

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 26			Issued on Date	14/06/2023
Assessment Reference	plot 26 ham	Prop Type Ref	21809		
Property	1 Red Oak Road, Southampton, SO30 0AU				
SAP Rating	87 B	DER	14.62	TER	18.18
Environmental	88 B	% DER<TER	19.57		
CO ₂ Emissions (t/year)	0.99	DFEE	51.30	TFEE	55.84
General Requirements Compliance	Pass	% DFEE<TFEE	8.14		
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jspsustainability.co.uk			Assessor ID	AU36-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Detached House, total floor area 97 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.18 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.62 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (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: 4.51 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESPl 35
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

Continuous extract system (decentralised)
Specific fan power: 0.1600 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading: Average
Windows facing North: 6.60 m², No overhang
Windows facing East: 5.50 m², No overhang
Windows facing South: 3.50 m², No overhang
Windows facing West: 0.65 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.11 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.033 W/m²K
Photovoltaic array 0.90 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
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											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.5100
Infiltration rate												0.2255 (18)
Number of sides sheltered												2 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1917 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2444	0.2396	0.2348	0.2108	0.2061	0.1821	0.1821	0.1773	0.1917	0.2061	0.2156	0.2252 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.2500	1.3258	21.5436		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	140.9000	18.2500	122.6500	0.2700	33.1155	150.0000	18397.4991 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			237.5000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.7681		(33)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 27039.5989 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							279.9130 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8622 (36)
Total fabric heat loss							(33) + (36) = 75.6303 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 40.2460	Feb 40.2460	Mar 40.2460	Apr 40.2460	May 40.2460	Jun 40.2460	Jul 40.2460	Aug 40.2460	Sep 40.2460	Oct 40.2460	Nov 40.2460	Dec 40.2460 (38)
Heat transfer coeff	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762 (39)
Average = Sum(39)m / 12 =												115.8762 (39)
HLP	Jan 1.1995	Feb 1.1995	Mar 1.1995	Apr 1.1995	May 1.1995	Jun 1.1995	Jul 1.1995	Aug 1.1995	Sep 1.1995	Oct 1.1995	Nov 1.1995	Dec 1.1995 (40)
HLP (average)												1.1995 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan 108.3075	Feb 104.3691	Mar 100.4306	Apr 96.4922	May 92.5537	Jun 88.6153	Jul 88.6153	Aug 92.5537	Sep 96.4922	Oct 100.4306	Nov 104.3691	Dec 108.3075 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Energy content (annual)										Total =	Sum (45)m =	1549.1812 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (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	14.1420	12.7624	14.1045	13.6055	14.0259	13.5353	13.9628	14.0037	13.5736	14.0715	13.6566	14.1299 (61)
Total heat required for water heating calculated for each month	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (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	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (64)
Heat gains from water heating, kWh/month	56.9406	49.8991	51.7251	45.4224	43.8267	38.1771	35.7317	40.4980	40.8323	47.1494	51.0413	55.2525 (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	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0964	20.5141	16.6832	12.6302	9.4412	7.9707	8.6126	11.1950	15.0259	19.0788	22.2678	23.7384 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.7111	253.3127	246.7568	232.7999	215.1820	198.6235	187.5615	184.9599	191.5159	205.4727	223.0906	239.6491 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287 (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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297 (71)
Water heating gains (Table 5)	76.5331	74.2546	69.5230	63.0867	58.9068	53.0237	48.0265	54.4328	56.7116	63.3728	70.8907	74.2641 (72)
Total internal gains	416.9268	414.6675	399.5490	375.1030	350.1161	326.2041	310.7868	317.1739	329.8395	354.5104	382.8353	404.2377 (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				6.6000	10.6334	0.4500	0.0000			0.7700	24.3175 (74)	
East				5.5000	19.6403	0.4500	0.0000			0.7700	37.4294 (76)	
South				3.5000	46.7521	0.4500	0.0000			0.7700	56.6986 (78)	
West				0.6500	19.6403	0.4500	0.0000			0.7700	4.4235 (80)	
Solar gains	122.8690	221.2028	332.0849	457.1750	551.1750	563.6895	536.6416	464.4531	375.3229	252.6239	149.3916	103.6828 (83)
Total gains	539.7958	635.8703	731.6339	832.2780	901.2911	889.8936	847.4285	781.6270	705.1624	607.1344	532.2269	507.9205 (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	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192
alpha	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213
util living area	0.9992	0.9979	0.9932	0.9737	0.9066	0.7564	0.5849	0.6509	0.8896	0.9869	0.9982	0.9994 (86)
MIT	19.7704	19.9155	20.1600	20.4787	20.7705	20.9397	20.9875	20.9786	20.8483	20.4662	20.0491	19.7322 (87)
Th 2	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204 (88)
util rest of house	0.9989	0.9970	0.9903	0.9618	0.8641	0.6593	0.4503	0.5139	0.8225	0.9790	0.9973	0.9992 (89)
MIT 2	18.8008	18.9456	19.1887	19.5006	19.7673	19.8941	19.9176	19.9149	19.8371	19.4926	19.0792	18.7627 (90)
Living area fraction	18.9313	19.0761	19.3194	19.6322	19.9023	20.0348	20.0616	20.0580	fLA = Living area / (4) =	19.9732	19.6236	19.2098 (91)
MIT	18.9313	19.0761	19.3194	19.6322	19.9023	20.0348	20.0616	20.0580	19.9732	19.6236	19.2098	18.8932 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7813	18.9261	19.1694	19.4822	19.7523	19.8848	19.9116	19.9080	19.8232	19.4736	19.0598	18.7432 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9984	0.9959	0.9875	0.9553	0.8560	0.6557	0.4491	0.5122	0.8149	0.9743	0.9962	0.9988 (94)
Ext temp.	538.9190	633.2387	722.5016	795.0591	771.5226	583.5314	380.6113	400.3831	574.6204	591.5084	530.2083	507.3199 (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	1678.0401	1625.2914	1468.0848	1226.2244	933.0736	612.3856	383.7313	406.4972	663.1849	1028.2391	1385.8519	1685.2103 (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 per m ²	847.5061	666.6594	554.7139	310.4390	120.1939	0.0000	0.0000	0.0000	0.0000	324.9277	616.0634	876.3505 (98)
												4316.8538 (98)
												(98) / (4) = 44.6879 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4770.0042	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	847.5061	666.6594	554.7139	310.4390	120.1939	0.0000	0.0000	0.0000	0.0000	324.9277	616.0634	876.3505	(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)	936.4708	736.6402	612.9435	343.0265	132.8109	0.0000	0.0000	0.0000	0.0000	359.0361	680.7330	968.3431	(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	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788	(64)
Efficiency of water heater (217)m	89.9364	89.8842	89.7667	89.4806	88.7768	87.3000	87.3000	87.3000	87.3000	89.4865	89.8316	89.9651	(216)
Fuel for water heating, kWh/month	194.3139	170.4849	177.1967	156.4411	152.3930	135.3685	127.0657	143.4973	144.5268	162.3642	174.6558	188.6052	(219)
Water heating fuel used												1926.9131	(219)
Annual totals kWh/year													
Space heating fuel - main system												4770.0042	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)												65.3345	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												140.3345	(231)
Electricity for lighting (calculated in Appendix L)												407.8905	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 + 0.90 + 853 + 1.00) =										-614.1815		-614.1815	(233)
Total delivered energy for all uses												6630.9608	(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	4770.0042	0.2160	1030.3209 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1926.9131	0.2160	416.2132 (264)
Space and water heating			1446.5341 (265)
Pumps and fans	140.3345	0.5190	72.8336 (267)
Energy for lighting	407.8905	0.5190	211.6952 (268)
Energy saving/generation technologies			
PV Unit	-614.1815	0.5190	-318.7602 (269)
Total CO2, kg/year			1412.3027 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.6200 (273)

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

DER	14.6200	ZC1
Total Floor Area	96.6000	TFA
Assumed number of occupants	2.7057	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	15.3795	ZC2
CO2 emissions from cooking, equation (L16)	1.9041	ZC3
Total CO2 emissions	31.9036	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	31.9036	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (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) =	0.1230 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3730 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3170 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
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	(22)				
Adj infilt rate	0.4042	0.3963	0.3884	0.3487	0.3408	0.3012	0.3012	0.2933	0.3170	0.3408	0.3567	0.3725	(22a)				
Effective ac	0.5817	0.5785	0.5754	0.5608	0.5581	0.5454	0.5454	0.5430	0.5503	0.5581	0.5636	0.5694	(22b)				
													(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			2.0000	1.0000	2.0000		(26)					
TER Opening Type (Uw = 1.40)			16.2500	1.3258	21.5436		(27)					
ground			48.3000	0.1300	6.2790		(28a)					
external	140.9000	18.2500	122.6500	0.1800	22.0770		(29a)					
cold	48.3000		48.3000	0.1300	6.2790		(30)					
Total net area of external elements Aum(A, m2)			237.5000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	58.1786		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3760 (36)					
Total fabric heat loss						(33) + (36) =	68.5546 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 46.8223	Feb 46.5669	Mar 46.3166	Apr 45.1409	May 44.9210	Jun 43.8970	Jul 43.8970	Aug 43.7073	Sep 44.2914	Oct 44.9210	Nov 45.3660	Dec 45.8312 (38)
Heat transfer coeff	115.3769	115.1215	114.8712	113.6955	113.4755	112.4515	112.4515	112.2619	112.8460	113.4755	113.9205	114.3857 (39)
Average = Sum(39)m / 12 =												113.6944 (39)
HLP	Jan 1.1944	Feb 1.1917	Mar 1.1891	Apr 1.1770	May 1.1747	Jun 1.1641	Jul 1.1641	Aug 1.1621	Sep 1.1682	Oct 1.1747	Nov 1.1793	Dec 1.1841 (40)
HLP (average)												1.1770 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan 108.3075	Feb 104.3691	Mar 100.4306	Apr 96.4922	May 92.5537	Jun 88.6153	Jul 88.6153	Aug 92.5537	Sep 96.4922	Oct 100.4306	Nov 104.3691	Dec 108.3075 (44)
Energy conte	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Energy content (annual)										Total = Sum(45)m =		1549.1812 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (46)
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 Built)

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	50.9589	47.5852	47.1644	43.7007	45.1574	47.1644	47.5852	50.9589	49.3151	50.9589 (61)
Solar input	211.5759	186.5040	195.9182	173.9642	168.4280	148.3420	142.1229	158.4338	160.1835	182.1814	192.5547	206.5078 (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	211.5759	186.5040	195.9182	173.9642	168.4280	148.3420	142.1229	158.4338	160.1835	182.1814	192.5547	206.5078 (64)
	66.1449	58.2153	60.9387	53.9173	52.1113	45.7184	43.5304	48.7882	49.3352	56.3712	59.9559	64.4597 (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	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0964	20.5141	16.6832	12.6302	9.4412	7.9707	8.6126	11.1950	15.0259	19.0788	22.2678	23.7384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.7111	253.3127	246.7568	232.7999	215.1820	198.6235	187.5615	184.9599	191.5159	205.4727	223.0906	239.6491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	(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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	(71)
Water heating gains (Table 5)	88.9044	86.6299	81.9068	74.8852	70.0420	63.4978	58.5086	65.5755	68.5212	75.7677	83.2721	86.6394	(72)
Total internal gains	429.2981	427.0428	411.9329	386.9015	361.2514	336.6782	321.2689	328.3166	341.6491	366.9054	395.2168	416.6130	(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					6.6000	10.6334	0.6300	0.7000	0.7700		21.4480 (74)	
East					5.5000	19.6403	0.6300	0.7000	0.7700		33.0128 (76)	
South					3.5000	46.7521	0.6300	0.7000	0.7700		50.0081 (78)	
West					0.6500	19.6403	0.6300	0.7000	0.7700		3.9015 (80)	
Solar gains	108.3704	195.1009	292.8989	403.2284	486.1364	497.1741	473.3179	409.6477	331.0348	222.8143	131.7634	91.4483 (83)
Total gains	537.6685	622.1437	704.8318	790.1298	847.3877	833.8523	794.5868	737.9642	672.6839	589.7197	526.9801	508.0613 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.1428	58.2718	58.3987	59.0026	59.1170	59.6553	59.6553	59.7561	59.4468	59.1170	58.8861	58.6466	
alpha	4.8762	4.8848	4.8932	4.9335	4.9411	4.9770	4.9770	4.9837	4.9631	4.9411	4.9257	4.9098	
util living area	0.9986	0.9968	0.9914	0.9713	0.9085	0.7661	0.5991	0.6596	0.8869	0.9835	0.9970	0.9989	(86)
MIT	19.6596	19.8100	20.0666	20.4116	20.7237	20.9215	20.9818	20.9712	20.8236	20.4191	19.9768	19.6336	(87)
Th 2	19.9245	19.9266	19.9287	19.9385	19.9403	19.9488	19.9488	19.9504	19.9455	19.9403	19.9366	19.9327	(88)
util rest of house	0.9981	0.9957	0.9881	0.9596	0.8698	0.6752	0.4678	0.5283	0.8241	0.9747	0.9958	0.9986	(89)
MIT 2	18.1361	18.3573	18.7324	19.2345	19.6596	19.8942	19.9419	19.9380	19.7961	19.2527	18.6086	18.1040	(90)
Living area fraction	18.3411	18.5528	18.9120	19.3929	19.8028	20.0325	20.0819	20.0771	19.9343	19.4096	18.7927	18.3098	(92)
Temperature adjustment	18.3411	18.5528	18.9120	19.3929	19.8028	20.0325	20.0819	20.0771	19.9343	19.4096	18.7927	18.3098	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9969	0.9934	0.9836	0.9516	0.8637	0.6833	0.4853	0.5453	0.8232	0.9684	0.9937	0.9976	(94)
Ext temp.	536.0078	618.0620	693.3064	751.8629	731.9138	569.7675	385.5885	402.4172	553.7766	571.0883	523.6598	506.8656	(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	1620.0234	1571.7330	1425.7765	1192.9968	919.4745	610.8920	391.5394	412.7934	658.3825	999.6793	1332.0416	1613.9614	(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 per m2	806.5076	640.8669	544.9578	317.6164	139.5452	0.0000	0.0000	0.0000	0.0000	318.8717	582.0349	823.6793	(98)
												4174.0798	(98)
												43.2099	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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													4469.0362 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	806.5076	640.8669	544.9578	317.6164	139.5452	0.0000	0.0000	0.0000	0.0000	318.8717	582.0349	823.6793	(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)	863.4985	686.1530	583.4666	340.0604	149.4060	0.0000	0.0000	0.0000	0.0000	341.4044	623.1637	881.8836	(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	211.5759	186.5040	195.9182	173.9642	168.4280	148.3420	142.1229	158.4338	160.1835	182.1814	192.5547	206.5078	(64)
Efficiency of water heater (217)m	88.0972	87.9076	87.4900	86.5476	84.5819	80.3000	80.3000	80.3000	80.3000	86.4466	87.6591	88.1768	(216)
Fuel for water heating, kWh/month	240.1618	212.1592	223.9321	201.0040	199.1302	184.7347	176.9900	197.3023	199.4813	210.7445	219.6630	234.1975	(219)
Water heating fuel used												2499.5005	(219)
Annual totals kWh/year													
Space heating fuel - main system												4469.0362	(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)												407.8905	(232)
Total delivered energy for all uses												7451.4272	(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	4469.0362	0.2160	965.3118 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2499.5005	0.2160	539.8921 (264)
Space and water heating			1505.2039 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	407.8905	0.5190	211.6952 (268)
Total CO2, kg/m2/year			1755.8241 (272)
Emissions per m2 for space and water heating			15.5818 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1915 (272b)
Emissions per m2 for pumps and fans			0.4030 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5818 * 1.00) + 2.1915 + 0.4030, rounded to 2 d.p.			18.1800 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (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) = 0.1230 (8)
Pressure test					Yes
Measured/design AP50					4.5100
Infiltration rate					0.3485 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2962 (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	0.3777	0.3703	0.3629	0.3258	0.3184	0.2814	0.2814	0.2740	0.2962	0.3184	0.3332	0.3481 (22b)
Effective ac	0.5713	0.5686	0.5658	0.5531	0.5507	0.5396	0.5396	0.5375	0.5439	0.5507	0.5555	0.5606 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.2500	1.3258	21.5436		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	140.9000	18.2500	122.6500	0.2700	33.1155	150.0000	18397.4991 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			237.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.7681		(33)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (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) = 27039.5989 (34)
279.9130 (35)
7.8622 (36)
(33) + (36) = 75.6303 (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	45.9867	45.7638	45.5453	44.5190	44.3270	43.4331	43.4331	43.2676	43.7774	44.3270	44.7154	45.1215 (38)
Heat transfer coeff	121.6170	121.3941	121.1756	120.1493	119.9572	119.0633	119.0633	118.8978	119.4077	119.9572	120.3457	120.7518 (39)
Average = Sum(39)m / 12 =												120.1483 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2590	1.2567	1.2544	1.2438	1.2418	1.2325	1.2325	1.2308	1.2361	1.2418	1.2458	1.2500 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	108.3075	104.3691	100.4306	96.4922	92.5537	88.6153	88.6153	92.5537	96.4922	100.4306	104.3691	108.3075 (44)
Energy content (annual)	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1549.1812 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	34.1311	29.8513	30.8038	26.8555	25.7685	22.2363	20.6052	23.6447	23.9271	27.8848	30.4384	33.0541 (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	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0964	20.5141	16.6832	12.6302	9.4412	7.9707	8.6126	11.1950	15.0259	19.0788	22.2678	23.7384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.7111	253.3127	246.7568	232.7999	215.1820	198.6235	187.5615	184.9599	191.5159	205.4727	223.0906	239.6491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	(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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	(71)
Water heating gains (Table 5)	45.8751	44.4215	41.4030	37.2994	34.6351	30.8837	27.6951	31.7806	33.2321	37.4795	42.2756	44.4276	(72)
Total internal gains	383.2688	381.8345	368.4291	346.3157	322.8445	301.0641	287.4554	291.5216	303.3600	325.6172	351.2202	371.4012	(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				6.6000	10.6334	0.4500	0.0000	0.7700	24.3175 (74)				
East				5.5000	19.6403	0.4500	0.0000	0.7700	37.4294 (76)				
South				3.5000	46.7521	0.4500	0.0000	0.7700	56.6986 (78)				
West				0.6500	19.6403	0.4500	0.0000	0.7700	4.4235 (80)				
Solar gains	122.8690	221.2028	332.0849	457.1750	551.1750	563.6895	536.6416	464.4531	375.3229	252.6239	149.3916	103.6828	(83)
Total gains	506.1378	603.0373	700.5140	803.4907	874.0195	864.7536	824.0970	755.9748	678.6830	578.2411	500.6118	475.0840	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	61.7595	61.8729	61.9844	62.5139	62.6140	63.0841	63.0841	63.1719	62.9022	62.6140	62.4119	62.2020	
alpha	5.1173	5.1249	5.1323	5.1676	5.1743	5.2056	5.2056	5.2115	5.1935	5.1743	5.1608	5.1468	
util living area	0.9994	0.9983	0.9946	0.9786	0.9213	0.7815	0.6124	0.6807	0.9079	0.9899	0.9986	0.9996	(86)
MIT	19.6695	19.8197	20.0743	20.4162	20.7285	20.9245	20.9832	20.9717	20.8181	20.4093	19.9746	19.6425	(87)
Th 2	19.8731	19.8749	19.8767	19.8851	19.8867	19.8941	19.8941	19.8954	19.8912	19.8867	19.8835	19.8802	(88)
util rest of house	0.9991	0.9977	0.9923	0.9684	0.8827	0.6846	0.4706	0.5385	0.8463	0.9835	0.9979	0.9994	(89)
MIT 2	18.6620	18.8135	19.0685	19.4114	19.7025	19.8605	19.8902	19.8880	19.7886	19.4097	18.9753	18.6408	(90)
Living area fraction	18.7976	18.9489	19.2038	19.5466	19.8406	20.0037	20.0373	20.0338	19.9272	19.5442	19.1098	18.7756	(91)
MIT	18.7976	18.9489	19.2038	19.5466	19.8406	20.0037	20.0373	20.0338	19.9272	19.5442	19.1098	18.7756	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7976	18.9489	19.2038	19.5466	19.8406	20.0037	20.0373	20.0338	19.9272	19.5442	19.1098	18.7756	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9988	0.9969	0.9903	0.9643	0.8807	0.6954	0.4900	0.5578	0.8488	0.9808	0.9972	0.9991	(94)
Ext temp.	505.5299	601.1417	693.7476	774.8373	769.7607	601.3360	403.7996	421.7041	576.0689	567.1123	499.2342	474.6738	(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	1763.1550	1705.4557	1539.3926	1279.1790	976.5194	643.3779	409.2595	432.0532	695.8097	1072.9226	1445.3240	1760.0318	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	935.6731	742.0990	629.1599	363.1261	153.8285	0.0000	0.0000	0.0000	0.0000	376.3228	681.1847	956.3064	(98)
Space heating per m2												4837.7004	(98)
												50.0797	(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	1119.1955	881.0688	903.6234	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8370	0.9068	0.8735	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	936.7266	798.9417	789.3487	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1114.1764	1064.4678	986.7500	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	127.7639	197.5514	146.8666	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												472.1818 (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	31.9410	49.3878	36.7166	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												118.0455 (107)
Space cooling per m2												1.2220 (108)
Energy for space heating												50.0797 (99)
Energy for space cooling												1.2220 (108)
Total												51.3017 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (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) =	0.1230 (8)	
Pressure test															Yes		
Measured/design AP50																5.0000	
Infiltration rate																0.3730 (18)	
Number of sides sheltered																2 (19)	
Shelter factor														(20) = 1 - [0.075 x (19)] =		0.8500 (20)	
Infiltration rate adjusted to include shelter factor														(21) = (18) x (20) =		0.3170 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4042	0.3963	0.3884	0.3487	0.3408	0.3012	0.3012	0.2933	0.3170	0.3408	0.3567	0.3725	(22b)				
Effective ac	0.5817	0.5785	0.5754	0.5608	0.5581	0.5454	0.5454	0.5430	0.5503	0.5581	0.5636	0.5694	(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			2.0000	1.0000	2.0000		(26)					
TER Opening Type (Uw = 1.40)			16.2500	1.3258	21.5436		(27)					
ground			48.3000	0.1300	6.2790		(28a)					
external	140.9000	18.2500	122.6500	0.1800	22.0770		(29a)					
cold	48.3000		48.3000	0.1300	6.2790		(30)					
Total net area of external elements Aum(A, m2)			237.5000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	58.1786		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3760 (36)					
Total fabric heat loss						(33) + (36) =	68.5546 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 46.8223	Feb 46.5669	Mar 46.3166	Apr 45.1409	May 44.9210	Jun 43.8970	Jul 43.8970	Aug 43.7073	Sep 44.2914	Oct 44.9210	Nov 45.3660	Dec 45.8312 (38)
Heat transfer coeff	115.3769	115.1215	114.8712	113.6955	113.4755	112.4515	112.4515	112.2619	112.8460	113.4755	113.9205	114.3857 (39)
Average = Sum(39)m / 12 =												113.6944 (39)
HLP	Jan 1.1944	Feb 1.1917	Mar 1.1891	Apr 1.1770	May 1.1747	Jun 1.1641	Jul 1.1641	Aug 1.1621	Sep 1.1682	Oct 1.1747	Nov 1.1793	Dec 1.1841 (40)
HLP (average)												1.1770 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan 108.3075	Feb 104.3691	Mar 100.4306	Apr 96.4922	May 92.5537	Jun 88.6153	Jul 88.6153	Aug 92.5537	Sep 96.4922	Oct 100.4306	Nov 104.3691	Dec 108.3075 (44)
Energy conte	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Energy content (annual)										Total = Sum(45)m =		1549.1812 (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	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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)
	34.1311	29.8513	30.8038	26.8555	25.7685	22.2363	20.6052	23.6447	23.9271	27.8848	30.4384	33.0541 (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	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0964	20.5141	16.6832	12.6302	9.4412	7.9707	8.6126	11.1950	15.0259	19.0788	22.2678	23.7384 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.7111	253.3127	246.7568	232.7999	215.1820	198.6235	187.5615	184.9599	191.5159	205.4727	223.0906	239.6491 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287 (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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297 (71)
Water heating gains (Table 5)	45.8751	44.4215	41.4030	37.2994	34.6351	30.8837	27.6951	31.7806	33.2321	37.4795	42.2756	44.4276 (72)
Total internal gains	383.2688	381.8345	368.4291	346.3157	322.8445	301.0641	287.4554	291.5216	303.3600	325.6172	351.2202	371.4012 (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	6.6000	10.6334	0.6300	0.7000	0.7700	21.4480 (74)
East	5.5000	19.6403	0.6300	0.7000	0.7700	33.0128 (76)
South	3.5000	46.7521	0.6300	0.7000	0.7700	50.0081 (78)
West	0.6500	19.6403	0.6300	0.7000	0.7700	3.9015 (80)

Solar gains	108.3704	195.1009	292.8989	403.2284	486.1364	497.1741	473.3179	409.6477	331.0348	222.8143	131.7634	91.4483 (83)
Total gains	491.6393	576.9353	661.3280	749.5440	808.9808	798.2382	760.7733	701.1693	634.3949	548.4315	482.9836	462.8495 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.1428	58.2718	58.3987	59.0026	59.1170	59.6553	59.7561	59.4468	59.1170	58.8861	58.6466	
alpha	4.8762	4.8848	4.8932	4.9335	4.9411	4.9770	4.9770	4.9837	4.9631	4.9411	4.9257	4.9098
util living area	0.9990	0.9977	0.9934	0.9766	0.9209	0.7868	0.6214	0.6862	0.9050	0.9877	0.9980	0.9993 (86)
MIT	19.6155	19.7670	20.0263	20.3772	20.6997	20.9112	20.9787	20.9658	20.8018	20.3821	19.9348	19.5901 (87)
Th 2	19.9245	19.9266	19.9287	19.9385	19.9403	19.9488	19.9488	19.9504	19.9455	19.9403	19.9366	19.9327 (88)
util rest of house	0.9987	0.9969	0.9909	0.9668	0.8858	0.6978	0.4873	0.5532	0.8481	0.9810	0.9971	0.9991 (89)
MIT 2	18.6595	18.8124	19.0722	19.4253	19.7288	19.9057	19.9432	19.9401	19.8277	19.4352	18.9882	18.6407 (90)
Living area fraction												0.1346 (91)
MIT	18.7881	18.9409	19.2006	19.5534	19.8595	20.0410	20.0825	20.0781	19.9588	19.5626	19.1156	18.7685 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7881	18.9409	19.2006	19.5534	19.8595	20.0410	20.0825	20.0781	19.9588	19.5626	19.1156	18.7685 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9982	0.9958	0.9885	0.9621	0.8825	0.7066	0.5054	0.5708	0.8490	0.9776	0.9962	0.9987 (94)
Useful gains	490.7499	574.5097	653.7268	721.1292	713.9244	564.0712	384.5075	400.2520	538.6063	536.1705	481.1327	462.2289 (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	1671.5941	1616.4077	1458.9311	1211.2479	925.9004	611.8538	391.6155	412.9105	661.1416	1017.0380	1368.8179	1666.4276 (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	878.5481	700.1555	599.0720	352.8855	157.7102	0.0000	0.0000	0.0000	0.0000	357.7654	639.1333	895.9238 (98)
Space heating												4581.1938 (98)
Space heating per m2										(98) / (4) =		47.4244 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1057.0443	832.1413	853.1904	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8244	0.8962	0.8637	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	871.4143	745.7234	736.9204	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1036.4312	990.4530	922.6917	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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)
	0.0000	0.0000	0.0000	0.0000	0.0000	118.8122	182.0789	138.2139	0.0000	0.0000	0.0000	0.0000 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												439.1049 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	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	29.7030	45.5197	34.5535	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												109.7762 (107)
Space cooling per m2												1.1364 (108)
Energy for space heating												47.4244 (99)
Energy for space cooling												1.1364 (108)
Total												48.5608 (109)
Target Fabric Energy Efficiency (TFEE)												55.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
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											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.5100
Infiltration rate												0.2255 (18)
Number of sides sheltered												2 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1917 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Adj infilt rate	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
	0.2252	0.2108	0.2108	0.1917	0.1965	0.1869	0.1869	0.1821	0.1821	0.1965	0.1917	0.1965 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.2500	1.3258	21.5436		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	140.9000	18.2500	122.6500	0.2700	33.1155	150.0000	18397.4991 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			237.5000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.7681		(32)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 27039.5989 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							279.9130 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8622 (36)
Total fabric heat loss							(33) + (36) = 75.6303 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 40.2460	Feb 40.2460	Mar 40.2460	Apr 40.2460	May 40.2460	Jun 40.2460	Jul 40.2460	Aug 40.2460	Sep 40.2460	Oct 40.2460	Nov 40.2460	Dec 40.2460 (38)
Heat transfer coeff	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762 (39)
Average = Sum(39)m / 12 =												115.8762 (39)
HLP	Jan 1.1995	Feb 1.1995	Mar 1.1995	Apr 1.1995	May 1.1995	Jun 1.1995	Jul 1.1995	Aug 1.1995	Sep 1.1995	Oct 1.1995	Nov 1.1995	Dec 1.1995 (40)
HLP (average)												1.1995 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan 108.3075	Feb 104.3691	Mar 100.4306	Apr 96.4922	May 92.5537	Jun 88.6153	Jul 88.6153	Aug 92.5537	Sep 96.4922	Oct 100.4306	Nov 104.3691	Dec 108.3075 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (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	14.1420	12.7624	14.1045	13.6055	14.0259	13.5353	13.9628	14.0037	13.5736	14.0715	13.6566	14.1299 (61)
Total heat required for water heating calculated for each month	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (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	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (64)
RHI water heating demand												1715 (64)
Heat gains from water heating, kWh/month	56.9406	49.8991	51.7251	45.4224	43.8267	38.1771	35.7317	40.4980	40.8323	47.1494	51.0413	55.2525 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.7411	51.2852	41.7079	31.5756	23.6031	19.9267	21.5315	27.9875	37.5648	47.6971	55.6696	59.3459 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	374.1957	378.0787	368.2937	347.4626	321.1671	296.4531	279.9425	276.0596	285.8446	306.6756	332.9711	357.6852 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402 (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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297 (71)
Water heating gains (Table 5)	76.5331	74.2546	69.5230	63.0867	58.9068	53.0237	48.0265	54.4328	56.7116	63.3728	70.8907	74.2641 (72)
Total internal gains	619.5250	614.6735	590.5796	553.1799	514.7321	480.4586	460.5557	469.5349	491.1760	528.8006	570.5865	602.3503 (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				6.6000	13.4684	0.4500	0.0000	0.7700	30.8009 (74)			
East				5.5000	25.1733	0.4500	0.0000	0.7700	47.9739 (76)			
South				3.5000	56.5862	0.4500	0.0000	0.7700	68.6249 (78)			
West				0.6500	25.1733	0.4500	0.0000	0.7700	5.6696 (80)			
Solar gains	153.0694	235.2891	361.3497	501.6139	570.2403	645.5841	590.4213	428.3556	290.4705	185.6638	122.1762 (83)	
Total gains	772.5944	849.9625	951.9292	1054.7937	1084.9724	1126.0426	1050.9770	1002.0306	919.5315	819.2711	756.2502	724.5264 (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	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192
Feb	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213
Mar	0.9934	0.9885	0.9700	0.9070	0.7627	0.5166	0.3628	0.3689	0.6692	0.9212	0.9842	0.9949 (86)
MIT	20.1041	20.2090	20.4456	20.7301	20.9225	20.9919	20.9990	20.9990	20.9704	20.7563	20.3899	20.0732 (87)
Th 2	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204 (88)
util rest of house	0.9908	0.9841	0.9582	0.8719	0.6861	0.4115	0.2447	0.2451	0.5570	0.8810	0.9767	0.9929 (89)
MIT 2	19.1329	19.2362	19.4663	19.7281	19.8799	19.9182	19.9203	19.9203	19.9101	19.7579	19.4155	19.1025 (90)
Living area fraction									fLA = Living area / (4) =			0.1346 (91)
MIT	19.2636	19.3671	19.5980	19.8630	20.0202	20.0627	20.0654	20.0654	20.0528	19.8923	19.5466	19.2331 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1136	19.2171	19.4480	19.7130	19.8702	19.9127	19.9154	19.9154	19.9028	19.7423	19.3966	19.0831 (93)

8. Space heating requirement

Utilisation	0.9881	0.9801	0.9515	0.8638	0.6821	0.4107	0.2442	0.2445	0.5550	0.8726	0.9717	0.9906 (94)
Useful gains	763.3684	833.0736	905.7851	911.1606	740.0941	462.4953	256.6095	245.0255	510.3857	714.9281	734.8250	717.7422 (95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Heat loss rate W	1565.9022	1531.5510	1372.9071	1113.9128	784.5042	464.9709	256.7168	245.1287	521.7695	885.5576	1251.0684	1550.7846 (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	597.0851	469.3768	347.5388	145.9816	33.0411	0.0000	0.0000	0.0000	0.0000	126.9484	371.6952	619.7836 (98)
Space heating												2711.4506 (98)
RHI space heating demand												2711 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
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																0 * 10 =	0.0000 (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) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50																4.5100	
Infiltration rate																0.2255 (18)	
Number of sides sheltered																2 (19)	
Shelter factor										(20) = 1 - [0.075 x (19)] =						0.8500 (20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =						0.1917 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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																	
	0.2444	0.2396	0.2348	0.2108	0.2061	0.1821	0.1821	0.1773	0.1917	0.2061	0.2156	0.2252 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.2500	1.3258	21.5436		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	140.9000	18.2500	122.6500	0.2700	33.1155	150.0000	18397.4991 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			237.5000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.7681		(33)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 27039.5989 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							279.9130 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8622 (36)
Total fabric heat loss						(33) + (36) =	75.6303 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 40.2460	Feb 40.2460	Mar 40.2460	Apr 40.2460	May 40.2460	Jun 40.2460	Jul 40.2460	Aug 40.2460	Sep 40.2460	Oct 40.2460	Nov 40.2460	Dec 40.2460 (38)
Heat transfer coeff	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762 (39)
Average = Sum(39)m / 12 =												115.8762 (39)
HLP	Jan 1.1995	Feb 1.1995	Mar 1.1995	Apr 1.1995	May 1.1995	Jun 1.1995	Jul 1.1995	Aug 1.1995	Sep 1.1995	Oct 1.1995	Nov 1.1995	Dec 1.1995 (40)
HLP (average)												1.1995 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan 108.3075	Feb 104.3691	Mar 100.4306	Apr 96.4922	May 92.5537	Jun 88.6153	Jul 88.6153	Aug 92.5537	Sep 96.4922	Oct 100.4306	Nov 104.3691	Dec 108.3075 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Energy content (annual)										Total =	Sum (45)m =	1549.1812 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (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	14.1420	12.7624	14.1045	13.6055	14.0259	13.5353	13.9628	14.0037	13.5736	14.0715	13.6566	14.1299 (61)
Total heat required for water heating calculated for each month	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (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	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (64)
Heat gains from water heating, kWh/month	56.9406	49.8991	51.7251	45.4224	43.8267	38.1771	35.7317	40.4980	40.8323	47.1494	51.0413	55.2525 (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	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.7411	51.2852	41.7079	31.5756	23.6031	19.9267	21.5315	27.9875	37.5648	47.6971	55.6696	59.3459	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	374.1957	378.0787	368.2937	347.4626	321.1671	296.4531	279.9425	276.0596	285.8446	306.6756	332.9711	357.6852	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	(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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	(71)
Water heating gains (Table 5)	76.5331	74.2546	69.5230	63.0867	58.9068	53.0237	48.0265	54.4328	56.7116	63.3728	70.8907	74.2641	(72)
Total internal gains	619.5250	614.6735	590.5796	553.1799	514.7321	480.4586	460.5557	469.5349	491.1760	528.8006	570.5865	602.3503	(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				6.6000	10.6334		0.4500		0.0000		0.7700		24.3175 (74)
East				5.5000	19.6403		0.4500		0.0000		0.7700		37.4294 (76)
South				3.5000	46.7521		0.4500		0.0000		0.7700		56.6986 (78)
West				0.6500	19.6403		0.4500		0.0000		0.7700		4.4235 (80)
Solar gains	122.8690	221.2028	332.0849	457.1750	551.1750	563.6895	536.6416	464.4531	375.3229	252.6239	149.3916	103.6828	(83)
Total gains	742.3940	835.8763	922.6645	1010.3549	1065.9070	1044.1480	997.1973	933.9881	866.4989	781.4245	719.9780	706.0331	(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	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	
alpha	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	
util living area	0.9962	0.9923	0.9810	0.9441	0.8464	0.6726	0.5041	0.5579	0.8061	0.9625	0.9923	0.9971	(86)
MIT	19.9468	20.0872	20.3172	20.6051	20.8454	20.9654	20.9937	20.9895	20.9110	20.6009	20.2105	19.9052	(87)
Th 2	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	(88)
util rest of house	0.9948	0.9894	0.9737	0.9223	0.7910	0.5752	0.3843	0.4337	0.7211	0.9433	0.9890	0.9960	(89)
MIT 2	18.9765	19.1156	19.3419	19.6163	19.8239	19.9064	19.9190	19.9179	19.8767	19.6183	19.2389	18.9351	(90)
Living area fraction	19.1071	19.2464	19.4731	19.7494	19.9614	20.0489	20.0637	20.0621	20.0159	19.7505	19.3697	19.0657	(91)
MIT	19.1071	19.2464	19.4731	19.7494	19.9614	20.0489	20.0637	20.0621	20.0159	19.7505	19.3697	19.0657	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9571	19.0964	19.3231	19.5994	19.8114	19.8989	19.9137	19.9121	19.8659	19.6005	19.2197	18.9157	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9931	0.9864	0.9684	0.9142	0.7845	0.5732	0.3836	0.4328	0.7162	0.9357	0.9859	0.9946	(94)
Ext temp.	737.2549	824.5147	893.5281	923.6422	836.2032	598.4768	382.5016	404.1921	620.5892	731.1507	709.8038	702.2263	(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	1698.4039	1645.0237	1485.8974	1239.8011	939.9181	614.0165	383.9761	406.9687	668.1286	1042.9454	1404.3818	1705.1988	(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	715.0948	551.3820	440.7228	227.6344	77.1639	0.0000	0.0000	0.0000	0.0000	231.9753	500.0962	746.2115	(98)
Space heating per m ²												3490.2808	(98)
												36.1313	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3856.6639 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	715.0948	551.3820	440.7228	227.6344	77.1639	0.0000	0.0000	0.0000	0.0000	231.9753	500.0962	746.2115	(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)	790.1600	609.2619	486.9865	251.5297	85.2640	0.0000	0.0000	0.0000	0.0000	256.3262	552.5924	824.5431	(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	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788	(64)
Efficiency of water heater (217)m	89.8532	89.7843	89.6287	89.2542	88.4357	87.3000	87.3000	87.3000	87.3000	89.2402	89.7147	89.8896	(216)
Fuel for water heating, kWh/month	194.4940	170.6747	177.4696	156.8380	152.9807	135.3685	127.0657	143.4973	144.5268	162.8122	174.8835	188.7636	(219)
Water heating fuel used												1929.3745	(219)
Annual totals kWh/year													
Space heating fuel - main system												3856.6639	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)												65.3345	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												140.3345	(231)
Electricity for lighting (calculated in Appendix L)												407.8905	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 + 0.90 + 853 + 1.00) =										-614.1815		-614.1815	(233)
Total delivered energy for all uses												5720.0819	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3856.6639	3.4800	134.2119 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1929.3745	3.4800	67.1422 (247)
Mechanical ventilation fans	65.3345	13.1900	8.6176 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	407.8905	13.1900	53.8008 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-614.1815	13.1900	-81.0105 (252)
Total energy cost			312.6545 (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] =	0.9274 (257)
SAP value		87.0633
SAP rating (Section 12)		87 (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	3856.6639	0.2160	833.0394 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1929.3745	0.2160	416.7449 (264)
Space and water heating			1249.7843 (265)
Pumps and fans	140.3345	0.5190	72.8336 (267)
Energy for lighting	407.8905	0.5190	211.6952 (268)
Energy saving/generation technologies			
PV Unit	-614.1815	0.5190	-318.7602 (269)
Total kg/year			1215.5529 (272)
CO2 emissions per m2			12.5800 (273)
EI value			88.4969
EI rating			88 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, 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 Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
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											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.5100
Infiltration rate												0.2255 (18)
Number of sides sheltered												2 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1917 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate												
	0.2252	0.2108	0.2108	0.1917	0.1965	0.1869	0.1869	0.1821	0.1821	0.1965	0.1917	0.1965 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.2500	1.3258	21.5436		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	140.9000	18.2500	122.6500	0.2700	33.1155	150.0000	18397.4991 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			237.5000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.7681		(33)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 27039.5989 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							279.9130 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8622 (36)
Total fabric heat loss							(33) + (36) = 75.6303 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460 (38)
Heat transfer coeff	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762 (39)
Average = Sum(39)m / 12 =												115.8762 (39)
HLP	Jan 1.1995	Feb 1.1995	Mar 1.1995	Apr 1.1995	May 1.1995	Jun 1.1995	Jul 1.1995	Aug 1.1995	Sep 1.1995	Oct 1.1995	Nov 1.1995	Dec 1.1995 (40)
HLP (average)												1.1995 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.3075	104.3691	100.4306	96.4922	92.5537	88.6153	88.6153	92.5537	96.4922	100.4306	104.3691	108.3075 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Energy content (annual)										Total =	Sum (45)m =	1549.1812 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (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	14.1420	12.7624	14.1045	13.6055	14.0259	13.5353	13.9628	14.0037	13.5736	14.0715	13.6566	14.1299 (61)
Total heat required for water heating calculated for each month	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (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	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (64)
Heat gains from water heating, kWh/month	56.9406	49.8991	51.7251	45.4224	43.8267	38.1771	35.7317	40.4980	40.8323	47.1494	51.0413	55.2525 (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	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.7411	51.2852	41.7079	31.5756	23.6031	19.9267	21.5315	27.9875	37.5648	47.6971	55.6696	59.3459 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	374.1957	378.0787	368.2937	347.4626	321.1671	296.4531	279.9425	276.0596	285.8446	306.6756	332.9711	357.6852 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402 (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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297 (71)
Water heating gains (Table 5)	76.5331	74.2546	69.5230	63.0867	58.9068	53.0237	48.0265	54.4328	56.7116	63.3728	70.8907	74.2641 (72)
Total internal gains	619.5250	614.6735	590.5796	553.1799	514.7321	480.4586	460.5557	469.5349	491.1760	528.8006	570.5865	602.3503 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.6000	13.4684	0.4500	0.0000	0.7700	30.8009 (74)
East	5.5000	25.1733	0.4500	0.0000	0.7700	47.9739 (76)
South	3.5000	56.5862	0.4500	0.0000	0.7700	68.6249 (78)
West	0.6500	25.1733	0.4500	0.0000	0.7700	5.6696 (80)

Solar gains	153.0694	235.2891	361.3497	501.6139	570.2403	645.5841	590.4213	532.4957	428.3556	290.4705	185.6638	122.1762 (83)
Total gains	772.5944	849.9625	951.9292	1054.7937	1084.9724	1126.0426	1050.9770	1002.0306	919.5315	819.2711	756.2502	724.5264 (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	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192
alpha	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213
util living area	0.9934	0.9885	0.9700	0.9070	0.7627	0.5166	0.3628	0.3689	0.6692	0.9212	0.9842	0.9949 (86)
MIT	20.1041	20.2090	20.4456	20.7301	20.9225	20.9919	20.9990	20.9990	20.9704	20.7563	20.3899	20.0732 (87)
Th 2	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204 (88)
util rest of house	0.9908	0.9841	0.9582	0.8719	0.6861	0.4115	0.2447	0.2451	0.5570	0.8810	0.9767	0.9929 (89)
MIT 2	19.1329	19.2362	19.4663	19.7281	19.8799	19.9182	19.9203	19.9203	19.9101	19.7579	19.4155	19.1025 (90)
Living area fraction	19.2636	19.3671	19.5980	19.8630	20.0202	20.0627	20.0654	20.0654	fLA = Living area / (4) =	19.8923	19.5466	0.1346 (91)
MIT	19.2636	19.3671	19.5980	19.8630	20.0202	20.0627	20.0654	20.0654	20.0528	19.8923	19.5466	19.2331 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1136	19.2171	19.4480	19.7130	19.8702	19.9127	19.9154	19.9154	19.9028	19.7423	19.3966	19.0831 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9881	0.9801	0.9515	0.8638	0.6821	0.4107	0.2442	0.2445	0.5550	0.8726	0.9717	0.9906 (94)
Ext temp.	763.3684	833.0736	905.7851	911.1606	740.0941	462.4953	256.6095	245.0255	510.3857	714.9281	734.8250	717.7422 (95)
Heat loss rate W	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Month fracti	1565.9022	1531.5510	1372.9071	1113.9128	784.5042	464.9709	256.7168	245.1287	521.7695	885.5576	1251.0684	1550.7846 (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	597.0851	469.3768	347.5388	145.9816	33.0411	0.0000	0.0000	0.0000	0.0000	126.9484	371.6952	619.7836 (98)
Space heating per m ²												2711.4506 (98)
										(98) / (4) =		28.0688 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2996.0780 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	597.0851	469.3768	347.5388	145.9816	33.0411	0.0000	0.0000	0.0000	0.0000	126.9484	371.6952	619.7836	(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)	659.7626	518.6484	384.0208	161.3056	36.5095	0.0000	0.0000	0.0000	0.0000	140.2744	410.7129	684.8437	(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													
	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788	(64)
Efficiency of water heater (217)m	89.7551	89.6908	89.4703	88.9048	87.9101	87.3000	87.3000	87.3000	87.3000	88.7635	89.5260	89.7926	(216)
Fuel for water heating, kWh/month	194.7065	170.8525	177.7839	157.4544	153.8953	135.3685	127.0657	143.4973	144.5268	163.6865	175.2522	188.9675	(219)
Water heating fuel used												1933.0570	(219)
Annual totals kWh/year													
Space heating fuel - main system												2996.0780	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)												65.3345	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												140.3345	(231)
Electricity for lighting (calculated in Appendix L)												407.8905	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.90 * 966 * 1.00) =										-695.3672		-695.3672	(233)
Total delivered energy for all uses												4781.9929	(238)

10a. Fuel costs - using BEDF prices (519)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2996.0780	9.7400	291.8180	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1933.0570	9.7400	188.2798	(247)
Mechanical ventilation fans	65.3345	36.8500	24.0758	(249)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Energy for lighting	407.8905	36.8500	150.3077	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-695.3672	36.8500	-256.2428	(252)
Total energy cost			529.8759	(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	2996.0780	0.2160	647.1528	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1933.0570	0.2160	417.5403	(264)
Space and water heating			1064.6932	(265)
Pumps and fans	140.3345	0.5190	72.8336	(267)
Energy for lighting	407.8905	0.5190	211.6952	(268)
Energy saving/generation technologies				
PV Unit	-695.3672	0.5190	-360.8956	(269)
Total kg/year			988.3264	(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	2996.0780	1.2200	3655.2152	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1933.0570	1.2200	2358.3296	(264)
Space and water heating			6013.5448	(265)
Pumps and fans	140.3345	3.0700	430.8270	(267)
Energy for lighting	407.8905	3.0700	1252.2239	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-695.3672	3.0700	-2134.7772 (269)
Primary energy kWh/year			5561.8184 (272)
Primary energy kWh/m2/year			57.5758 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 88

(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	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 80	-192 kg (19.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£80 1.99 kg/m²	B 88	B 90
Total Savings	£80 1.99 kg/m²		

Potential energy efficiency rating:	B 88
Potential environmental impact rating:	B 90

Fuel prices for cost data on this page from database revision number 519 TEST (31 May 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£202	£220	-£18
Mains gas	£584	£486	£98
Space heating	£448	£448	£0
Water heating	£188	£108	£80
Lighting	£150	£150	£0
Generated (PV)	-£256	-£256	£0
Total cost of fuels	£530	£450	£80
Total cost of uses	£530	£450	£80
Delivered energy	50 kWh/m²	40 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	58 kWh/m²	46 kWh/m²	11 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (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																0 * 10 =	0.0000 (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) =					0.0000 / (5) =	0.0000 (8)					
Pressure test															Yes						
Measured/design AP50																4.5100					
Infiltration rate																0.2255 (18)					
Number of sides sheltered																2 (19)					
Shelter factor										(20) = 1 - [0.075 x (19)] =						0.8500 (20)					
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =						0.1917 (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	0.2444	0.2396	0.2348	0.2108	0.2061	0.1821	0.1821	0.1773	0.1917	0.2061	0.2156	0.2252 (22b)									
Mechanical extract ventilation - decentralised																					
If mechanical ventilation:																0.5000 (23a)					
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.2500	1.3258	21.5436		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	140.9000	18.2500	122.6500	0.2700	33.1155	150.0000	18397.4991 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			237.5000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.7681		(33)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 27039.5989 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							279.9130 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8622 (36)
Total fabric heat loss						(33) + (36) =	75.6303 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 40.2460	Feb 40.2460	Mar 40.2460	Apr 40.2460	May 40.2460	Jun 40.2460	Jul 40.2460	Aug 40.2460	Sep 40.2460	Oct 40.2460	Nov 40.2460	Dec 40.2460 (38)
Heat transfer coeff	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762 (39)
Average = Sum(39)m / 12 =												115.8762 (39)
HLP	Jan 1.1995	Feb 1.1995	Mar 1.1995	Apr 1.1995	May 1.1995	Jun 1.1995	Jul 1.1995	Aug 1.1995	Sep 1.1995	Oct 1.1995	Nov 1.1995	Dec 1.1995 (40)
HLP (average)												1.1995 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan 108.3075	Feb 104.3691	Mar 100.4306	Apr 96.4922	May 92.5537	Jun 88.6153	Jul 88.6153	Aug 92.5537	Sep 96.4922	Oct 100.4306	Nov 104.3691	Dec 108.3075 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (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	14.1420	12.7624	14.1045	13.6055	14.0259	13.5353	13.9628	14.0037	13.5736	14.0715	13.6566	14.1299 (61)
Total heat required for water heating calculated for each month	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (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												1.1707 (H8)
Utilisation factor												0.5744 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.4614 (H14)
Volume ratio Veff/V												0.7617 (H15)
Solar storage volume factor												0.9456 (H16)
Solar input												-866.0921 (H17)
Solar input	-25.1149	-41.9096	-71.3769	-95.6591	-118.1787	-116.1885	-114.6531	-100.1729	-78.4555	-53.5759	-29.7899	-21.0169 (63)
Solar input (sum of months) = Sum (63)m =												-866.0921 (63)
Output from w/h	149.6440	111.3294	87.6869	44.3254	17.1108	1.9881	0.0000	25.1002	47.7164	91.7181	127.1062	148.6619 (64)
Total per year (kWh/year) = Sum (64)m =												852.3875 (64)
Heat gains from water heating, kWh/month	56.9406	49.8991	51.7251	45.4224	43.8267	38.1771	35.7317	40.4980	40.8323	47.1494	51.0413	55.2525 (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	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.7411	51.2852	41.7079	31.5756	23.6031	19.9267	21.5315	27.9875	37.5648	47.6971	55.6696	59.3459	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	374.1957	378.0787	368.2937	347.4626	321.1671	296.4531	279.9425	276.0596	285.8446	306.6756	332.9711	357.6852	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	(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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	(71)
Water heating gains (Table 5)	76.5331	74.2546	69.5230	63.0867	58.9068	53.0237	48.0265	54.4328	56.7116	63.3728	70.8907	74.2641	(72)
Total internal gains	619.5250	614.6735	590.5796	553.1799	514.7321	480.4586	460.5557	469.5349	491.1760	528.8006	570.5865	602.3503	(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					6.6000	10.6334	0.4500	0.0000	0.7700	24.3175 (74)		
East					5.5000	19.6403	0.4500	0.0000	0.7700	37.4294 (76)		
South					3.5000	46.7521	0.4500	0.0000	0.7700	56.6986 (78)		
West					0.6500	19.6403	0.4500	0.0000	0.7700	4.4235 (80)		
Solar gains	122.8690	221.2028	332.0849	457.1750	551.1750	563.6895	536.6416	464.4531	375.3229	252.6239	149.3916	103.6828 (83)
Total gains	742.3940	835.8763	922.6645	1010.3549	1065.9070	1044.1480	997.1973	933.9881	866.4989	781.4245	719.9780	706.0331 (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	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192
alpha	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213
util living area												
	0.9962	0.9923	0.9810	0.9441	0.8464	0.6726	0.5041	0.5579	0.8061	0.9625	0.9923	0.9971 (86)
MIT	19.9468	20.0872	20.3172	20.6051	20.8454	20.9654	20.9937	20.9895	20.9110	20.6009	20.2105	19.9052 (87)
Th 2	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204 (88)
util rest of house												
	0.9948	0.9894	0.9737	0.9223	0.7910	0.5752	0.3843	0.4337	0.7211	0.9433	0.9890	0.9960 (89)
MIT 2	18.9765	19.1156	19.3419	19.6163	19.8239	19.9064	19.9190	19.9179	19.8767	19.6183	19.2389	18.9351 (90)
Living area fraction									fLA = Living area / (4) =			0.1346 (91)
MIT	19.1071	19.2464	19.4731	19.7494	19.9614	20.0489	20.0637	20.0621	20.0159	19.7505	19.3697	19.0657 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.9571	19.0964	19.3231	19.5994	19.8114	19.8989	19.9137	19.9121	19.8659	19.6005	19.2197	18.9157 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9931	0.9864	0.9684	0.9142	0.7845	0.5732	0.3836	0.4328	0.7162	0.9357	0.9859	0.9946 (94)
Useful gains	737.2549	824.5147	893.5281	923.6422	836.2032	598.4768	382.5016	404.1921	620.5892	731.1507	709.8038	702.2263 (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	1698.4039	1645.0237	1485.8974	1239.8011	939.9181	614.0165	383.9761	406.9687	668.1286	1042.9454	1404.3818	1705.1988 (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	715.0948	551.3820	440.7228	227.6344	77.1639	0.0000	0.0000	0.0000	0.0000	231.9753	500.0962	746.2115 (98)
Space heating												3490.2808 (98)
Space heating per m2										(98) / (4) =		36.1313 (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	3856.6639	(211)

[illegible]

Water heating

[illegible]

Electricity for pumps and fans:

(MEVDcentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)

mechanical ventilation fans (SFP = 0.2196)

central heating pump

main heating flue fan

pump for solar water heating

Total electricity for the above, kWh/year
Electricity for lighting (calculated in Appendix I)

Electricity for lighting (calculated in Appendix L)

Energy saving/generation technologies

Energy saving/generation technology
PV Unit 0 10 80 * 0 90 * 853 * 1 00

Total delivered energy for all uses

total delivered energy for all uses

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3856.6639	3.4800	134.2119 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	950.8048	3.4800	33.0880 (247)
Mechanical ventilation fans	65.3345	13.1900	8.6176 (249)
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	407.8905	13.1900	53.8008 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-614.1815	13.1900	-81.0105 (252)
Total energy cost			285.1953 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8459	(257)
SAP value		88.1994	
SAP rating (Section 12)		88	(258)
SAP band		B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	3856.6639	0.2160	833.0394 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	950.8048	0.2160	205.3738 (264)
Space and water heating			1038.4132 (265)
Pumps and fans	190.3345	0.5190	98.7836 (267)
Energy for lighting	407.8905	0.5190	211.6952 (268)
Energy saving/generation technologies			
PV Unit	-614.1815	0.5190	-318.7602 (269)
Total kg/year			1030.1318 (272)
CO2 emissions per m2			10.6600 (273)
EI value			90.2516
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
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											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.5100
Infiltration rate												0.2255 (18)
Number of sides sheltered												2 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1917 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate												
	0.2252	0.2108	0.2108	0.1917	0.1965	0.1869	0.1869	0.1821	0.1821	0.1965	0.1917	0.1965 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.2500	1.3258	21.5436		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	140.9000	18.2500	122.6500	0.2700	33.1155	150.0000	18397.4991 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			237.5000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.7681		(32)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 27039.5989 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							279.9130 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8622 (36)
Total fabric heat loss							(33) + (36) = 75.6303 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460 (38)
Heat transfer coeff	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762	115.8762 (39)
Average = Sum(39)m / 12 =												115.8762 (39)
HLP	Jan 1.1995	Feb 1.1995	Mar 1.1995	Apr 1.1995	May 1.1995	Jun 1.1995	Jul 1.1995	Aug 1.1995	Sep 1.1995	Oct 1.1995	Nov 1.1995	Dec 1.1995 (40)
HLP (average)												1.1995 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.3075	104.3691	100.4306	96.4922	92.5537	88.6153	88.6153	92.5537	96.4922	100.4306	104.3691	108.3075 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (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	14.1420	12.7624	14.1045	13.6055	14.0259	13.5353	13.9628	14.0037	13.5736	14.0715	13.6566	14.1299 (61)
Total heat required for water heating calculated for each month	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (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												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3079 (H8)
Utilisation factor												0.5345 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.4614 (H14)
Volume ratio Veff/V												0.7617 (H15)
Solar storage volume factor												0.9456 (H16)
Solar input												-900.3717 (H17)
Solar input	-29.3803	-41.7821	-72.5026	-97.5283	-113.3344	-123.2750	-116.8835	-106.5864	-83.4249	-57.6603	-34.7502	-23.2638 (63)
Solar input (sum of months) = Sum (63)m =												-900.3717 (63)
Output from w/h	145.3787	111.4570	86.5611	42.4562	21.9552	0.0000	0.0000	18.6867	42.7469	87.6337	122.1460	146.4151 (64)
Total per year (kWh/year) = Sum (64)m =												825.4366 (64)
Heat gains from water heating, kWh/month	56.9406	49.8991	51.7251	45.4224	43.8267	38.1771	35.7317	40.4980	40.8323	47.1494	51.0413	55.2525 (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	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.7411	51.2852	41.7079	31.5756	23.6031	19.9267	21.5315	27.9875	37.5648	47.6971	55.6696	59.3459	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	374.1957	378.0787	368.2937	347.4626	321.1671	296.4531	279.9425	276.0596	285.8446	306.6756	332.9711	357.6852	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	(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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	(71)
Water heating gains (Table 5)	76.5331	74.2546	69.5230	63.0867	58.9068	53.0237	48.0265	54.4328	56.7116	63.3728	70.8907	74.2641	(72)
Total internal gains	619.5250	614.6735	590.5796	553.1799	514.7321	480.4586	460.5557	469.5349	491.1760	528.8006	570.5865	602.3503	(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					6.6000	13.4684	0.4500	0.0000			0.7700	30.8009 (74)
East					5.5000	25.1733	0.4500	0.0000			0.7700	47.9739 (76)
South					3.5000	56.5862	0.4500	0.0000			0.7700	68.6249 (78)
West					0.6500	25.1733	0.4500	0.0000			0.7700	5.6696 (80)

Solar gains	153.0694	235.2891	361.3497	501.6139	570.2403	645.5841	590.4213	532.4957	428.3556	290.4705	185.6638	122.1762 (83)
Total gains	772.5944	849.9625	951.9292	1054.7937	1084.9724	1126.0426	1050.9770	1002.0306	919.5315	819.2711	756.2502	724.5264 (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)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	64.8192	
util living area	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	5.3213	
	0.9934	0.9885	0.9700	0.9070	0.7627	0.5166	0.3628	0.3689	0.6692	0.9212	0.9842	0.9949	(86)
MIT	20.1041	20.2090	20.4456	20.7301	20.9225	20.9919	20.9990	20.9990	20.9704	20.7563	20.3899	20.0732	(87)
Th 2	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	19.9204	(88)
util rest of house	0.9908	0.9841	0.9582	0.8719	0.6861	0.4115	0.2447	0.2451	0.5570	0.8810	0.9767	0.9929	(89)
MIT 2	19.1329	19.2362	19.4663	19.7281	19.8799	19.9182	19.9203	19.9203	19.9101	19.7579	19.4155	19.1025	(90)
Living area fraction	19.2636	19.3671	19.5980	19.8630	20.0202	20.0627	20.0654	20.0654	20.0528	19.8923	19.5466	19.2331	(91)
MIT													(92)
Temperature adjustment													(93)
adjusted MIT	19.1136	19.2171	19.4480	19.7130	19.8702	19.9127	19.9154	19.9154	19.9028	19.7423	19.3966	19.0831	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	0.9881	0.9801	0.9515	0.8638	0.6821	0.4107	0.2442	0.2445	0.5550	0.8726	0.9717	0.9906	(94)
Useful gains	763.3684	833.0736	905.7851	911.1606	740.0941	462.4953	256.6095	245.0255	510.3857	714.9281	734.8250	717.7422	(95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W	1565.9022	1531.5510	1372.9071	1113.9128	784.5042	464.9709	256.7168	245.1287	521.7695	885.5576	1251.0684	1550.7846	(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	597.0851	469.3768	347.5388	145.9816	33.0411	0.0000	0.0000	0.0000	0.0000	126.9484	371.6952	619.7836	(98)
Space heating												2711.4506	(98)
Space heating per m2											(98) / (4) =	28.0688	(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													2996.0780	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	597.0851	469.3768	347.5388	145.9816	33.0411	0.0000	0.0000	0.0000	0.0000	126.9484	371.6952	619.7836	(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)	659.7626	518.6484	384.0208	161.3056	36.5095	0.0000	0.0000	0.0000	0.0000	140.2744	410.7129	684.8437	(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	145.3787	111.4570	86.5611	42.4562	21.9552	0.0000	0.0000	18.6867	42.7469	87.6337	122.1460	146.4151	(64)	
Efficiency of water heater	89.8551	89.8679	89.8433	89.7587	89.1948	87.3000	87.3000	87.3000	87.3000	89.1652	89.6869	89.8705	(216)	
(217)m	89.8551	89.8679	89.8433	89.7587	89.1948	87.3000	87.3000	87.3000	87.3000	89.1652	89.6869	89.8705	(217)	
Fuel for water heating, kWh/month	161.7924	124.0231	96.3468	47.3004	24.6149	0.0000	0.0000	21.4052	48.9656	98.2823	136.1916	162.9178	(219)	
Water heating fuel used												921.8401	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2996.0780	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)														
mechanical ventilation fans (SFP = 0.2196)													65.3345	(230a)
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													190.3345	(231)
Electricity for lighting (calculated in Appendix L)													407.8905	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.90 * 966 * 1.00) =													-695.3672	(233)
Total delivered energy for all uses													3820.7759	(238)

10a. Fuel costs - using BEDF prices (519)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2996.0780	9.7400	291.8180	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	921.8401	9.7400	89.7872	(247)
Mechanical ventilation fans	65.3345	36.8500	24.0758	(249)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	407.8905	36.8500	150.3077	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-695.3672	36.8500	-256.2428	(252)
Total energy cost			449.8083	(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	2996.0780	0.2160	647.1528	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	921.8401	0.2160	199.1175	(264)
Space and water heating			846.2703	(265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Pumps and fans	190.3345	0.5190	98.7836 (267)
Energy for lighting	407.8905	0.5190	211.6952 (268)
Energy saving/generation technologies			
PV Unit	-695.3672	0.5190	-360.8956 (269)
Total kg/year			795.8535 (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	2996.0780	1.2200	3655.2152 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	921.8401	1.2200	1124.6449 (264)
Space and water heating			4779.8601 (265)
Pumps and fans	190.3345	3.0700	584.3270 (267)
Energy for lighting	407.8905	3.0700	1252.2239 (268)
Energy saving/generation technologies			
PV Unit	-695.3672	3.0700	-2134.7772 (269)
Primary energy kWh/year			4481.6337 (272)
Primary energy kWh/m2/year			46.3937 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	279.9 (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	321.97 (P1)
Transmission heat loss coefficient	75.63 (37)
Summer heat loss coefficient	397.60 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.6000	87.1704	0.4500	0.0000	0.9000	233.0066
East	5.5000	125.2818	0.4500	0.0000	0.9000	279.0652
South	3.5000	118.5567	0.4500	0.0000	0.9000	168.0541
West	0.6500	125.2818	0.4500	0.0000	0.9000	32.9804
total:						713.1063

Solar gains	Jun 768	Jul 713	Aug 629	(P4)
Internal gains	477	458	467	
Total summer gains	1245	1171	1096	(P5)
Summer gain/loss ratio	3.13	2.94	2.76	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 279.9)	0.04	0.04	0.04	
Threshold temperature	18.57	20.28	20.10	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 26	Issued on Date	14/06/2023
Assessment Reference	plot 26 ham	Prop Type Ref	21809
Property	1 Red Oak Road, Southampton, SO30 0AU		
SAP Rating	87 B	DER	14.62
Environmental	88 B	TER	18.18
CO ₂ Emissions (t/year)	0.99	% DER<TER	19.57
General Requirements Compliance	Pass	DFEE	51.30
		TFEE	55.84
		% DFEE<TFEE	8.14
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jspsustainability.co.uk		Assessor ID
			AU36-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

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)	18.18	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.62	kgCO ₂ /m ²	Pass
	-3.56 (-19.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.84	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	51.30	kWh/m ² /yr	
	-4.5 (-8.1%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.12 (max. 0.25)	0.12 (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	4.51 (measured in this dwelling)	
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 35 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
---------------------	---	------

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

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

Continuous extract system (decentralised)

Specific fan power

0.1600 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

6.60 m², No overhang

Windows facing East

5.50 m², No overhang

Windows facing South

3.50 m², No overhang

Windows facing West

0.65 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.51 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Roof U-value

0.11

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.00

W/m²K

Thermal bridging γ -value

0.033

W/m²K

Photovoltaic array

0.90

kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	Plot 26	Issued on Date	14/06/2023
Assessment Reference	plot 26 ham	Prop Type Ref	21809
Property	1 Red Oak Road, Southampton, SO30 0AU		
SAP Rating	87 B	DER	14.62
Environmental	88 B	TER	18.18
CO ₂ Emissions (t/year)	0.99	% DER<TER	19.57
General Requirements Compliance	Pass	DFEE	51.30
		TFEE	55.84
		% DFEE<TFEE	8.14
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jspsustainability.co.uk		Assessor ID
			AU36-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	East						
Property Tenure	Owner-occupied						
Transaction Type	Marketed sale						
Terrain Type	Suburban						
1.0 Property Type	House, Detached						
2.0 Number of Storeys	2						
3.0 Date Built	2021						
4.0 Sheltered Sides	2						
5.0 Sunlight/Shade	Average or unknown						
6.0 Measurements							
			Heat Loss Perimeter	Internal Floor Area	Average Storey Height		
		Ground Floor:	1.00 m	48.30 m ²	2.45 m		
		1st Storey:	1.00 m	48.30 m ²	2.60 m		
7.0 Living Area	13.00			m ²			
8.0 Thermal Mass Parameter	Precise calculation						
Thermal Mass	279.91			kJ/m ² K			
9.0 External Walls							
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
external	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure		0.27	150.00	140.90	122.65
9.2 Internal Walls							
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)	
stud	Plasterboard on timber frame				9.00	141.20	
block	Dense block, plasterboard on dabs				75.00	26.80	
10.0 External Roofs							
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
cold	External Plane Roof	Plasterboard, insulated at ceiling level		0.11	9.00	48.30	48.30
10.2 Internal Ceilings							
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)	
internal	Other				9.00	48.30	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
ground	Ground Floor - Solid	Suspended concrete floor, carpeted	0.12	75.00	48.30

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
internal	Plasterboard ceiling, carpeted chipboard floor	18.00	48.30

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
entrance	Manufacturer	Solid Door							1.00
front	BFRC data	Window	Double Low-E Soft 0.05			0.45			1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
entrance	Solid Door	[1] external	East							2.00	
front	Window	[1] external	East	None	0.00					5.50	
rear	Window	[1] external	West	None	0.00					0.65	
side	Window	[1] external	South	None	0.00					3.50	
side	Window	[1] external	North	None	0.00					6.60	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.70	0.300	No
Independently assessed	E3 Sill	9.00	0.015	No
Independently assessed	E4 Jamb	26.70	0.011	No
Independently assessed	E5 Ground floor (normal)	27.90	0.020	No
Independently assessed	E6 Intermediate floor within a dwelling	27.90	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	15.20	0.060	No
Independently assessed	E12 Gable (insulation at ceiling level)	12.70	0.063	No
Independently assessed	E16 Corner (normal)	20.20	0.067	No

Y-value 0.033 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.01	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	4.51	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	0.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500229
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count
0.16	Through Wall Fan Kitchen	1
0.18	In Room Fan Other Wet Room	4

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	20	
Total number of L.E.L. fittings	20	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
------------------------	----

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Percentage of Heat	100	%
Database Ref. No.	17929	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.5	
In Summer	87.3	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	Yes	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

SAP Code

29.0 Hot Water Cylinder

32.0 Photovoltaic Unit

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.90	West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£80	B 88	