

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 5				Issued on Date	18/08/2021
Assessment Reference	As Built	Prop Type Ref	Dh			
Property	4 Winchat Road, Botley, Southampton, SO32 2UF					
SAP Rating	86 B	DER	15.16	TER	15.74	
Environmental	86 B	% DER<TER	3.71			
CO ₂ Emissions (t/year)	1.84	DFEE	44.40	TFEE	55.04	
General Requirements Compliance	Pass	% DFEE<TFEE	19.33			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

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

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DWELLING AS BUILT

Detached House, total floor area 149 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) 15.74 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.16 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)44.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.24 (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

Worcester Greenstar 36CDi Compact ErP

Combi boiler

Efficiency: 89.8% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 9.82 m², Overhang twice as wide as window, ratio 0.56
Windows facing East: 1.44 m², No overhang
Windows facing South: 15.95 m², No overhang
Windows facing South West: 0.72 m², No overhang
Windows facing West: 2.15 m², No overhang
Windows facing North West: 0.72 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.029 W/m²K

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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	74.6300 (1b)	x 2.3900 (2b)	= 178.3657 (1b) - (3b)
First floor	74.4200 (1c)	x 2.6700 (2c)	= 198.7014 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 377.0671 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1061 (8)
Pressure test					Yes
Measured/design AP50					4.2400
Infiltration rate					0.3181 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3181 (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	0.4056	0.3976	0.3897	0.3499	0.3419	0.3022	0.3022	0.2942	0.3181	0.3419	0.3578	0.3737 (22b)
Effective ac	0.5822	0.5790	0.5759	0.5612	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5640	0.5698 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			30.8000	1.1450	35.2672		(27)
Ground Floor			74.6300	0.1100	8.2093	140.0000	10448.2000 (28a)
Brick and Block	184.4600	32.9200	151.5400	0.2400	36.3696	42.2200	6398.0188 (29a)
Pitched Roof	74.6300		74.6300	0.1000	7.4630	9.1000	679.1330 (30)
Total net area of external elements Aum(A, m ²)			333.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.6411		(33)
Ground Block			65.2500			75.0000	4893.7500 (32c)
Ground Stud			44.0300			9.0000	396.2700 (32c)
First Floor Block			50.8700			75.0000	3815.2500 (32c)
First Floor Stud			105.2600			9.0000	947.3400 (32c)
Internal Floor 1			72.4200			18.0000	1303.5600 (32d)
Internal Ceiling 1			74.6300			18.0000	1343.3400 (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) = 30224.8618 (34)
202.7834 (35)
9.6816 (36)
(33) + (36) = 99.3226 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	72.4490	72.0517	71.6622	69.8328	69.4905	67.8971	67.8971	67.6020	68.5109	69.4905	70.1829	70.9068 (38)
Average = Sum(39)m / 12 =	171.7717	171.3743	170.9848	169.1554	168.8131	167.2198	167.2198	166.9247	167.8335	168.8131	169.5055	170.2294 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1524	1.1498	1.1472	1.1349	1.1326	1.1219	1.1219	1.1199	1.1260	1.1326	1.1372	1.1421 (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												2.9327 (42)
Average daily hot water use (litres/day)												103.8515 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.2367	110.0826	105.9286	101.7745	97.6204	93.4664	93.4664	97.6204	101.7745	105.9286	110.0826	114.2367 (44)
	169.4097	148.1668	152.8949	133.2974	127.9021	110.3698	102.2738	117.3607	118.7623	138.4061	151.0810	164.0642 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1633.9888 (45)
Distribution loss (46)m = 0.15 x (45)m													
25.4115	22.2250	22.9342	19.9946	19.1853	16.5555	15.3411	17.6041	17.8144	20.7609	22.6622	24.6096 (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	27.5672	24.8980	27.5541	26.6467	27.5152	26.5976	27.4654	27.4977	26.6222	27.5303	26.6641 (61)		
Total heat required for water heating calculated for each month													
196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231 (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 (63)		
												Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h													
196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231 (64)		
												Total per year (kWh/year) = Sum(64)m =	1958.1061 (64)
Heat gains from water heating, kWh/month													
63.2205	55.4899	57.7261	50.9831	49.4062	43.3473	40.8724	45.8969	46.1440	52.9026	56.9005	61.4411 (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	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.5958	25.3985	20.6554	15.6375	11.6892	9.8685	10.6633	13.8606	18.6036	23.6215	27.5698	29.3905	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	319.4875	322.8027	314.4483	296.6628	274.2118	253.1110	239.0144	235.6991	244.0535	261.8390	284.2900	305.3908	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	(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)	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	(71)
Water heating gains (Table 5)	84.9738	82.5743	77.5888	70.8098	66.4062	60.2046	54.9360	61.6893	64.0889	71.1056	79.0284	82.5821	(72)
Total internal gains	503.0475	500.7660	482.6830	453.1006	422.2977	393.1746	374.6041	381.2394	396.7364	426.5566	460.8787	487.3539	(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				9.8200	10.6334	0.6300	0.7000		0.7700		31.9121 (74)	
East				1.4400	19.6403	0.6300	0.7000		0.7700		8.6433 (76)	
South				15.9500	46.7521	0.6300	0.7000		0.7700		227.8942 (78)	
Southwest				0.7200	36.7938	0.6300	0.7000		0.7700		8.0962 (79)	
West				2.1500	19.6403	0.6300	0.7000		0.7700		12.9050 (80)	
Northwest				0.7200	11.2829	0.6300	0.7000		0.7700		2.4827 (81)	
Solar gains	291.9335	495.2151	676.4552	843.3742	954.5399	953.3581	916.6572	831.9414	733.5048	546.5970	349.1895	250.2015 (83)
Total gains	794.9810	995.9811	1159.1382	1296.4748	1376.8376	1346.5327	1291.2613	1213.1808	1130.2413	973.1537	810.0682	737.5554 (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	48.8776	48.9910	49.1026	49.6336	49.7343	50.2082	50.2082	50.2969	50.0245	49.7343	49.5311	49.3205	
alpha	4.2585	4.2661	4.2735	4.3089	4.3156	4.3472	4.3472	4.3531	4.3350	4.3156	4.3021	4.2880	
util living area	0.9969	0.9917	0.9790	0.9438	0.8610	0.7098	0.5474	0.5982	0.8223	0.9635	0.9933	0.9978	(86)
MIT	19.4631	19.6879	20.0035	20.3883	20.7142	20.9147	20.9785	20.9686	20.8298	20.3918	19.8477	19.4242	(87)
Th 2	19.9582	19.9604	19.9625	19.9724	19.9743	19.9830	19.9830	19.9846	19.9796	19.9743	19.9705	19.9666	(88)
util rest of house	0.9961	0.9894	0.9728	0.9265	0.8177	0.6250	0.4312	0.4814	0.7537	0.9489	0.9911	0.9971	(89)
MIT 2	18.5533	18.7785	19.0922	19.4732	19.7728	19.9393	19.9764	19.9739	19.8792	19.4843	18.9465	18.5209	(90)
Living area fraction													
MIT	18.6734	18.8986	19.2125	19.5941	19.8971	20.0681	20.1087	20.1053	20.0047	19.6041	19.0655	18.6402	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6734	18.8986	19.2125	19.5941	19.8971	20.0681	20.1087	20.1053	20.0047	19.6041	19.0655	18.6402	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9945	0.9861	0.9670	0.9187	0.8139	0.6327	0.4462	0.4961	0.7556	0.9421	0.9883	0.9960	(94)	
Useful gains	790.6472	982.1502	1120.9116	1191.0587	1120.6234	851.9402	576.1878	601.9043	854.0291	916.7869	800.6126	734.5921	(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	2468.9485	2398.9962	2173.6510	1808.9592	1383.7800	914.3737	586.7191	618.4997	991.0013	1520.0173	2028.2172	2458.1463	(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	1248.6562	952.1205	783.2382	444.8884	195.7885	0.0000	0.0000	0.0000	0.0000	448.8034	883.8753	1282.3243	(98)	
Space heating												6239.6948	(98)	
Space heating per m2												(98) / (4) =	41.8631	(99)

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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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6879.4871 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1248.6562	952.1205	783.2382	444.8884	195.7885	0.0000	0.0000	0.0000	0.0000	448.8034	883.8753	1282.3243	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1376.6882	1049.7470	863.5481	490.5054	215.8638	0.0000	0.0000	0.0000	0.0000	494.8218	974.5042	1413.8085	(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	196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231	(64)
Efficiency of water heater (217)m	90.3080	90.2578	90.1622	89.9424	89.4392	87.9000	87.9000	87.9000	87.9000	89.9268	90.2188	87.9000	(216)
Fuel for water heating, kWh/month	218.1166	191.7450	200.1381	177.8296	173.7686	155.8218	147.5987	164.7991	165.3977	184.5239	197.0156	212.1462	(219)
Water heating fuel used												2188.9009	(219)
Annual totals kWh/year													
Space heating fuel - main system												6879.4871	(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)												505.0100	(232)
Total delivered energy for all uses												9648.3979	(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	6879.4871	0.2160	1485.9692	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2188.9009	0.2160	472.8026	(264)
Space and water heating			1958.7718	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	505.0100	0.5190	262.1002	(268)
Total CO2, kg/year			2259.7970	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1600	(273)

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

DER			15.1600	ZC1
Total Floor Area		TFA	149.0500	
Assumed number of occupants		N	2.9327	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			12.7019	ZC2
CO2 emissions from cooking, equation (L16)			1.2706	ZC3
Total CO2 emissions			29.1325	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			29.1325	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.6300 (1b)	x 2.3900 (2b)	= 178.3657 (1b) - (3b)
First floor	74.4200 (1c)	x 2.6700 (2c)	= 198.7014 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 377.0671 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1061 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3561 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3561 (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	0.4540	0.4451	0.4362	0.3917	0.3828	0.3383	0.3383	0.3294	0.3561	0.3828	0.4006	0.4184 (22b)
Effective ac	0.6031	0.5991	0.5951	0.5767	0.5733	0.5572	0.5572	0.5542	0.5634	0.5733	0.5802	0.5875 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			30.8000	1.3258	40.8333		(27)
Ground Floor			74.6300	0.1300	9.7019		(28a)
Brick and Block	184.4600	32.9200	151.5400	0.1800	27.2772		(29a)
Pitched Roof	74.6300		74.6300	0.1300	9.7019		(30)
Total net area of external elements Aum(A, m ²)			333.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	90.0583		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4430 (36)
Total fabric heat loss						(33) + (36) =	105.5013 (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	75.0401	74.5421	74.0540	71.7613	71.3324	69.3356	69.3356	68.9658	70.1047	71.3324	72.2001	73.1073 (38)
Heat transfer coeff	180.5414	180.0434	179.5553	177.2627	176.8337	174.8369	174.8369	174.4671	175.6060	176.8337	177.7015	178.6087 (39)
Average = Sum(39)m / 12 =												177.2606 (39)
HLP	1.2113	1.2079	1.2047	1.1893	1.1864	1.1730	1.1730	1.1705	1.1782	1.1864	1.1922	1.1983 (40)
HLP (average)												1.1893 (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												2.9327 (42)
Average daily hot water use (litres/day)												103.8515 (43)
Daily hot water use	114.2367	110.0826	105.9286	101.7745	97.6204	93.4664	93.4664	97.6204	101.7745	105.9286	110.0826	114.2367 (44)
Energy conte	169.4097	148.1668	152.8949	133.2974	127.9021	110.3698	102.2738	117.3607	118.7623	138.4061	151.0810	164.0642 (45)
Energy content (annual)										Total = Sum(45)m =		1633.9888 (45)
Distribution loss (46)m = 0.15 x (45)m	25.4115	22.2250	22.9342	19.9946	19.1853	16.5555	15.3411	17.6041	17.8144	20.7609	22.6622	24.6096 (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												

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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	49.3151	49.7463	46.0930	47.6294	49.7463	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	220.3686	194.1942	203.8538	182.6125	177.6484	156.4628	149.9032	167.1070	168.0774	189.3650	200.3961	215.0231 (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	220.3686	194.1942	203.8538	182.6125	177.6484	156.4628	149.9032	167.1070	168.0774	189.3650	200.3961	215.0231 (64)
	69.0684	60.7723	63.5773	56.6502	54.9640	48.2212	45.9134	51.4590	51.8172	58.7597	62.5632	67.2911 (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	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.5958	25.3985	20.6554	15.6375	11.6892	9.8685	10.6633	13.8606	18.6036	23.6215	27.5698	29.3905	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	319.4875	322.8027	314.4483	296.6628	274.2118	253.1110	239.0144	235.6991	244.0535	261.8390	284.2900	305.3908	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	(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)	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	(71)
Water heating gains (Table 5)	92.8339	90.4350	85.4533	78.6808	73.8764	66.9739	61.7116	69.1653	71.9684	78.9782	86.8934	90.4450	(72)
Total internal gains	510.9076	508.6267	490.5475	460.9715	429.7678	399.9438	381.3796	388.7154	404.6159	434.4291	468.7437	495.2168	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	9.8200	10.6334	0.6300	0.7000	0.7700	31.9121 (74)
East	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433 (76)
South	15.9500	46.7521	0.6300	0.7000	0.7700	227.8942 (78)
Southwest	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962 (79)
West	2.1500	19.6403	0.6300	0.7000	0.7700	12.9050 (80)
Northwest	0.7200	11.2829	0.6300	0.7000	0.7700	2.4827 (81)

Solar gains	291.9335	495.2151	676.4552	843.3742	954.5399	953.3581	916.6572	831.9414	733.5048	546.5970	349.1895	250.2015	(83)
Total gains	802.8411	1003.8418	1167.0027	1304.3457	1384.3077	1353.3020	1298.0368	1220.6568	1138.1207	981.0262	817.9331	745.4183	(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	57.3314	57.4900	57.6463	58.3918	58.5335	59.2020	59.2020	59.3275	58.9427	58.5335	58.2477	57.9518	
alpha	4.8221	4.8327	4.8431	4.8928	4.9022	4.9468	4.9468	4.9552	4.9295	4.9022	4.8832	4.8635	
util living area	0.9988	0.9961	0.9886	0.9637	0.8934	0.7443	0.5737	0.6268	0.8563	0.9780	0.9970	0.9991	(86)
MIT	19.6209	19.8161	20.0954	20.4445	20.7448	20.9299	20.9845	20.9765	20.8513	20.4494	19.9654	19.5910	(87)
Th 2	19.9110	19.9137	19.9163	19.9286	19.9309	19.9417	19.9417	19.9437	19.9375	19.9309	19.9262	19.9213	(88)
util rest of house	0.9983	0.9947	0.9844	0.9494	0.8507	0.6517	0.4453	0.4977	0.7851	0.9668	0.9957	0.9988	(89)
MIT 2	18.0702	18.3570	18.7647	19.2719	19.6761	19.8939	19.9359	19.9338	19.8167	19.2877	18.5847	18.0337	(90)
Living area fraction	18.2749	18.5497	18.9404	19.4267	19.8172	20.0307	20.0744	20.0715	19.9533	19.4411	18.7670	18.2393	(91)
Temperature adjustment	18.2749	18.5497	18.9404	19.4267	19.8172	20.0307	20.0744	20.0715	19.9533	19.4411	18.7670	18.2393	(92)
adjusted MIT	18.2749	18.5497	18.9404	19.4267	19.8172	20.0307	20.0744	20.0715	19.9533	19.4411	18.7670	18.2393	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	800.6492	995.9553	1142.4317	1226.8734	1170.1027	893.6146	599.8117	627.8134	894.9970	941.2770	812.6344	743.9820	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2523.0500	2457.5312	2233.7447	1865.9997	1435.4018	949.4908	607.4478	640.5566	1027.8815	1563.3985	2073.2422	2507.5434	(97)
Month fracti	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 kWh	1281.4662	982.1790	811.9369	460.1709	197.3825	0.0000	0.0000	0.0000	0.0000	462.8584	907.6376	1312.0897	(98)
Space heating												6415.7212	(98)
Space heating per m2												43.0441	(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													6869.0806 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1281.4662	982.1790	811.9369	460.1709	197.3825	0.0000	0.0000	0.0000	0.0000	462.8584	907.6376	1312.0897	(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)	1372.0195	1051.5835	869.3114	492.6884	211.3303	0.0000	0.0000	0.0000	0.0000	495.5657	971.7748	1404.8069	(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	220.3686	194.1942	203.8538	182.6125	177.6484	156.4628	149.9032	167.1070	168.0774	189.3650	200.3961	215.0231	(64)
Efficiency of water heater (217)m	88.7618	88.5612	88.1743	87.2812	85.3168	80.3000	80.3000	80.3000	80.3000	87.2151	88.3893	88.8269	(216)
Fuel for water heating, kWh/month	248.2696	219.2769	231.1940	209.2233	208.2220	194.8478	186.6790	208.1034	209.3119	217.1242	226.7198	242.0699	(219)
Water heating fuel used												2601.0416	(219)
Annual totals kWh/year													
Space heating fuel - main system												6869.0806	(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)												505.0100	(232)
Total delivered energy for all uses												10050.1321	(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	6869.0806	0.2160	1483.7214 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2601.0416	0.2160	561.8250 (264)
Space and water heating			2045.5464 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	505.0100	0.5190	262.1002 (268)
Total CO2, kg/m2/year			2346.5716 (272)
Emissions per m2 for space and water heating			13.7239 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.7585 (272b)
Emissions per m2 for pumps and fans			0.2612 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7239 * 1.00) + 1.7585 + 0.2612, rounded to 2 d.p.			15.7400 (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	74.6300 (1b)	x 2.3900 (2b)	= 178.3657 (1b) - (3b)
First floor	74.4200 (1c)	x 2.6700 (2c)	= 198.7014 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 377.0671 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1061 (8)
Pressure test					Yes
Measured/design AP50					4.2400
Infiltration rate					0.3181 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3181 (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	0.4056	0.3976	0.3897	0.3499	0.3419	0.3022	0.3022	0.2942	0.3181	0.3419	0.3578	0.3737 (22b)
Effective ac	0.5822	0.5790	0.5759	0.5612	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5640	0.5698 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			30.8000	1.1450	35.2672		(27)
Ground Floor			74.6300	0.1100	8.2093	140.0000	10448.2000 (28a)
Brick and Block	184.4600	32.9200	151.5400	0.2400	36.3696	42.2200	6398.0188 (29a)
Pitched Roof	74.6300		74.6300	0.1000	7.4630	9.1000	679.1330 (30)
Total net area of external elements Aum(A, m ²)			333.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.6411		(33)
Ground Block			65.2500			75.0000	4893.7500 (32c)
Ground Stud			44.0300			9.0000	396.2700 (32c)
First Floor Block			50.8700			75.0000	3815.2500 (32c)
First Floor Stud			105.2600			9.0000	947.3400 (32c)
Internal Floor 1			72.4200			18.0000	1303.5600 (32d)
Internal Ceiling 1			74.6300			9.0000	671.6700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	29553.1918 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							198.2770 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6816 (36)
Total fabric heat loss						(33) + (36) =	99.3226 (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	72.4490	72.0517	71.6622	69.8328	69.4905	67.8971	67.8971	67.6020	68.5109	69.4905	70.1829	70.9068 (38)
Heat transfer coeff	171.7717	171.3743	170.9848	169.1554	168.8131	167.2198	167.2198	166.9247	167.8335	168.8131	169.5055	170.2294 (39)
Average = Sum(39)m / 12 =												169.1538 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1524	1.1498	1.1472	1.1349	1.1326	1.1219	1.1219	1.1199	1.1260	1.1326	1.1372	1.1421 (40)
HLP (average)												1.1349 (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												2.9327 (42)
Average daily hot water use (litres/day)												103.8515 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.2367	110.0826	105.9286	101.7745	97.6204	93.4664	93.4664	97.6204	101.7745	105.9286	110.0826	114.2367 (44)
Energy conte	169.4097	148.1668	152.8949	133.2974	127.9021	110.3698	102.2738	117.3607	118.7623	138.4061	151.0810	164.0642 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1633.9888 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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	35.9996	31.4854	32.4902	28.3257	27.1792	23.4536	21.7332	24.9391	25.2370	29.4113	32.1047	34.8636 (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	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.5958	25.3985	20.6554	15.6375	11.6892	9.8685	10.6633	13.8606	18.6036	23.6215	27.5698	29.3905	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	319.4875	322.8027	314.4483	296.6628	274.2118	253.1110	239.0144	235.6991	244.0535	261.8390	284.2900	305.3908	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	(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)	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	(71)
Water heating gains (Table 5)	48.3865	46.8533	43.6696	39.3413	36.5312	32.5744	29.2113	33.5204	35.0514	39.5313	44.5899	46.8597	(72)
Total internal gains	463.4602	462.0450	445.7638	418.6320	389.4226	362.5444	345.8793	350.0704	364.6989	391.9823	423.4402	448.6315	(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				9.8200	10.6334	0.6300	0.7000		0.7700		31.9121 (74)	
East				1.4400	19.6403	0.6300	0.7000		0.7700		8.6433 (76)	
South				15.9500	46.7521	0.6300	0.7000		0.7700		227.8942 (78)	
Southwest				0.7200	36.7938	0.6300	0.7000		0.7700		8.0962 (79)	
West				2.1500	19.6403	0.6300	0.7000		0.7700		12.9050 (80)	
Northwest				0.7200	11.2829	0.6300	0.7000		0.7700		2.4827 (81)	
Solar gains	291.9335	495.2151	676.4552	843.3742	954.5399	953.3581	916.6572	831.9414	733.5048	546.5970	349.1895	250.2015 (83)
Total gains	755.3937	957.2602	1122.2190	1262.0062	1343.9625	1315.9025	1262.5365	1182.0119	1098.2037	938.5793	772.6297	698.8330 (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	47.7915	47.9023	48.0114	48.5306	48.6290	49.0924	49.0924	49.1792	48.9129	48.6290	48.4304	48.2244	
alpha	4.1861	4.1935	4.2008	4.2354	4.2419	4.2728	4.2728	4.2786	4.2609	4.2419	4.2287	4.2150	
util living area	0.9972	0.9923	0.9801	0.9463	0.8664	0.7187	0.5571	0.6096	0.8308	0.9661	0.9940	0.9980	(86)
MIT	19.4074	19.6370	19.9602	20.3556	20.6933	20.9056	20.9754	20.9641	20.8139	20.3581	19.8003	19.3682	(87)
Th 2	19.9582	19.9604	19.9625	19.9724	19.9743	19.9830	19.9830	19.9846	19.9796	19.9743	19.9705	19.9666	(88)
util rest of house	0.9965	0.9901	0.9743	0.9299	0.8245	0.6347	0.4399	0.4923	0.7643	0.9526	0.9920	0.9975	(89)
MIT 2	18.4999	18.7301	19.0516	19.4438	19.7560	19.9338	19.9752	19.9721	19.8680	19.4537	18.9015	18.4673	(90)
Living area fraction	18.6197	18.8498	19.1716	19.5642	19.8798	20.0621	20.1073	20.1031	19.9929	19.5731	19.0202	18.5862	(92)
Temperature adjustment	18.6197	18.8498	19.1716	19.5642	19.8798	20.0621	20.1073	20.1031	19.9929	19.5731	19.0202	18.5862	(93)
adjusted MIT	18.6197	18.8498	19.1716	19.5642	19.8798	20.0621	20.1073	20.1031	19.9929	19.5731	19.0202	18.5862	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9950	0.9870	0.9686	0.9218	0.8200	0.6419	0.4550	0.5068	0.7653	0.9456	0.9893	0.9964	(94)
Ext temp.	751.6480	944.7922	1086.9501	1163.3088	1102.0806	844.6478	574.4104	599.1017	840.4332	887.5602	764.3866	696.3003	(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	2459.7253	2390.6385	2166.6448	1803.9026	1380.8495	913.3726	586.4853	618.1327	989.0210	1514.7807	2020.5321	2448.9629	(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 per m2	1270.8095	971.6087	803.2929	461.2275	207.4040	0.0000	0.0000	0.0000	0.0000	466.6521	904.4248	1303.9809	(98)
												6389.4005	(98)
												42.8675	(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
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1571.8657	1237.4262	1268.6276	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8326	0.8978	0.8731	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1308.6982	1111.0029	1107.6150	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1663.5208	1598.2076	1506.5433	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	255.4723	362.4803	296.8026	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			914.7552	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor	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	63.8681	90.6201	74.2007	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												228.6888	(107)
Energy for space heating												1.5343	(108)
Energy for space cooling												42.8675	(99)
Total												1.5343	(108)
Dwelling Fabric Energy Efficiency (DFEE)												44.4018	(109)
												44.4	(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	74.6300 (1b)	x 2.3900 (2b)	= 178.3657 (1b) - (3b)
First floor	74.4200 (1c)	x 2.6700 (2c)	= 198.7014 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 377.0671 (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																4 * 10 =	40.0000 (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) =					40.0000	/ (5) =	0.1061 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3561 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3561	(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	0.4540	0.4451	0.4362	0.3917	0.3828	0.3383	0.3383	0.3294	0.3561	0.3828	0.4006	0.4184	(22b)				
Effective ac	0.6031	0.5991	0.5951	0.5767	0.5733	0.5572	0.5572	0.5542	0.5634	0.5733	0.5802	0.5875	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)				
TER Opening Type (Uw = 1.40)			30.8000	1.3258	40.8333			(27)				
Ground Floor			74.6300	0.1300	9.7019			(28a)				
Brick and Block	184.4600	32.9200	151.5400	0.1800	27.2772			(29a)				
Pitched Roof	74.6300		74.6300	0.1300	9.7019			(30)				
Total net area of external elements Aum(A, m2)			333.7200					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	90.0583			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								15.4430 (36)				
Total fabric heat loss						(33) + (36) =		105.5013 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 75.0401	Feb 74.5421	Mar 74.0540	Apr 71.7613	May 71.3324	Jun 69.3356	Jul 69.3356	Aug 68.9658	Sep 70.1047	Oct 71.3324	Nov 72.2001	Dec 73.1073 (38)
Heat transfer coeff	180.5414	180.0434	179.5553	177.2627	176.8337	174.8369	174.8369	174.4671	175.6060	176.8337	177.7015	178.6087 (39)
Average = Sum(39)m / 12 =												177.2606 (39)
HLP	Jan 1.2113	Feb 1.2079	Mar 1.2047	Apr 1.1893	May 1.1864	Jun 1.1730	Jul 1.1730	Aug 1.1705	Sep 1.1782	Oct 1.1864	Nov 1.1922	Dec 1.1983 (40)
HLP (average)												1.1893 (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													2.9327 (42)
Average daily hot water use (litres/day)													103.8515 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2367	110.0826	105.9286	101.7745	97.6204	93.4664	93.4664	97.6204	101.7745	105.9286	110.0826	114.2367 (44)	
Energy content (annual)	169.4097	148.1668	152.8949	133.2974	127.9021	110.3698	102.2738	117.3607	118.7623	138.4061	151.0810	164.0642 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1633.9888 (45)	
	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													

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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)
	35.9996	31.4854	32.4902	28.3257	27.1792	23.4536	21.7332	24.9391	25.2370	29.4113	32.1047	34.8636 (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	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348	146.6348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.5958	25.3985	20.6554	15.6375	11.6892	9.8685	10.6633	13.8606	18.6036	23.6215	27.5698	29.3905 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	319.4875	322.8027	314.4483	296.6628	274.2118	253.1110	239.0144	235.6991	244.0535	261.8390	284.2900	305.3908 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635	37.6635 (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)	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078 (71)
Water heating gains (Table 5)	48.3865	46.8533	43.6696	39.3413	36.5312	32.5744	29.2113	33.5204	35.0514	39.5313	44.5899	46.8597 (72)
Total internal gains	463.4602	462.0450	445.7638	418.6320	389.4226	362.5444	345.8793	350.0704	364.6989	391.9823	423.4402	448.6315 (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	9.8200	10.6334	0.6300	0.7000	0.7700	31.9121 (74)
East	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433 (76)
South	15.9500	46.7521	0.6300	0.7000	0.7700	227.8942 (78)
Southwest	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962 (79)
West	2.1500	19.6403	0.6300	0.7000	0.7700	12.9050 (80)
Northwest	0.7200	11.2829	0.6300	0.7000	0.7700	2.4827 (81)

Solar gains	291.9335	495.2151	676.4552	843.3742	954.5399	953.3581	916.6572	831.9414	733.5048	546.5970	349.1895	250.2015 (83)
Total gains	755.3937	957.2602	1122.2190	1262.0062	1343.9625	1315.9025	1262.5365	1182.0119	1098.2037	938.5793	772.6297	698.8330 (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	57.3314	57.4900	57.6463	58.3918	58.5335	59.2020	59.2020	59.3275	58.9427	58.5335	58.2477	57.9518
alpha	4.8221	4.8327	4.8431	4.8928	4.9022	4.9468	4.9468	4.9552	4.9295	4.9022	4.8832	4.8635
util living area	0.9991	0.9968	0.9903	0.9679	0.9024	0.7581	0.5876	0.6434	0.8695	0.9815	0.9976	0.9994 (86)
MIT	19.5915	19.7876	20.0690	20.4223	20.7297	20.9238	20.9828	20.9736	20.8390	20.4255	19.9375	19.5620 (87)
Th 2	19.9110	19.9137	19.9163	19.9286	19.9309	19.9417	19.9417	19.9437	19.9375	19.9309	19.9262	19.9213 (88)
util rest of house	0.9987	0.9957	0.9866	0.9549	0.8619	0.6663	0.4572	0.5128	0.8015	0.9719	0.9966	0.9991 (89)
MIT 2	18.6248	18.8225	19.1041	19.4595	19.7449	19.9058	19.9373	19.9360	19.8467	19.4690	18.9825	18.6036 (90)
Living area fraction									fLA = Living area / (4) =			0.1320 (91)
MIT	18.7525	18.9499	19.2315	19.5866	19.8749	20.0402	20.0753	20.0730	19.9777	19.5953	19.1086	18.7301 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7525	18.9499	19.2315	19.5866	19.8749	20.0402	20.0753	20.0730	19.9777	19.5953	19.1086	18.7301 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9982	0.9943	0.9835	0.9496	0.8594	0.6758	0.4745	0.5299	0.8046	0.9677	0.9955	0.9988 (94)
Useful gains	754.0319	951.8084	1103.7175	1198.4632	1154.9393	889.2439	599.0414	626.3201	883.5782	908.2553	769.1677	697.9678 (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	2609.2658	2529.6007	2286.0137	1894.3361	1445.6023	951.1497	607.6123	640.8229	1032.1578	1590.6766	2133.9497	2595.2103 (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	1380.2940	1060.2765	879.6283	501.0285	216.2533	0.0000	0.0000	0.0000	0.0000	507.7214	982.6431	1411.5484 (98)
Space heating												6939.3936 (98)
Space heating per m2										(98) / (4) =		46.5575 (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	1643.4669	1293.7931	1325.9502	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8368	0.9064	0.8804	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1375.3291	1172.6767	1167.4162	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1663.5208	1598.2076	1506.5433	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)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	207.4980	316.5950	252.3105	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												776.4036 (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	51.8745	79.1488	63.0776	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												194.1009 (107)
Space cooling per m2												1.3023 (108)
Energy for space heating												46.5575 (99)
Energy for space cooling												1.3023 (108)
Total												47.8597 (109)
Target Fabric Energy Efficiency (TFEE)												55.0 (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	74.6300 (1b)	x 2.3900 (2b)	= 178.3657 (1b) - (3b)
First floor	74.4200 (1c)	x 2.6700 (2c)	= 198.7014 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 377.0671 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1061 (8)
Pressure test					Yes
Measured/design AP50					4.2400
Infiltration rate					0.3181 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3181 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3340	0.3101	0.3181	0.3022	0.3022	0.2942	0.2863	0.2783	0.2704	0.2942	0.2783	0.2942 (22b)
	0.5558	0.5481	0.5506	0.5457	0.5457	0.5433	0.5410	0.5387	0.5365	0.5433	0.5387	0.5433 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			30.8000	1.1450	35.2672		(27)
Ground Floor			74.6300	0.1100	8.2093	140.0000	10448.2000 (28a)
Brick and Block	184.4600	32.9200	151.5400	0.2400	36.3696	42.2200	6398.0188 (29a)
Pitched Roof	74.6300		74.6300	0.1000	7.4630	9.1000	679.1330 (30)
Total net area of external elements Aum(A, m ²)			333.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.6411		(33)
Ground Block			65.2500			75.0000	4893.7500 (32c)
Ground Stud			44.0300			9.0000	396.2700 (32c)
First Floor Block			50.8700			75.0000	3815.2500 (32c)
First Floor Stud			105.2600			9.0000	947.3400 (32c)
Internal Floor 1			72.4200			18.0000	1303.5600 (32d)
Internal Ceiling 1			74.6300			18.0000	1343.3400 (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 (33) + (36) = 99.3226 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	69.1561	68.2000	68.5109	67.8971	67.8971	67.6020	67.3148	67.0355	66.7640	67.6020	67.0355	67.6020 (38)
Average = Sum(39)m / 12 =	168.4787	167.5227	167.8335	167.2198	167.2198	166.9247	166.6375	166.3582	166.0867	166.9247	166.3582	166.9247 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1304	1.1239	1.1260	1.1219	1.1219	1.1199	1.1180	1.1161	1.1143	1.1199	1.1161	1.1199 (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												2.9327 (42)
Average daily hot water use (litres/day)												103.8515 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.2367	110.0826	105.9286	101.7745	97.6204	93.4664	93.4664	97.6204	101.7745	105.9286	110.0826	114.2367 (44)
	169.4097	148.1668	152.8949	133.2974	127.9021	110.3698	102.2738	117.3607	118.7623	138.4061	151.0810	164.0642 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1633.9888 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.4115	22.2250	22.9342	19.9946	19.1853	16.5555	15.3411	17.6041	17.8144	20.7609	22.6622	24.6096 (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	27.5672	24.8980	27.5541	26.6467	27.5152	26.5976	27.4654	27.4977	26.6222	27.5303	26.6641	27.5588 (61)
Total heat required for water heating calculated for each month	196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231 (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)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	63.2205	55.4899	57.7261	50.9831	49.4062	43.3473	40.8724	45.8969	46.1440	52.9026	56.9005	61.4411 (65)
												1958 (64)
												1958 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.4894	63.4962	51.6386	39.0938	29.2230	24.6713	26.6582	34.6514	46.5090	59.0539	68.9246	73.4763	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	476.8470	481.7951	469.3259	442.7803	409.2713	377.7776	356.7378	351.7897	364.2589	390.8045	424.3135	455.8072	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	(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)	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	(71)
Water heating gains (Table 5)	84.9738	82.5743	77.5888	70.8098	66.4062	60.2046	54.9360	61.6893	64.0889	71.1056	79.0284	82.5821	(72)
Total internal gains	750.4929	745.0485	715.7361	669.8667	622.0834	579.8363	555.5149	565.3131	592.0396	638.1468	689.4493	729.0484	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	9.8200	13.4839	0.6300	0.7000	0.7700	40.4668 (74)
East	1.4400	25.1925	0.6300	0.7000	0.7700	11.0868 (76)
South	15.9500	56.7559	0.6300	0.7000	0.7700	276.6580 (78)
Southwest	0.7200	45.1778	0.6300	0.7000	0.7700	9.9410 (79)
West	2.1500	25.1925	0.6300	0.7000	0.7700	16.5532 (80)
Northwest	0.7200	14.6176	0.6300	0.7000	0.7700	3.2165 (81)

Solar gains	357.9223	516.8680	714.1721	903.0158	978.7671	1065.4403	1014.9402	938.0488	820.1603	615.9988	426.6951	301.6011 (83)
Total gains	1108.4152	1261.9165	1429.9082	1572.8825	1600.8505	1645.2766	1570.4551	1503.3619	1412.2000	1254.1456	1116.1443	1030.6495 (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	49.8330	50.1174	50.0245	50.2082	50.2082	50.2969	50.3836	50.4682	50.5507	50.2969	50.4682	50.2969
alpha	4.3222	4.3412	4.3350	4.3472	4.3472	4.3531	4.3589	4.3645	4.3700	4.3531	4.3645	4.3531
util living area	0.9875	0.9781	0.9511	0.8846	0.7617	0.5546	0.4086	0.4252	0.6762	0.8977	0.9730	0.9902 (86)
MIT	19.7966	19.9603	20.2632	20.6038	20.8495	20.9709	20.9939	20.9929	20.9318	20.6446	20.1843	19.7698 (87)
Th 2	19.9761	19.9813	19.9796	19.9830	19.9830	19.9846	19.9862	19.9877	19.9892	19.9846	19.9877	19.9846 (88)
util rest of house	0.9842	0.9723	0.9380	0.8542	0.7018	0.4653	0.3050	0.3180	0.5900	0.8631	0.9644	0.9875 (89)
MIT 2	18.9982	19.0634	19.3564	19.6779	19.8877	19.9724	19.9847	19.9860	19.9554	19.7232	19.2905	18.8786 (90)
Living area fraction	19.0168	19.1818	19.4761	19.8002	20.0147	20.1042	20.1180	20.1190	20.0843	19.8449	19.4085	18.9963 (91)
MIT	19.0168	19.1818	19.4761	19.8002	20.0147	20.1042	20.1180	20.1190	20.0843	19.8449	19.4085	18.9963 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0168	19.1818	19.4761	19.8002	20.0147	20.1042	20.1180	20.1190	20.0843	19.8449	19.4085	18.9963 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9800	0.9665	0.9302	0.8479	0.7038	0.4762	0.3187	0.3322	0.5987	0.8574	0.9581	0.9839 (94)
Useful gains	1086.2031	1219.6813	1330.0788	1333.6935	1126.6905	783.5461	500.5131	499.4264	845.5406	1075.3211	1069.3937	1014.1039 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	2378.3871	2325.5150	2093.9135	1722.3945	1256.6033	801.9402	502.9074	502.2273	894.2647	1409.6623	1914.5325	2336.3283 (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	961.3849	743.1202	568.2931	279.8647	96.6551	0.0000	0.0000	0.0000	0.0000	248.7499	608.4999	983.7349 (98)
Space heating												4490.3027 (98)
RHI space heating demand												4490 (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	74.6300 (1b)	x 2.3900 (2b)	= 178.3657 (1b) - (3b)
First floor	74.4200 (1c)	x 2.6700 (2c)	= 198.7014 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 377.0671 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1061 (8)
Pressure test					Yes
Measured/design AP50					4.2400
Infiltration rate					0.3181 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3181 (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	0.4056	0.3976	0.3897	0.3499	0.3419	0.3022	0.3022	0.2942	0.3181	0.3419	0.3578	0.3737 (22b)
Effective ac	0.5822	0.5790	0.5759	0.5612	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5640	0.5698 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			30.8000	1.1450	35.2672		(27)
Ground Floor			74.6300	0.1100	8.2093	140.0000	10448.2000 (28a)
Brick and Block	184.4600	32.9200	151.5400	0.2400	36.3696	42.2200	6398.0188 (29a)
Pitched Roof	74.6300		74.6300	0.1000	7.4630	9.1000	679.1330 (30)
Total net area of external elements Aum(A, m ²)			333.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.6411		(33)
Ground Block			65.2500			75.0000	4893.7500 (32c)
Ground Stud			44.0300			9.0000	396.2700 (32c)
First Floor Block			50.8700			75.0000	3815.2500 (32c)
First Floor Stud			105.2600			9.0000	947.3400 (32c)
Internal Floor 1			72.4200			18.0000	1303.5600 (32d)
Internal Ceiling 1			74.6300			18.0000	1343.3400 (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) = 30224.8618 (34)
202.7834 (35)
9.6816 (36)
(33) + (36) = 99.3226 (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	72.4490	72.0517	71.6622	69.8328	69.4905	67.8971	67.8971	67.6020	68.5109	69.4905	70.1829	70.9068 (38)
Heat transfer coeff	171.7717	171.3743	170.9848	169.1554	168.8131	167.2198	167.2198	166.9247	167.8335	168.8131	169.5055	170.2294 (39)
Average = Sum(39)m / 12 =												169.1538 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1524	1.1498	1.1472	1.1349	1.1326	1.1219	1.1219	1.1199	1.1260	1.1326	1.1372	1.1421 (40)
HLP (average)												1.1349 (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
Average daily hot water use (litres/day)
2.9327 (42)
103.8515 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.2367	110.0826	105.9286	101.7745	97.6204	93.4664	93.4664	97.6204	101.7745	105.9286	110.0826	114.2367 (44)
Energy conte	169.4097	148.1668	152.8949	133.2974	127.9021	110.3698	102.2738	117.3607	118.7623	138.4061	151.0810	164.0642 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1633.9888 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.4115	22.2250	22.9342	19.9946	19.1853	16.5555	15.3411	17.6041	17.8144	20.7609	22.6622	24.6096	(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	27.5672	24.8980	27.5541	26.6467	27.5152	26.5976	27.4654	27.4977	26.6222	27.5303	26.6641	27.5588 (61)
Total heat required for water heating calculated for each month												
196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231	(64)
Heat gains from water heating, kWh/month												
63.2205	55.4899	57.7261	50.9831	49.4062	43.3473	40.8724	45.8969	46.1440	52.9026	56.9005	61.4411	(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	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.4894	63.4962	51.6386	39.0938	29.2230	24.6713	26.6582	34.6514	46.5090	59.0539	68.9246	73.4763	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	476.8470	481.7951	469.3259	442.7803	409.2713	377.7776	356.7378	351.7897	364.2589	390.8045	424.3135	455.8072	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	(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)	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	(71)
Water heating gains (Table 5)	84.9738	82.5743	77.5888	70.8098	66.4062	60.2046	54.9360	61.6893	64.0889	71.1056	79.0284	82.5821	(72)
Total internal gains	750.4929	745.0485	715.7361	669.8667	622.0834	579.8363	555.5149	565.3131	592.0396	638.1468	689.4493	729.0484	(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				9.8200	10.6334	0.6300	0.7000		0.7700		31.9121 (74)	
East				1.4400	19.6403	0.6300	0.7000		0.7700		8.6433 (76)	
South				15.9500	46.7521	0.6300	0.7000		0.7700		227.8942 (78)	
Southwest				0.7200	36.7938	0.6300	0.7000		0.7700		8.0962 (79)	
West				2.1500	19.6403	0.6300	0.7000		0.7700		12.9050 (80)	
Northwest				0.7200	11.2829	0.6300	0.7000		0.7700		2.4827 (81)	
Solar gains	291.9335	495.2151	676.4552	843.3742	954.5399	953.3581	916.6572	831.9414	733.5048	546.5970	349.1895	250.2015 (83)
Total gains	1042.4264	1240.2636	1392.1913	1513.2409	1576.6233	1533.1945	1472.1721	1397.2546	1325.5445	1184.7438	1038.6388	979.2499 (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	48.8776	48.9910	49.1026	49.6336	49.7343	50.2082	50.2082	50.2969	50.0245	49.7343	49.5311	49.3205
alpha	4.2585	4.2661	4.2735	4.3089	4.3156	4.3472	4.3472	4.3531	4.3350	4.3156	4.3021	4.2880
util living area	0.9914	0.9816	0.9609	0.9112	0.8102	0.6463	0.4872	0.5305	0.7540	0.9320	0.9833	0.9933 (86)
MIT	19.6415	19.8580	20.1540	20.5037	20.7824	20.9409	20.9862	20.9802	20.8819	20.5157	20.0086	19.5999 (87)
Th 2	19.9582	19.9604	19.9625	19.9724	19.9743	19.9830	19.9830	19.9846	19.9796	19.9743	19.9705	19.9666 (88)
util rest of house	0.9891	0.9767	0.9504	0.8869	0.7597	0.5617	0.3805	0.4221	0.6777	0.9082	0.9781	0.9915 (89)
MIT 2	18.7304	18.9459	19.2371	19.5780	19.8263	19.9540	19.9789	19.9782	19.9138	19.5978	19.1047	18.6957 (90)
Living area fraction												
MIT	18.8507	19.0663	19.3582	19.7002	19.9526	20.0843	20.1119	20.1105	20.0416	19.7190	19.2240	18.8151 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8507	19.0663	19.3582	19.7002	19.9526	20.0843	20.1119	20.1105	20.0416	19.7190	19.2240	18.8151 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9858	0.9713	0.9428	0.8794	0.7585	0.5706	0.3945	0.4360	0.6828	0.9010	0.9730	0.9888	(94)	
Useful gains	1027.6109	1204.6678	1312.5840	1330.7091	1195.9117	874.9113	580.7150	609.2499	905.1026	1067.4172	1010.6141	968.2751	(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	2499.3967	2427.7469	2198.5562	1826.9156	1393.1434	917.0773	587.2595	619.3687	997.1968	1539.4006	2055.0928	2487.9136	(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	1095.0086	821.9092	659.1633	357.2687	146.7404	0.0000	0.0000	0.0000	0.0000	351.1556	752.0247	1130.6110	(98)	
Space heating												5313.8815	(98)	
Space heating per m2												(98) / (4) =	35.6517	(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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5858.7448 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1095.0086	821.9092	659.1633	357.2687	146.7404	0.0000	0.0000	0.0000	0.0000	351.1556	752.0247	1130.6110	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1207.2862	906.1843	726.7512	393.9015	161.7866	0.0000	0.0000	0.0000	0.0000	387.1617	829.1342	1246.5392	(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	196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231	(64)
Efficiency of water heater	90.2616	90.2002	90.0833	89.8153	89.2379	87.9000	87.9000	87.9000	87.9000	89.7822	90.1510	87.9000	(216)
Fuel for water heating, kWh/month	218.2287	191.8673	200.3135	178.0813	174.1607	155.8218	147.5987	164.7991	165.3977	184.8209	197.1638	212.2466	(219)
Water heating fuel used												2190.5001	(219)
Annual totals kWh/year													
Space heating fuel - main system												5858.7448	(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)												505.0100	(232)
Total delivered energy for all uses												8629.2548	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5858.7448	3.4800	203.8843 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2190.5001	3.4800	76.2294 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	505.0100	13.1900	66.6108 (250)
Additional standing charges			120.0000 (251)
Total energy cost			476.6170 (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] =	1.0316 (257)
SAP value		85.6094
SAP rating (Section 12)		86 (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	5858.7448	0.2160	1265.4889 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2190.5001	0.2160	473.1480 (264)
Space and water heating			1738.6369 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	505.0100	0.5190	262.1002 (268)
Total kg/year			2039.6621 (272)
CO2 emissions per m2			13.6800 (273)
EI value			85.9152
EI rating			86 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8928 = 3.898$, stars = 4
Water heating environmental impact	$0.216 / 0.8928 = 0.2419$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	74.6300 (1b)	x 2.3900 (2b)	= 178.3657 (1b) - (3b)
First floor	74.4200 (1c)	x 2.6700 (2c)	= 198.7014 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 377.0671 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1061 (8)
Pressure test					Yes
Measured/design AP50					4.2400
Infiltration rate					0.3181 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3181 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3340	0.3101	0.3181	0.3022	0.3022	0.2942	0.2863	0.2783	0.2704	0.2942	0.2783	0.2942 (22b)
	0.5558	0.5481	0.5506	0.5457	0.5457	0.5433	0.5410	0.5387	0.5365	0.5433	0.5387	0.5433 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			30.8000	1.1450	35.2672		(27)
Ground Floor			74.6300	0.1100	8.2093	140.0000	10448.2000 (28a)
Brick and Block	184.4600	32.9200	151.5400	0.2400	36.3696	42.2200	6398.0188 (29a)
Pitched Roof	74.6300		74.6300	0.1000	7.4630	9.1000	679.1330 (30)
Total net area of external elements Aum(A, m ²)			333.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.6411		(33)
Ground Block			65.2500			75.0000	4893.7500 (32c)
Ground Stud			44.0300			9.0000	396.2700 (32c)
First Floor Block			50.8700			75.0000	3815.2500 (32c)
First Floor Stud			105.2600			9.0000	947.3400 (32c)
Internal Floor 1			72.4200			18.0000	1303.5600 (32d)
Internal Ceiling 1			74.6300			18.0000	1343.3400 (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) = 30224.8618 (34)
202.7834 (35)
9.6816 (36)
(33) + (36) = 99.3226 (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	69.1561	68.2000	68.5109	67.8971	67.8971	67.6020	67.3148	67.0355	66.7640	67.6020	67.0355	67.6020 (38)
Heat transfer coeff	168.4787	167.5227	167.8335	167.2198	167.2198	166.9247	166.6375	166.3582	166.0867	166.9247	166.3582	166.9247 (39)
Average = Sum(39)m / 12 =												167.0407 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1304	1.1239	1.1260	1.1219	1.1219	1.1199	1.1180	1.1161	1.1143	1.1199	1.1161	1.1199 (40)
HLP (average)												1.1207 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.9327 (42)
103.8515 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.2367	110.0826	105.9286	101.7745	97.6204	93.4664	93.4664	97.6204	101.7745	105.9286	110.0826	114.2367 (44)
Energy conte	169.4097	148.1668	152.8949	133.2974	127.9021	110.3698	102.2738	117.3607	118.7623	138.4061	151.0810	164.0642 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	Total = Sum(45)m = 1633.9888 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.4115	22.2250	22.9342	19.9946	19.1853	16.5555	15.3411	17.6041	17.8144	20.7609	22.6622	24.6096 (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	27.5672	24.8980	27.5541	26.6467	27.5152	26.5976	27.4654	27.4977	26.6222	27.5303	26.6641 (61)
Total heat required for water heating calculated for each month											
196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231 (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 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231 (64)
Heat gains from water heating, kWh/month											
63.2205	55.4899	57.7261	50.9831	49.4062	43.3473	40.8724	45.8969	46.1440	52.9026	56.9005	61.4411 (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	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.4894	63.4962	51.6386	39.0938	29.2230	24.6713	26.6582	34.6514	46.5090	59.0539	68.9246	73.4763 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	476.8470	481.7951	469.3259	442.7803	409.2713	377.7776	356.7378	351.7897	364.2589	390.8045	424.3135	455.8072 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289 (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)	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078 (71)
Water heating gains (Table 5)	84.9738	82.5743	77.5888	70.8098	66.4062	60.2046	54.9360	61.6893	64.0889	71.1056	79.0284	82.5821 (72)
Total internal gains	750.4929	745.0485	715.7361	669.8667	622.0834	579.8363	555.5149	565.3131	592.0396	638.1468	689.4493	729.0484 (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					9.8200	13.4839		0.6300	0.7000	0.7700		40.4668 (74)	
East					1.4400	25.1925		0.6300	0.7000	0.7700		11.0868 (76)	
South					15.9500	56.7559		0.6300	0.7000	0.7700		276.6580 (78)	
Southwest					0.7200	45.1778		0.6300	0.7000	0.7700		9.9410 (79)	
West					2.1500	25.1925		0.6300	0.7000	0.7700		16.5532 (80)	
Northwest					0.7200	14.6176		0.6300	0.7000	0.7700		3.2165 (81)	
Solar gains	357.9223	516.8680	714.1721	903.0158	978.7671	1065.4403	1014.9402	938.0488	820.1603	615.9988	426.6951	301.6011	(83)
Total gains	1108.4152	1261.9165	1429.9082	1572.8825	1600.8505	1645.2766	1570.4551	1503.3619	1412.2000	1254.1456	1116.1443	1030.6495	(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	49.8330	50.1174	50.0245	50.2082	50.2082	50.2969	50.3836	50.4682	50.5507	50.2969	50.4682	50.2969
alpha	4.3222	4.3412	4.3350	4.3472	4.3472	4.3531	4.3589	4.3645	4.3700	4.3531	4.3645	4.3531
util living area	0.9875	0.9781	0.9511	0.8846	0.7617	0.5546	0.4086	0.4252	0.6762	0.8977	0.9730	0.9902 (86)
MIT	19.7966	19.9603	20.2632	20.6038	20.8495	20.9709	20.9939	20.9929	20.9318	20.6446	20.1843	19.7698 (87)
Th 2	19.9761	19.9813	19.9796	19.9830	19.9830	19.9846	19.9862	19.9877	19.9892	19.9846	19.9877	19.9846 (88)
util rest of house	0.9842	0.9723	0.9380	0.8542	0.7018	0.4653	0.3050	0.3180	0.5900	0.8631	0.9644	0.9875 (89)
MIT 2	18.8982	19.0634	19.3564	19.6779	19.8877	19.9724	19.9847	19.9860	19.9554	19.7232	19.2905	18.8786 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.0168	19.1818	19.4761	19.8002	20.0147	20.1042	20.1180	20.1190	20.0843	19.8449	19.4085	18.9963 (92)
Temperature adjustment												
adjusted MIT	19.0168	19.1818	19.4761	19.8002	20.0147	20.1042	20.1180	20.1190	20.0843	19.8449	19.4085	18.9963 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9800	0.9665	0.9302	0.8479	0.7038	0.4762	0.3187	0.3322	0.5987	0.8574	0.9581	0.9839	(94)
Useful gains	1086.2031	1219.6813	1330.0788	1333.6935	1126.6905	783.5461	500.5131	499.4264	845.5406	1075.3211	1069.3937	1014.1039	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	2378.3871	2325.5150	2093.9135	1722.3945	1256.6033	801.9402	502.9074	502.2273	894.2647	1409.6623	1914.5325	2336.3283	(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	961.3849	743.1202	568.2931	279.8647	96.6551	0.0000	0.0000	0.0000	0.0000	248.7499	608.4999	983.7349	(98)
Space heating													4490.3027 (98)
Space heating per m2	(98) / (4) =												30.1262 (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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4950.7197 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	961.3849	743.1202	568.2931	279.8647	96.6551	0.0000	0.0000	0.0000	0.0000	248.7499	608.4999	983.7349	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1059.9613	819.3167	626.5635	308.5609	106.5657	0.0000	0.0000	0.0000	0.0000	274.2556	670.8930	1084.6030	(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	196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231	(64)
Efficiency of water heater	90.2113	90.1575	90.0090	89.6613	88.9530	87.9000	87.9000	87.9000	87.9000	89.5584	90.0515	87.9000	(216)
Fuel for water heating, kWh/month	218.3504	191.9582	200.4788	178.3870	174.7185	155.8218	147.5987	164.7991	165.3977	185.2828	197.3816	212.3685	(219)
Water heating fuel used												2192.5431	(219)
Annual totals kWh/year													
Space heating fuel - main system												4950.7197	(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)												505.0100	(232)
Total delivered energy for all uses												7723.2727	(238)

10a. Fuel costs - using BEDF prices (480)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4950.7197	3.7400	185.1569 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2192.5431	3.7400	82.0011 (247)
Pumps and fans for heating	75.0000	19.1200	14.3400 (249)
Energy for lighting	505.0100	19.1200	96.5579 (250)
Additional standing charges			94.0000 (251)
Total energy cost			472.0559 (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	4950.7197	0.2160	1069.3554 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2192.5431	0.2160	473.5893 (264)
Space and water heating			1542.9448 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	505.0100	0.5190	262.1002 (268)
Total kg/year			1843.9699 (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	4950.7197	1.2200	6039.8780 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2192.5431	1.2200	2674.9026 (264)
Space and water heating			8714.7806 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	505.0100	3.0700	1550.3806 (268)
Primary energy kWh/year			10495.4112 (272)
Primary energy kWh/m2/year			70.4154 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

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

Recommended measures: SAP change Cost change CO2 change
U Solar photovoltaic panels + 6.9 -£ 370 -1003 kg (54.4%)

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.8 -£ 29 -199 kg (10.8%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£370	6.73 kg/m²	A 92	A 92
Total Savings	£370	6.73 kg/m²		
Potential energy efficiency rating:			A 92	
Potential environmental impact rating:				A 92

Fuel prices for cost data on this page from database revision number 480 TEST (28 Jul 2021)
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	£111	£111	£0
Mains gas	£361	£361	£0
Space heating	£293	£293	£0
Water heating	£82	£82	£0
Lighting	£97	£97	£0
Generated (PV)	-£0	-£370	£370

Total cost of fuels	£472	£102	£370
Total cost of uses	£472	£102	£370
Delivered energy	52 kWh/m²	39 kWh/m²	13 kWh/m²
Carbon dioxide emissions	1.8 tonnes	0.8 tonnes	1.0 tonnes
CO2 emissions per m²	12 kg/m²	6 kg/m²	7 kg/m²
Primary energy	70 kWh/m²	31 kWh/m²	40 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	74.6300 (1b)	x 2.3900 (2b)	= 178.3657 (1b) - (3b)
First floor	74.4200 (1c)	x 2.6700 (2c)	= 198.7014 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 377.0671 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1061 (8)
Pressure test					Yes
Measured/design AP50					4.2400
Infiltration rate					0.3181 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3181 (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	0.4056	0.3976	0.3897	0.3499	0.3419	0.3022	0.3022	0.2942	0.3181	0.3419	0.3578	0.3737 (22b)
Effective ac	0.5822	0.5790	0.5759	0.5612	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5640	0.5698 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			30.8000	1.1450	35.2672		(27)
Ground Floor			74.6300	0.1100	8.2093	140.0000	10448.2000 (28a)
Brick and Block	184.4600	32.9200	151.5400	0.2400	36.3696	42.2200	6398.0188 (29a)
Pitched Roof	74.6300		74.6300	0.1000	7.4630	9.1000	679.1330 (30)
Total net area of external elements Aum(A, m ²)			333.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.6411		(33)
Ground Block			65.2500			75.0000	4893.7500 (32c)
Ground Stud			44.0300			9.0000	396.2700 (32c)
First Floor Block			50.8700			75.0000	3815.2500 (32c)
First Floor Stud			105.2600			9.0000	947.3400 (32c)
Internal Floor 1			72.4200			18.0000	1303.5600 (32d)
Internal Ceiling 1			74.6300			18.0000	1343.3400 (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) = 30224.8618 (34)
202.7834 (35)
9.6816 (36)
(33) + (36) = 99.3226 (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	72.4490	72.0517	71.6622	69.8328	69.4905	67.8971	67.8971	67.6020	68.5109	69.4905	70.1829	70.9068 (38)
Heat transfer coeff	171.7717	171.3743	170.9848	169.1554	168.8131	167.2198	167.2198	166.9247	167.8335	168.8131	169.5055	170.2294 (39)
Average = Sum(39)m / 12 =												169.1538 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1524	1.1498	1.1472	1.1349	1.1326	1.1219	1.1219	1.1199	1.1260	1.1326	1.1372	1.1421 (40)
HLP (average)												1.1349 (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
Average daily hot water use (litres/day)
2.9327 (42)
103.8515 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.2367	110.0826	105.9286	101.7745	97.6204	93.4664	93.4664	97.6204	101.7745	105.9286	110.0826	114.2367 (44)
Energy conte	169.4097	148.1668	152.8949	133.2974	127.9021	110.3698	102.2738	117.3607	118.7623	138.4061	151.0810	164.0642 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1633.9888 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.4115	22.2250	22.9342	19.9946	19.1853	16.5555	15.3411	17.6041	17.8144	20.7609	22.6622	24.6096 (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	27.5672	24.8980	27.5541	26.6467	27.5152	26.5976	27.4654	27.4977	26.6222	27.5303	26.6641 (61)
Total heat required for water heating calculated for each month											
196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231 (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 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231 (64)
Heat gains from water heating, kWh/month											
63.2205	55.4899	57.7261	50.9831	49.4062	43.3473	40.8724	45.8969	46.1440	52.9026	56.9005	61.4411 (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	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.4894	63.4962	51.6386	39.0938	29.2230	24.6713	26.6582	34.6514	46.5090	59.0539	68.9246	73.4763 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	476.8470	481.7951	469.3259	442.7803	409.2713	377.7776	356.7378	351.7897	364.2589	390.8045	424.3135	455.8072 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289 (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)	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078 (71)
Water heating gains (Table 5)	84.9738	82.5743	77.5888	70.8098	66.4062	60.2046	54.9360	61.6893	64.0889	71.1056	79.0284	82.5821 (72)
Total internal gains	750.4929	745.0485	715.7361	669.8667	622.0834	579.8363	555.5149	565.3131	592.0396	638.1468	689.4493	729.0484 (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				9.8200	10.6334	0.6300	0.7000		0.7700		31.9121 (74)	
East				1.4400	19.6403	0.6300	0.7000		0.7700		8.6433 (76)	
South				15.9500	46.7521	0.6300	0.7000		0.7700		227.8942 (78)	
Southwest				0.7200	36.7938	0.6300	0.7000		0.7700		8.0962 (79)	
West				2.1500	19.6403	0.6300	0.7000		0.7700		12.9050 (80)	
Northwest				0.7200	11.2829	0.6300	0.7000		0.7700		2.4827 (81)	
Solar gains	291.9335	495.2151	676.4552	843.3742	954.5399	953.3581	916.6572	831.9414	733.5048	546.5970	349.1895	250.2015 (83)
Total gains	1042.4264	1240.2636	1392.1913	1513.2409	1576.6233	1533.1945	1472.1721	1397.2546	1325.5445	1184.7438	1038.6388	979.2499 (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	48.8776	48.9910	49.1026	49.6336	49.7343	50.2082	50.2082	50.2969	50.0245	49.7343	49.5311	49.3205
alpha	4.2585	4.2661	4.2735	4.3089	4.3156	4.3472	4.3472	4.3531	4.3350	4.3156	4.3021	4.2880
util living area	0.9914	0.9816	0.9609	0.9112	0.8102	0.6463	0.4872	0.5305	0.7540	0.9320	0.9833	0.9933 (86)
MIT	19.6415	19.8580	20.1540	20.5037	20.7824	20.9409	20.9862	20.9802	20.8819	20.5157	20.0086	19.5999 (87)
Th 2	19.9582	19.9604	19.9625	19.9724	19.9743	19.9830	19.9830	19.9846	19.9796	19.9743	19.9705	19.9666 (88)
util rest of house	0.9891	0.9767	0.9504	0.8869	0.7597	0.5617	0.3805	0.4221	0.6777	0.9082	0.9781	0.9915 (89)
MIT 2	18.7304	18.9459	19.2371	19.5780	19.8263	19.9540	19.9789	19.9782	19.9138	19.5978	19.1047	18.6957 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.8507	19.0663	19.3582	19.7002	19.9526	20.0843	20.1119	20.1105	20.0416	19.7190	19.2240	18.8151 (92)
Temperature adjustment												
adjusted MIT	18.8507	19.0663	19.3582	19.7002	19.9526	20.0843	20.1119	20.1105	20.0416	19.7190	19.2240	18.8151 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9713	0.9428	0.8794	0.7585	0.5706	0.3945	0.4360	0.6828	0.9010	0.9730	0.9888	(94)
Useful gains	1027.6109	1204.6678	1312.5840	1330.7091	1195.9117	874.9113	580.7150	609.2499	905.1026	1067.4172	1010.6141	968.2751	(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													
	2499.3967	2427.7469	2198.5562	1826.9156	1393.1434	917.0773	587.2595	619.3687	997.1968	1539.4006	2055.0928	2487.9136	(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	1095.0086	821.9092	659.1633	357.2687	146.7404	0.0000	0.0000	0.0000	0.0000	351.1556	752.0247	1130.6110	(98)
Space heating													5313.8815 (98)
Space heating per m2	(98) / (4) =												35.6517 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5858.7448 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1095.0086	821.9092	659.1633	357.2687	146.7404	0.0000	0.0000	0.0000	0.0000	351.1556	752.0247	1130.6110	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1207.2862	906.1843	726.7512	393.9015	161.7866	0.0000	0.0000	0.0000	0.0000	387.1617	829.1342	1246.5392	(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	196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231	(64)
Efficiency of water heater (217)m	90.2616	90.2002	90.0833	89.8153	89.2379	87.9000	87.9000	87.9000	87.9000	89.7822	90.1510	87.9000	(216)
Fuel for water heating, kWh/month	218.2287	191.8673	200.3135	178.0813	174.1607	155.8218	147.5987	164.7991	165.3977	184.8209	197.1638	212.2466	(219)
Water heating fuel used												2190.5001	(219)
Annual totals kWh/year													
Space heating fuel - main system												5858.7448	(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)												505.0100	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)
Total delivered energy for all uses												6902.0154	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5858.7448	3.4800	203.8843	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2190.5001	3.4800	76.2294	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	505.0100	13.1900	66.6108	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			248.7942	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.5385 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	92.4881
SAP rating (Section 12)		92 (258)
SAP band		A

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	5858.7448	0.2160	1265.4889	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2190.5001	0.2160	473.1480	(264)
Space and water heating			1738.6369	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	505.0100	0.5190	262.1002	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			1143.2248	(272)
CO2 emissions per m2			7.6700	(273)
EI value			92.1055	
EI rating			92 (274)	
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	74.6300 (1b)	x 2.3900 (2b)	= 178.3657 (1b) - (3b)
First floor	74.4200 (1c)	x 2.6700 (2c)	= 198.7014 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 377.0671 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1061 (8)
Pressure test					Yes
Measured/design AP50					4.2400
Infiltration rate					0.3181 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3181 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3340	0.3101	0.3181	0.3022	0.3022	0.2942	0.2863	0.2783	0.2704	0.2942	0.2783	0.2942 (22b)
	0.5558	0.5481	0.5506	0.5457	0.5457	0.5433	0.5410	0.5387	0.5365	0.5433	0.5387	0.5433 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			30.8000	1.1450	35.2672		(27)
Ground Floor			74.6300	0.1100	8.2093	140.0000	10448.2000 (28a)
Brick and Block	184.4600	32.9200	151.5400	0.2400	36.3696	42.2200	6398.0188 (29a)
Pitched Roof	74.6300		74.6300	0.1000	7.4630	9.1000	679.1330 (30)
Total net area of external elements Aum(A, m ²)			333.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.6411		(33)
Ground Block			65.2500			75.0000	4893.7500 (32c)
Ground Stud			44.0300			9.0000	396.2700 (32c)
First Floor Block			50.8700			75.0000	3815.2500 (32c)
First Floor Stud			105.2600			9.0000	947.3400 (32c)
Internal Floor 1			72.4200			18.0000	1303.5600 (32d)
Internal Ceiling 1			74.6300			18.0000	1343.3400 (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) = 30224.8618 (34)
202.7834 (35)
9.6816 (36)
(33) + (36) = 99.3226 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	69.1561	68.2000	68.5109	67.8971	67.8971	67.6020	67.3148	67.0355	66.7640	67.6020	67.0355	67.6020 (38)
Average = Sum(39)m / 12 =	168.4787	167.5227	167.8335	167.2198	167.2198	166.9247	166.6375	166.3582	166.0867	166.9247	166.3582	166.9247 (39)
												167.0407 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1304	1.1239	1.1260	1.1219	1.1219	1.1199	1.1180	1.1161	1.1143	1.1199	1.1161	1.1199 (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												2.9327 (42)
Average daily hot water use (litres/day)												103.8515 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.2367	110.0826	105.9286	101.7745	97.6204	93.4664	93.4664	97.6204	101.7745	105.9286	110.0826	114.2367 (44)
	169.4097	148.1668	152.8949	133.2974	127.9021	110.3698	102.2738	117.3607	118.7623	138.4061	151.0810	164.0642 (45)

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)	Total = Sum(45)m = 1633.9888 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.4115	22.2250	22.9342	19.9946	19.1853	16.5555	15.3411	17.6041	17.8144	20.7609	22.6622	24.6096 (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	27.5672	24.8980	27.5541	26.6467	27.5152	26.5976	27.4654	27.4977	26.6222	27.5303	26.6641 (61)
Total heat required for water heating calculated for each month											
196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231 (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 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231 (64)
Heat gains from water heating, kWh/month											
63.2205	55.4899	57.7261	50.9831	49.4062	43.3473	40.8724	45.8969	46.1440	52.9026	56.9005	61.4411 (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	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	175.9617	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.4894	63.4962	51.6386	39.0938	29.2230	24.6713	26.6582	34.6514	46.5090	59.0539	68.9246	73.4763	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	476.8470	481.7951	469.3259	442.7803	409.2713	377.7776	356.7378	351.7897	364.2589	390.8045	424.3135	455.8072	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	55.5289	(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)	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	-117.3078	(71)
Water heating gains (Table 5)	84.9738	82.5743	77.5888	70.8098	66.4062	60.2046	54.9360	61.6893	64.0889	71.1056	79.0284	82.5821	(72)
Total internal gains	750.4929	745.0485	715.7361	669.8667	622.0834	579.8363	555.5149	565.3131	592.0396	638.1468	689.4493	729.0484	(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				9.8200	13.4839	0.6300	0.7000	0.7700	40.4668 (74)			
East				1.4400	25.1925	0.6300	0.7000	0.7700	11.0868 (76)			
South				15.9500	56.7559	0.6300	0.7000	0.7700	276.6580 (78)			
Southwest				0.7200	45.1778	0.6300	0.7000	0.7700	9.9410 (79)			
West				2.1500	25.1925	0.6300	0.7000	0.7700	16.5532 (80)			
Northwest				0.7200	14.6176	0.6300	0.7000	0.7700	3.2165 (81)			
Solar gains	357.9223	516.8680	714.1721	903.0158	978.7671	1065.4403	1014.9402	938.0488	820.1603	615.9988	426.6951	301.6011 (83)
Total gains	1108.4152	1261.9165	1429.9082	1572.8825	1600.8505	1645.2766	1570.4551	1503.3619	1412.2000	1254.1456	1116.1443	1030.6495 (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	49.8330	50.1174	50.0245	50.2082	50.2082	50.2969	50.3836	50.4682	50.5507	50.2969	50.4682	50.2969
alpha	4.3222	4.3412	4.3350	4.3472	4.3472	4.3531	4.3589	4.3645	4.3700	4.3531	4.3645	4.3531
util living area	0.9875	0.9781	0.9511	0.8846	0.7617	0.5546	0.4086	0.4252	0.6762	0.8977	0.9730	0.9902 (86)
MIT	19.7966	19.9603	20.2632	20.6038	20.8495	20.9709	20.9939	20.9929	20.9318	20.6446	20.1843	19.7698 (87)
Th 2	19.9761	19.9813	19.9796	19.9830	19.9830	19.9846	19.9862	19.9877	19.9892	19.9846	19.9877	19.9846 (88)
util rest of house	0.9842	0.9723	0.9380	0.8542	0.7018	0.4653	0.3050	0.3180	0.5900	0.8631	0.9644	0.9875 (89)
MIT 2	18.8982	19.0634	19.3564	19.6779	19.8877	19.9724	19.9847	19.9860	19.9554	19.7232	19.2905	18.8786 (90)
Living area fraction	fLA = Living area / (4) =											0.1320 (91)
MIT	19.0168	19.1818	19.4761	19.8002	20.0147	20.1042	20.1180	20.1190	20.0843	19.8449	19.4085	18.9963 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0168	19.1818	19.4761	19.8002	20.0147	20.1042	20.1180	20.1190	20.0843	19.8449	19.4085	18.9963 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9800	0.9665	0.9302	0.8479	0.7038	0.4762	0.3187	0.3322	0.5987	0.8574	0.9581	0.9839 (94)
Useful gains	1086.2031	1219.6813	1330.0788	1333.6935	1126.6905	783.5461	500.5131	499.4264	845.5406	1075.3211	1069.3937	1014.1039 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	2378.3871	2325.5150	2093.9135	1722.3945	1256.6033	801.9402	502.9074	502.2273	894.2647	1409.6623	1914.5325	2336.3283 (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	961.3849	743.1202	568.2931	279.8647	96.6551	0.0000	0.0000	0.0000	0.0000	248.7499	608.4999	983.7349 (98)
Space heating												4490.3027 (98)
Space heating per m2												(98) / (4) = 30.1262 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4950.7197 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	961.3849	743.1202	568.2931	279.8647	96.6551	0.0000	0.0000	0.0000	0.0000	248.7499	608.4999	983.7349	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1059.9613	819.3167	626.5635	308.5609	106.5657	0.0000	0.0000	0.0000	0.0000	274.2556	670.8930	1084.6030	(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	196.9768	173.0648	180.4490	159.9442	155.4173	136.9673	129.7393	144.8584	145.3846	165.9364	177.7452	191.6231	(64)
Efficiency of water heater (217)m	90.2113	90.1575	90.0090	89.6613	88.9530	87.9000	87.9000	87.9000	87.9000	89.5584	90.0515	87.9000	(216)
Fuel for water heating, kWh/month	218.3504	191.9582	200.4788	178.3870	174.7185	155.8218	147.5987	164.7991	165.3977	185.2828	197.3816	212.3685	(219)
Water heating fuel used												2192.5431	(219)
Annual totals kWh/year													
Space heating fuel - main system												4950.7197	(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)												505.0100	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1208 * 0.80) =									-1933.0416			-1933.0416	(233)
Total delivered energy for all uses												5790.2311	(238)

10a. Fuel costs - using BEDF prices (480)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4950.7197	3.7400	185.1569 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2192.5431	3.7400	82.0011 (247)
Pumps and fans for heating	75.0000	19.1200	14.3400 (249)
Energy for lighting	505.0100	19.1200	96.5579 (250)
Additional standing charges			94.0000 (251)
Energy saving/generation technologies			
PV Unit	-1933.0416	19.1200	-369.5976 (252)
Total energy cost			102.4584 (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	4950.7197	0.2160	1069.3554 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2192.5431	0.2160	473.5893 (264)
Space and water heating			1542.9448 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	505.0100	0.5190	262.1002 (268)
Energy saving/generation technologies			
PV Unit	-1933.0416	0.5190	-1003.2486 (269)
Total kg/year			840.7213 (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	4950.7197	1.2200	6039.8780 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2192.5431	1.2200	2674.9026 (264)
Space and water heating			8714.7806 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	505.0100	3.0700	1550.3806 (268)
Energy saving/generation technologies			
PV Unit	-1933.0416	3.0700	-5934.4378 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Primary energy kWh/year	4560.9733 (272)
Primary energy kWh/m2/year	30.6003 (273)