West					5.7800	23.7288		0.7600	0.7200	0.7700		52.0095 (80)	
Solar gains	121.0691	210.1568	345.9792	537.2061	640.0650	704.3333	661.1134	567.8045	432.2500	266.7811	152.2843	96.4112	(83)
Total gains	728.7826	813.0810	925.2882	1079.8870	1145.1363	1175.8572	1113.1452	1028.7159	914.3462	785.7280	712.1483	687.3354	(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	33.3178	33.5712	33.6529	34.0389	34.0389	34.2519	34.1825	34.3197	34.1825	33.9647	33.8890	33.6529	
alpha	3.2212	3.2381	3.2435	3.2693	3.2693	3.2835	3.2788	3.2880	3.2788	3.2643	3.2593	3.2435	
util living area	0.9648	0.9499	0.9098	0.8146	0.6682	0.4800	0.3391	0.3544	0.6182	0.8488	0.9418	0.9686	(86)
MIT	19.3945	19.5831	19.9769	20.4533	20.7887	20.9480	20.9879	20.9868	20.8817	20.4866	19.8940	19.3922	(87)
Th 2	19.9363	19.9435	19.9458	19.9565	19.9565	19.9623	19.9604	19.9641	19.9604	19.9544	19.9524	19.9458	(88)
util rest of house	0.9579	0.9404	0.8925	0.7809	0.6104	0.4007	0.2443	0.2532	0.5353	0.8105	0.9284	0.9623	(89)
MIT 2	18.5011	18.6906	19.0734	19.5258	19.8156	19.9374	19.9572	19.9607	19.8966	19.5675	19.0050	18.5065	(90)
Living area fraction									fLA = Living area / (4) =			0.1998	(91)
MIT	18.6796	18.8689	19.2539	19.7111	20.0100	20.1393	20.1631	20.1657	20.0934	19.7511	19.1826	18.6835	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5296	18.7189	19.1039	19.5611	19.8600	19.9893	20.0131	20.0157	19.9434	19.6011	19.0326	18.5335	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9460	0.9264	0.8758	0.7663	0.6046	0.4029	0.2492	0.2584	0.5338	0.7951	0.9135	0.9512	(94)
Useful gains	689.4075	753.2012	810.3340	827.5672	692.3200	473.6996	277.4494	265.8207	488.1098	624.7708	650.5743	653.8023	(95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000	(96)
Heat loss rate W	1485.8431	1451.6661	1305.1630	1081.5216	780.4166	490.2580	279.7165	268.2145	529.1615	851.1886	1180.4027	1449.7241	(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	592.5480	469.3684	368.1528	182.8471	65.5439	0.0000	0.0000	0.0000	0.0000	168.4548	381.4764	592.1658	(98)
Space heating												2820.5574	(98)
Space heating per m2											(98) / (4) =	30.2960	(99)

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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3116.6380	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	592.5480	469.3684	368.1528	182.8471	65.5439	0.0000	0.0000	0.0000	0.0000	168.4548	381.4764	592.1658	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	654.7492	518.6391	406.7987	202.0410	72.4242	0.0000	0.0000	0.0000	0.0000	186.1379	421.5209	654.3269	(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	146.1320	111.3360	88.4931	40.7960	17.6629	0.0000	0.0000	18.9580	43.5434	88.4262	122.9358	146.3758	(64)	
Efficiency of water heater	89.8485	89.8684	89.8617	89.8989	89.8012	87.3000	87.3000	87.3000	87.3000	89.3723	89.6987	89.8473	(217)	
Fuel for water heating, kWh/month	162.6427	123.8877	98.4770	45.3799	19.6689	0.0000	0.0000	21.7159	49.8779	98.9414	137.0542	162.9163	(219)	
Water heating fuel used												920.5619	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3116.6380	(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)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													399.3687	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1205 * 0.80) =										-1927.6103		-1927.6103	(233)	
Total delivered energy for all uses													2633.9583	(238)

10a. Fuel costs - using BEDF prices (500)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3116.6380	3.6300	113.1340	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	920.5619	3.6300	33.4164	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Pump for solar water heating	50.0000	19.4400	9.7200	(249)
Energy for lighting	399.3687	19.4400	77.6373	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-1927.6103	19.4400	-374.7274	(252)
Total energy cost			-31.2398	(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	3116.6380	0.2160	673.1938	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	920.5619	0.2160	198.8414	(264)
Space and water heating			872.0352	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	399.3687	0.5190	207.2724	(268)
Energy saving/generation technologies				
PV Unit	-1927.6103	0.5190	-1000.4297	(269)
Total kg/year			143.7528	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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	3116.6380	1.2200	3802.2984 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	920.5619	1.2200	1123.0856 (264)
Space and water heating			4925.3839 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	399.3687	3.0700	1226.0619 (268)
Energy saving/generation technologies			
PV Unit	-1927.6103	3.0700	-5917.7636 (269)
Primary energy kWh/year			617.4322 (272)
Primary energy kWh/m2/year			6.6319 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	South East England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	141.5 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	312.15 (P1)
Transmission heat loss coefficient	63.96 (37)
Summer heat loss coefficient	376.10 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.2400	86.6589	0.7600	0.7200	0.7650	105.7811
East	5.9400	124.7972	0.7600	0.7200	0.7650	279.2810
West	5.7800	124.7972	0.7600	0.7200	0.7650	271.7583
total:						656.8204

	Jun	Jul	Aug	
Solar gains	700	657	564	(P3)
Internal gains	469	449	458	
Total summer gains	1168	1106	1022	(P5)
Summer gain/loss ratio	3.11	2.94	2.72	(P6)
Summer external temperature	15.40	17.40	17.50	
Thermal mass temperature increment (TMP = 141.5)	1.01	1.01	1.01	
Threshold temperature	19.52	21.35	21.23	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	199 - PRJ010169	Issued on Date	07/07/2022
Assessment Reference	199	Prop Type Ref	HT10 - ET
Property	158, xx0 0xx		
SAP Rating	84 B	DER	17.17
Environmental	86 B	TER	17.88
CO ₂ Emissions (t/year)	1.33	% DER<TER	3.98
General Requirements Compliance	Pass	DFEE	46.53
		TFEE	53.10
		% DFEE<TFEE	12.38
Assessor Details	Chris Nicholls, , Tel: ,		Assessor ID
Client			4299-0004

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.88	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.17	kgCO ₂ /m ²	Pass
	-0.71 (-4.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.10	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	46.53	kWh/m ² /yr	
	-6.6 (-12.4%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.36 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.01 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (South East England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

3.24 m², No overhang

Windows facing East

5.94 m², No overhang

Windows facing West

5.78 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.01 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Door U-value

1.09

W/m²K