

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-173			Issued on Date	24/04/2019
Assessment Reference	As Built	Prop Type Ref	2302 - End (As)		
Property	59, St Andrews Road, Botley, SOUTHAMPTON, SO32 2ST				
SAP Rating	86 B	DER	15.37	TER	18.53
Environmental	88 B	% DER<TER	17.05		
CO ₂ Emissions (t/year)	0.94	DFEE	47.17	TFEE	51.81
General Requirements Compliance	Pass	% DFEE<TFEE	8.97		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	T511-0001
Client					

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

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DWELLING AS BUILT

End-Terrace House, total floor area 78 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.53 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.37 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 3.96 (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
Potterton Promax Ultra Combi 40 ErP
Combi boiler
Efficiency: 89.1% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading:
Average
Windows facing East: 4.46 m², No overhang
Windows facing South: 0.57 m², No overhang
Windows facing West: 8.00 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Air permeability 4.0 m³/m²h
Photovoltaic array 0.54 kW

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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	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					3.9600
Infiltration rate					0.3591 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3322 (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	0.4236	0.4152	0.4069	0.3654	0.3571	0.3156	0.3156	0.3073	0.3322	0.3571	0.3737	0.3903 (22b)
Effective ac	0.5897	0.5862	0.5828	0.5668	0.5638	0.5498	0.5498	0.5472	0.5552	0.5638	0.5698	0.5762 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (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) = 14453.2600 (34)
185.5361 (35)
7.3755 (36)
(33) + (36) = 55.8936 (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	36.2309	36.0169	35.8072	34.8219	34.6376	33.7794	33.7794	33.6205	34.1100	34.6376	35.0105	35.4003 (38)
Heat transfer coeff	92.1245	91.9105	91.7008	90.7155	90.5312	89.6731	89.6731	89.5141	90.0036	90.5312	90.9041	91.2940 (39)
Average = Sum(39)m / 12 =												90.7146 (39)
HLP	1.1826	1.1799	1.1772	1.1645	1.1621	1.1511	1.1511	1.1491	1.1554	1.1621	1.1669	1.1719 (40)
HLP (average)												1.1645 (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												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)

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Energy content (annual)												Total = Sum(45)m = 1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m												
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343	(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	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645	20.9866 (61)
Total heat required for water heating calculated for each month												
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(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												
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(64)
Heat gains from water heating, kWh/month												
54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245	(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	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
19.8270	17.6102	14.3216	10.8424	8.1048	6.8424	7.3935	9.6103	12.8989	16.3781	19.1157	20.3781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)												
73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains												
371.0735	368.9563	355.6250	334.1715	312.4252	291.4749	277.8798	283.8418	294.8798	316.5428	341.4074	360.0217	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d				Gains W
East					4.4600	19.6403	0.6200	0.7000	0.7700				26.3454 (76)
South					0.5700	46.7521	0.6200	0.7000	0.7700				8.0149 (78)
West					2.2000	19.6403	0.6200	0.7000	0.7700				12.9955 (80)
West					5.8000	19.6403	0.6200	0.7000	0.7700				34.2609 (80)
Solar gains	81.6167	157.1071	253.8364	364.7171	443.5072	452.8010	431.5592	372.7797	293.2421	185.0032	101.2732	67.4521 (83)	
Total gains	452.6902	526.0633	609.4614	698.8885	755.9323	744.2759	709.4391	656.6215	588.1218	501.5460	442.6806	427.4739 (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	43.5801	43.6815	43.7815	44.2570	44.3471	44.7715	44.7715	44.8510	44.6070	44.3471	44.1652	43.9766
alpha	3.9053	3.9121	3.9188	3.9505	3.9565	3.9848	3.9848	3.9901	3.9738	3.9565	3.9443	3.9318
util living area	0.9940	0.9887	0.9740	0.9316	0.8388	0.6848	0.5310	0.5868	0.8201	0.9595	0.9896	0.9952 (86)
MIT	19.3639	19.5567	19.8923	20.3260	20.6861	20.9028	20.9730	20.9600	20.7902	20.3050	19.7548	19.3301 (87)
Th 2	19.9339	19.9362	19.9383	19.9485	19.9504	19.9593	19.9593	19.9609	19.9559	19.9504	19.9465	19.9425 (88)
util rest of house	0.9925	0.9857	0.9669	0.9125	0.7934	0.6006	0.4165	0.4711	0.7530	0.9445	0.9864	0.9940 (89)
MIT 2	17.7524	18.0342	18.5211	19.1426	19.6250	19.8848	19.9465	19.9400	19.7693	19.1259	18.3312	17.7086 (90)
Living area fraction												
MIT	18.3755	18.6228	19.0512	19.6002	20.0353	20.2784	20.3434	20.3344	20.1640	19.5818	18.8816	18.3366 (91)
Temperature adjustment												-0.1500
adjusted MIT	18.2255	18.4728	18.9012	19.4502	19.8853	20.1284	20.1934	20.1844	20.0140	19.4318	18.7316	18.1856 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9889	0.9800	0.9578	0.9013	0.7902	0.6153	0.4433	0.4974	0.7573	0.9346	0.9810	0.9910	(94)
Useful gains	447.6469	515.5327	583.7188	629.8827	597.3494	457.9801	314.5004	326.6154	445.3666	468.7595	434.2679	423.6066	(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													
	1282.8781	1247.4865	1137.2029	957.0648	741.0218	495.7502	322.2269	338.7560	532.2849	799.5494	1057.3610	1276.7974	(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													
	621.4120	491.8730	411.7922	235.5711	106.8923	0.0000	0.0000	0.0000	0.0000	246.1077	448.6270	634.7740	(98)
Space heating													
Space heating per m2												3197.0493	(98)
											(98) / (4) =	41.0404	(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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3552.2770 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	621.4120	491.8730	411.7922	235.5711	106.8923	0.0000	0.0000	0.0000	0.0000	246.1077	448.6270	634.7740	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	690.4578	546.5256	457.5469	261.7456	118.7692	0.0000	0.0000	0.0000	0.0000	273.4530	498.4745	705.3044	(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	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(64)
Efficiency of water heater (217)m	89.2680	89.2073	89.0688	88.7527	88.1355	86.7000	86.7000	86.7000	86.7000	88.7579	89.1343	86.7000	(216)
Fuel for water heating, kWh/month	191.1361	167.9184	175.0759	155.3588	151.7445	135.5563	128.0378	143.4793	144.1738	161.2144	172.4295	185.7671	(219)
Water heating fuel used												1911.8919	(219)
Annual totals kWh/year													
Space heating fuel - main system												3552.2770	(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)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 908 * 1.00) =										-392.1930		-392.1930	(233)
Total delivered energy for all uses												5497.1274	(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	3552.2770	0.2160	767.2918	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1911.8919	0.2160	412.9687	(264)
Space and water heating			1180.2605	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	350.1515	0.5190	181.7287	(268)
Energy saving/generation technologies				
PV Unit	-392.1930	0.5190	-203.5482	(269)
Total CO2, kg/year			1197.3659	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.3700	(273)

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

DER			15.3700	ZC1
Total Floor Area		TFA	77.9000	
Assumed number of occupants		N	2.4218	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.3545	ZC2
CO2 emissions from cooking, equation (L16)			2.2737	ZC3
Total CO2 emissions			33.9983	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			33.9983	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1611 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4111 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3803 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4849	0.4754	0.4659	0.4183	0.4088	0.3613	0.3613	0.3518	0.3803	0.4088	0.4278	0.4469	(22b)				
Effective ac	0.6176	0.6130	0.6085	0.5875	0.5836	0.5653	0.5653	0.5619	0.5723	0.5836	0.5915	0.5998	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9600	1.0000	1.9600		(26)					
TER Opening Type (Uw = 1.40)			13.0300	1.3258	17.2746		(27)					
Jet Floor Lo			38.9500	0.1300	5.0635		(28a)					
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.1800	12.5316		(29a)					
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635		(30)					
Total net area of external elements Aum(A, m2)			162.5100				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		41.8932		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9775 (36)					
Total fabric heat loss						(33) + (36) =	50.8707 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 37.9424	Feb 37.6619	Mar 37.3870	Apr 36.0958	May 35.8542	Jun 34.7296	Jul 34.7296	Aug 34.5213	Sep 35.1628	Oct 35.8542	Nov 36.3429	Dec 36.8539 (38)
Heat transfer coeff	88.8131	88.5326	88.2577	86.9665	86.7249	85.6003	85.6003	85.3921	86.0335	86.7249	87.2137	87.7246 (39)
Average = Sum(39)m / 12 =												86.9654 (39)
HLP	Jan 1.1401	Feb 1.1365	Mar 1.1330	Apr 1.1164	May 1.1133	Jun 1.0988	Jul 1.0988	Aug 1.0962	Sep 1.1044	Oct 1.1133	Nov 1.1196	Dec 1.1261 (40)
HLP (average)												1.1164 (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												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
Daily hot water use	Jan 100.8897	Feb 97.2210	Mar 93.5523	Apr 89.8836	May 86.2148	Jun 82.5461	Jul 82.5461	Aug 86.2148	Sep 89.8836	Oct 93.5523	Nov 97.2210	Dec 100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)
Energy content (annual)										Total = Sum(45)m =		1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (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	44.7483	47.6732	44.3261	43.9341	40.7077	42.0646	43.9341	44.3261	47.6732	47.9446	50.9589 (61)
Solar input	200.5754	175.6039	182.7045	162.0496	156.8926	138.1823	132.3891	147.5829	149.2128	169.9085	181.3739	195.8545 (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	200.5754	175.6039	182.7045	162.0496	156.8926	138.1823	132.3891	147.5829	149.2128	169.9085	181.3739	195.8545 (64)
	62.4872	54.6966	56.8162	50.2246	48.5422	42.5872	40.5491	45.4467	45.9563	52.5615	56.3514	60.9175 (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	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8270	17.6102	14.3216	10.8424	8.1048	6.8424	7.3935	9.6103	12.8989	16.3781	19.1157	20.3781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	83.9882	81.3937	76.3658	69.7564	65.2449	59.1489	54.5014	61.0843	63.8283	70.6472	78.2658	81.8784	(72)
Total internal gains	381.1380	378.5576	364.6191	342.5619	320.2047	298.6467	285.0641	291.6329	303.2874	325.5542	351.0185	370.0930	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				4.4600	19.6403		0.6300		0.7000		0.7700		26.7703 (76)
South				0.5700	46.7521		0.6300		0.7000		0.7700		8.1442 (78)
West				8.0000	19.6403		0.6300		0.7000		0.7700		48.0186 (80)
Solar gains	82.9331	159.6410	257.9305	370.5996	450.6605	460.1043	438.5199	378.7923	297.9718	187.9872	102.9066	68.5401	(83)
Total gains	464.0711	538.1986	622.5496	713.1615	770.8652	758.7510	723.5840	670.4252	601.2592	513.5413	453.9252	438.6331	(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	60.9113	61.1043	61.2946	62.2047	62.3779	63.1975	63.1975	63.3516	62.8792	62.3779	62.0284	61.6671	
alpha	5.0608	5.0736	5.0863	5.1470	5.1585	5.2132	5.2132	5.2234	5.1919	5.1585	5.1352	5.1111	
util living area	0.9981	0.9955	0.9867	0.9521	0.8560	0.6797	0.5121	0.5705	0.8331	0.9757	0.9960	0.9986	(86)
MIT	19.7681	19.9249	20.1952	20.5472	20.8219	20.9609	20.9926	20.9874	20.8873	20.5134	20.0784	19.7458	(87)
Th 2	19.9682	19.9711	19.9740	19.9875	19.9900	20.0018	20.0018	20.0040	19.9972	19.9900	19.9849	19.9796	(88)
util rest of house	0.9974	0.9940	0.9819	0.9346	0.8071	0.5905	0.4003	0.4547	0.7599	0.9636	0.9943	0.9981	(89)
MIT 2	18.3254	18.5563	18.9504	19.4586	19.8179	19.9763	19.9991	19.9988	19.9074	19.4221	18.7910	18.3010	(90)
Living area fraction	18.8832	19.0854	19.4317	19.8795	20.2061	20.3570	20.3832	20.3811	20.2863	19.8440	19.2888	18.8596	(91)
MIT	18.8832	19.0854	19.4317	19.8795	20.2061	20.3570	20.3832	20.3811	20.2863	19.8440	19.2888	18.8596	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8832	19.0854	19.4317	19.8795	20.2061	20.3570	20.3832	20.3811	20.2863	19.8440	19.2888	18.8596	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	462.4154	533.9977	609.2499	664.9516	631.0737	473.2516	321.1183	335.0535	471.0245	493.7138	450.6161	437.4476	(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	1295.1823	1255.8745	1141.3238	954.8477	737.6929	492.7982	323.8434	339.9516	532.2280	801.6891	1063.0266	1286.0118	(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	619.5786	485.1012	395.8630	208.7252	79.3247	0.0000	0.0000	0.0000	0.0000	229.1336	440.9356	631.3318	(98)
Space heating												3089.9937	(98)
Space heating per m2												39.6662	(99)

8c. Space cooling requirement

Not applicable

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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													3308.3444 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	619.5786	485.1012	395.8630	208.7252	79.3247	0.0000	0.0000	0.0000	0.0000	229.1336	440.9356	631.3318	(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)	663.3604	519.3804	423.8362	223.4745	84.9300	0.0000	0.0000	0.0000	0.0000	245.3251	472.0937	675.9441	(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	200.5754	175.6039	182.7045	162.0496	156.8926	138.1823	132.3891	147.5829	149.2128	169.9085	181.3739	195.8545	(64)
Efficiency of water heater (217)m	87.7023	87.4757	86.9465	85.6895	83.4302	80.3000	80.3000	80.3000	80.3000	85.8047	87.2033	80.3000	(216)
Fuel for water heating, kWh/month	228.7004	200.7459	210.1342	189.1127	188.0526	172.0825	164.8682	183.7894	185.8191	198.0177	207.9899	223.1053	(219)
Water heating fuel used												2352.4179	(219)
Annual totals kWh/year													
Space heating fuel - main system												3308.3444	(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)												350.1515	(232)
Total delivered energy for all uses												6085.9138	(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	3308.3444	0.2160	714.6024 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2352.4179	0.2160	508.1223 (264)
Space and water heating			1222.7246 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	350.1515	0.5190	181.7287 (268)
Total CO2, kg/m2/year			1443.3783 (272)
Emissions per m2 for space and water heating			15.6961 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3328 (272b)
Emissions per m2 for pumps and fans			0.4997 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6961 * 1.00) + 2.3328 + 0.4997, rounded to 2 d.p.			18.5300 (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	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					3.9600
Infiltration rate					0.3591 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3322 (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	0.4236	0.4152	0.4069	0.3654	0.3571	0.3156	0.3156	0.3073	0.3322	0.3571	0.3737	0.3903 (22b)
Effective ac	0.5897	0.5862	0.5828	0.5668	0.5638	0.5498	0.5498	0.5472	0.5552	0.5638	0.5698	0.5762 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (28a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			9.0000	350.5500 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14102.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							181.0361 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3755 (36)
Total fabric heat loss						(33) + (36) =	55.8936 (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	36.2309	36.0169	35.8072	34.8219	34.6376	33.7794	33.7794	33.6205	34.1100	34.6376	35.0105	35.4003 (38)
Heat transfer coeff	92.1245	91.9105	91.7008	90.7155	90.5312	89.6731	89.6731	89.5141	90.0036	90.5312	90.9041	91.2940 (39)
Average = Sum(39)m / 12 =												90.7146 (39)
HLP	1.1826	1.1799	1.1772	1.1645	1.1621	1.1511	1.1511	1.1491	1.1554	1.1621	1.1669	1.1719 (40)
HLP (average)												1.1645 (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												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (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 = 1443.0801 (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	31.7935	27.8068	28.6941	25.0162	24.0037	20.7134	19.1940	22.0254	22.2884	25.9750	28.3537	30.7903 (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	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8270	17.6102	14.3216	10.8424	8.1048	6.8424	7.3935	9.6103	12.8989	16.3781	19.1157	20.3781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	42.7332	41.3792	38.5674	34.7448	32.2630	28.7685	25.7983	29.6040	30.9561	34.9126	39.3802	41.3848	(72)
Total internal gains	336.8830	335.5431	323.8207	304.5503	284.2228	265.2663	253.3610	257.1525	267.4153	286.8196	309.1329	326.5995	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					4.4600	19.6403	0.6200	0.7000	0.7700		26.3454 (76)	
South					0.5700	46.7521	0.6200	0.7000	0.7700		8.0149 (78)	
West					2.2000	19.6403	0.6200	0.7000	0.7700		12.9955 (80)	
West					5.8000	19.6403	0.6200	0.7000	0.7700		34.2609 (80)	
Solar gains	81.6167	157.1071	253.8364	364.7171	443.5072	452.8010	431.5592	372.7797	293.2421	185.0032	101.2732	67.4521 (83)
Total gains	418.4997	492.6501	577.6570	669.2674	727.7299	718.0674	684.9202	629.9322	560.6573	471.8228	410.4061	394.0516 (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	42.5231	42.6221	42.7196	43.1836	43.2715	43.6856	43.6856	43.7631	43.5251	43.2715	43.0940	42.9100	
alpha	3.8349	3.8415	3.8480	3.8789	3.8848	3.9124	3.9124	3.9175	3.9017	3.8848	3.8729	3.8607	
util living area	0.9950	0.9902	0.9767	0.9371	0.8488	0.6992	0.5458	0.6048	0.8345	0.9647	0.9913	0.9961	(86)
MIT	19.2830	19.4812	19.8272	20.2770	20.6553	20.8893	20.9681	20.9526	20.7642	20.2523	19.6843	19.2494	(87)
Th 2	19.9339	19.9362	19.9383	19.9485	19.9504	19.9593	19.9593	19.9609	19.9559	19.9504	19.9465	19.9425	(88)
util rest of house	0.9938	0.9877	0.9705	0.9194	0.8055	0.6158	0.4297	0.4880	0.7707	0.9515	0.9886	0.9951	(89)
MIT 2	18.3664	18.5651	18.9092	19.3539	19.7033	19.9002	19.9486	19.9435	19.8096	19.3392	18.7762	18.3394	(90)
Living area fraction	18.7208	18.9193	19.2641	19.7108	20.0714	20.2826	20.3428	20.3336	20.1787	19.6922	19.1273	18.6912	(91)
MIT	18.7208	18.9193	19.2641	19.7108	20.0714	20.2826	20.3428	20.3336	20.1787	19.6922	19.1273	18.6912	(92)
Temperature adjustment	18.7208	18.9193	19.2641	19.7108	20.0714	20.2826	20.3428	20.3336	20.1787	19.6922	19.1273	18.6912	(93)
adjusted MIT	18.7208	18.9193	19.2641	19.7108	20.0714	20.2826	20.3428	20.3336	20.1787	19.6922	19.1273	18.6912	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	415.0707	485.0044	557.6827	612.1297	590.2586	462.1020	324.7974	335.2452	440.7537	447.0066	404.5926	391.4664	(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	1328.5128	1288.5223	1170.4809	980.7097	757.8699	509.5754	335.6290	352.1168	547.1064	823.1285	1093.3299	1322.9602	(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	679.6009	539.9641	455.9219	265.3776	124.7028	0.0000	0.0000	0.0000	0.0000	279.8347	495.8909	693.0314	(98)
Space heating												3534.3243	(98)
Space heating per m2												45.3700	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	842.9267	663.5806	680.3075	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8335	0.8941	0.8661	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	702.5763	593.3081	589.1828	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	929.7326	889.1535	826.4681	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	163.5526	220.1090	176.5403	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			560.2018 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	40.8881	55.0272	44.1351	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												140.0505 (107)
Energy for space heating												1.7978 (108)
Energy for space cooling												45.3700 (99)
Total												1.7978 (108)
Dwelling Fabric Energy Efficiency (DFEE)												47.1678 (109)
												47.2 (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	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1611 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4111 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3803 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4849	0.4754	0.4659	0.4183	0.4088	0.3613	0.3613	0.3518	0.3803	0.4088	0.4278	0.4469	(22b)				
Effective ac	0.6176	0.6130	0.6085	0.5875	0.5836	0.5653	0.5653	0.5619	0.5723	0.5836	0.5915	0.5998	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9600	1.0000	1.9600		(26)					
TER Opening Type (Uw = 1.40)			13.0300	1.3258	17.2746		(27)					
Jet Floor Lo			38.9500	0.1300	5.0635		(28a)					
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.1800	12.5316		(29a)					
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635		(30)					
Total net area of external elements Aum(A, m2)			162.5100				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.8932		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9775 (36)					
Total fabric heat loss						(33) + (36) =	50.8707 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 37.9424	Feb 37.6619	Mar 37.3870	Apr 36.0958	May 35.8542	Jun 34.7296	Jul 34.7296	Aug 34.5213	Sep 35.1628	Oct 35.8542	Nov 36.3429	Dec 36.8539 (38)
Heat transfer coeff	88.8131	88.5326	88.2577	86.9665	86.7249	85.6003	85.6003	85.3921	86.0335	86.7249	87.2137	87.7246 (39)
Average = Sum(39)m / 12 =												86.9654 (39)
HLP	Jan 1.1401	Feb 1.1365	Mar 1.1330	Apr 1.1164	May 1.1133	Jun 1.0988	Jul 1.0988	Aug 1.0962	Sep 1.1044	Oct 1.1133	Nov 1.1196	Dec 1.1261 (40)
HLP (average)												1.1164 (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												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
Daily hot water use	Jan 100.8897	Feb 97.2210	Mar 93.5523	Apr 89.8836	May 86.2148	Jun 82.5461	Jul 82.5461	Aug 86.2148	Sep 89.8836	Oct 93.5523	Nov 97.2210	Dec 100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)
Energy content (annual)										Total = Sum(45)m =		1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	31.7935	27.8068	28.6941	25.0162	24.0037	20.7134	19.1940	22.0254	22.2884	25.9750	28.3537	30.7903 (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	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8270	17.6102	14.3216	10.8424	8.1048	6.8424	7.3935	9.6103	12.8989	16.3781	19.1157	20.3781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	42.7332	41.3792	38.5674	34.7448	32.2630	28.7685	25.7983	29.6040	30.9561	34.9126	39.3802	41.3848	(72)
Total internal gains	336.8830	335.5431	323.8207	304.5503	284.2228	265.2663	253.3610	257.1525	267.4153	286.8196	309.1329	326.5995	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF factor	Access factor Table 6d	Gains W	
East	4.4600	19.6403	0.6300	0.7000	0.7700	0.7700	26.7703	(76)
South	0.5700	46.7521	0.6300	0.7000	0.7700	0.7700	8.1442	(78)
West	8.0000	19.6403	0.6300	0.7000	0.7700	0.7700	48.0186	(80)

Solar gains	82.9331	159.6410	257.9305	370.5996	450.6605	460.1043	438.5199	378.7923	297.9718	187.9872	102.9066	68.5401	(83)
Total gains	419.8161	495.1841	581.7512	675.1499	734.8833	725.3706	691.8809	635.9448	565.3871	474.8067	412.0395	395.1396	(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	60.9113	61.1043	61.2946	62.2047	62.3779	63.1975	63.1975	63.3516	62.8792	62.3779	62.0284	61.6671		
alpha	5.0608	5.0736	5.0863	5.1470	5.1585	5.2132	5.2132	5.2234	5.1919	5.1585	5.1352	5.1111		
util living area	0.9988	0.9969	0.9900	0.9609	0.8740	0.7034	0.5337	0.5976	0.8582	0.9824	0.9974	0.9991	(86)	
MIT	19.7151	19.8740	20.1489	20.5105	20.8006	20.9542	20.9910	20.9845	20.8682	20.4714	20.0286	19.6935	(87)	
Th 2	19.9682	19.9711	19.9740	19.9875	19.9900	20.0018	20.0018	20.0040	19.9972	19.9900	19.9849	19.9796	(88)	
util rest of house	0.9984	0.9959	0.9864	0.9461	0.8283	0.6139	0.4182	0.4782	0.7899	0.9732	0.9963	0.9988	(89)	
MIT 2	18.7938	18.9546	19.2298	19.5926	19.8562	19.9810	19.9995	19.9995	19.9234	19.5625	19.1203	18.7813	(90)	
Living area fraction									fLA = Living area / (4) =			0.3866	(91)	
MIT	19.1500	19.3100	19.5852	19.9475	20.2214	20.3573	20.3829	20.3804	20.2887	19.9139	19.4715	19.1340	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.1500	19.3100	19.5852	19.9475	20.2214	20.3573	20.3829	20.3804	20.2887	19.9139	19.4715	19.1340	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9979	0.9950	0.9846	0.9454	0.8400	0.6475	0.4632	0.5248	0.8123	0.9724	0.9956	0.9985	(94)	
Ext temp.	418.9428	492.6865	572.7869	638.2786	617.2738	469.6654	320.4956	333.7681	459.2703	461.6842	410.2184	394.5363	(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	1318.8744	1275.7596	1154.8674	960.7667	739.0136	492.8266	323.8156	339.8915	532.4359	807.7490	1078.9596	1310.0799	(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	669.5491	526.2251	433.0679	232.1914	90.5744	0.0000	0.0000	0.0000	0.0000	257.4722	481.4937	681.1645	(98)	
Space heating												3371.7382	(98)	
Space heating per m2												43.2829	(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	804.6430	633.4424	648.9797	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8960	0.9459	0.9241	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	720.9999	599.1827	599.7211	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	938.2689	897.2893	833.4958	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	156.4337	221.7913	173.9284	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												552.1534	(104)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	39.1084	55.4478	43.4821	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												138.0384 (107)
Space cooling per m2												1.7720 (108)
Energy for space heating												43.2829 (99)
Energy for space cooling												1.7720 (108)
Total												45.0549 (109)
Target Fabric Energy Efficiency (TFEE)												51.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					3.9600
Infiltration rate					0.3591 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3322 (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	0.3488	0.3239	0.3322	0.3156	0.3156	0.3073	0.2990	0.2907	0.2824	0.3073	0.2907	0.3073 (22b)
Effective ac	0.5608	0.5525	0.5552	0.5498	0.5498	0.5472	0.5447	0.5422	0.5399	0.5472	0.5422	0.5472 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (28a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14453.2600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 185.5361 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.3755 (36)
Total fabric heat loss (33) + (36) = 55.8936 (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	34.4575	33.9426	34.1100	33.7794	33.7794	33.6205	33.4659	33.3154	33.1692	33.6205	33.3154	33.6205 (38)
Heat transfer coeff	90.3511	89.8362	90.0036	89.6731	89.6731	89.5141	89.3595	89.2090	89.0628	89.5141	89.2090	89.5141 (39)
Average = Sum(39)m / 12 =												89.5767 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1598	1.1532	1.1554	1.1511	1.1511	1.1491	1.1471	1.1452	1.1433	1.1491	1.1452	1.1491 (40)
HLP (average)												1.1499 (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 2.4218 (42)
Average daily hot water use (litres/day) 91.7179 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (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 = 1443.0801 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (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	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645 (61)
Total heat required for water heating calculated for each month											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (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	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938 (64)
RHI water heating demand	Total per year (kWh/year) = Sum(64)m = 1688.5811 (64)										
Heat gains from water heating, kWh/month	54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314 (65)
											1689 (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	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
East				4.4600	25.1925		0.6200		0.7000	0.7700	33.7932 (76)	
South				0.5700	56.7559		0.6200		0.7000	0.7700	9.7299 (78)	
West				2.2000	25.1925		0.6200		0.7000	0.7700	16.6693 (80)	
West				5.8000	25.1925		0.6200		0.7000	0.7700	43.9464 (80)	
Solar gains	104.1388	170.6106	277.4113	399.8112	461.0300	510.8679	483.2507	428.4757	338.0855	216.6661	128.8132	84.5880 (83)
Total gains	651.9079	714.0361	799.8035	889.6360	917.5609	937.5611	892.5031	845.9165	774.2662	685.6237	634.1831	617.4596 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.4355	44.6902	44.6070	44.7715	44.7715	44.8510	44.9286	45.0043	45.0782	44.8510	45.0043	44.8510
alpha	3.9624	3.9793	3.9738	3.9848	3.9848	3.9901	3.9952	4.0003	4.0052	3.9901	4.0003	3.9901
util living area	0.9766	0.9660	0.9330	0.8537	0.7194	0.5212	0.3849	0.4043	0.6561	0.8785	0.9584	0.9799 (86)
MIT	19.7641	19.9095	20.2229	20.5886	20.8454	20.9673	20.9924	20.9910	20.9194	20.6108	20.1498	19.7471 (87)
Th 2	19.9523	19.9576	19.9559	19.9593	19.9593	19.9609	19.9625	19.9641	19.9656	19.9609	19.9641	19.9609 (88)
util rest of house	0.9710	0.9579	0.9171	0.8199	0.6583	0.4351	0.2852	0.3003	0.5708	0.8415	0.9467	0.9749 (89)
MIT 2	18.3435	18.5552	18.9976	19.4971	19.8155	19.9403	19.9598	19.9608	19.9056	19.5408	18.9076	18.3255 (90)
Living area fraction	18.8928	19.0788	19.4714	19.9191	20.2137	20.3374	20.3591	20.3591	20.2976	19.9545	19.3879	18.8752 (91)
MIT	18.8928	19.0788	19.4714	19.9191	20.2137	20.3374	20.3591	20.3591	20.2976	19.9545	19.3879	18.8752 (92)
Temperature adjustment	18.7428	18.9288	19.3214	19.7691	20.0637	20.1874	20.2091	20.2091	20.1476	19.8045	19.2379	-0.1500
adjusted MIT	18.7428	18.9288	19.3214	19.7691	20.0637	20.1874	20.2091	20.2091	20.1476	19.8045	19.2379	18.7252 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9623	0.9477	0.9053	0.8129	0.6649	0.4545	0.3093	0.3253	0.5868	0.8349	0.9362	0.9670	(94)
Useful gains	627.3297	676.6747	724.0487	723.2167	610.0858	426.0893	276.0118	275.2009	454.3435	572.4295	593.7056	597.0726	(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	1250.7106	1224.3611	1108.9669	920.8622	678.2587	437.4907	277.8237	277.3630	485.1784	752.3216	1011.4409	1228.5981	(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	463.7954	368.0453	286.3792	142.3048	50.7206	0.0000	0.0000	0.0000	0.0000	133.8397	300.7694	469.8549	(98)
Space heating												2215.7092	(98)
RHI space heating demand												2216	(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	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					3.9600
Infiltration rate					0.3591 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3322 (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	0.4236	0.4152	0.4069	0.3654	0.3571	0.3156	0.3156	0.3073	0.3322	0.3571	0.3737	0.3903 (22b)
Effective ac	0.5897	0.5862	0.5828	0.5668	0.5638	0.5498	0.5498	0.5472	0.5552	0.5638	0.5698	0.5762 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (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) = 14453.2600 (34)
185.5361 (35)
7.3755 (36)
(33) + (36) = 55.8936 (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	36.2309	36.0169	35.8072	34.8219	34.6376	33.7794	33.7794	33.6205	34.1100	34.6376	35.0105	35.4003 (38)
Heat transfer coeff	92.1245	91.9105	91.7008	90.7155	90.5312	89.6731	89.6731	89.5141	90.0036	90.5312	90.9041	91.2940 (39)
Average = Sum(39)m / 12 =												90.7146 (39)
HLP	1.1826	1.1799	1.1772	1.1645	1.1621	1.1511	1.1511	1.1491	1.1554	1.1621	1.1669	1.1719 (40)
HLP (average)												1.1645 (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												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (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 = 1443.0801 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (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	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645 (61)
Total heat required for water heating calculated for each month											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (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											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (64)
Heat gains from water heating, kWh/month											
54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (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	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					4.4600	19.6403	0.6200	0.7000	0.7700		26.3454 (76)	
South					0.5700	46.7521	0.6200	0.7000	0.7700		8.0149 (78)	
West					2.2000	19.6403	0.6200	0.7000	0.7700		12.9955 (80)	
West					5.8000	19.6403	0.6200	0.7000	0.7700		34.2609 (80)	
Solar gains	81.6167	157.1071	253.8364	364.7171	443.5072	452.8010	431.5592	372.7797	293.2421	185.0032	101.2732	67.4521 (83)
Total gains	629.3858	700.5325	776.2286	854.5419	900.0381	879.4942	840.8117	790.2205	729.4228	653.9608	606.6431	600.3237 (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	43.5801	43.6815	43.7815	44.2570	44.3471	44.7715	44.7715	44.8510	44.6070	44.3471	44.1652	43.9766
alpha	3.9053	3.9121	3.9188	3.9505	3.9565	3.9848	3.9848	3.9901	3.9738	3.9565	3.9443	3.9318
util living area	0.9818	0.9710	0.9456	0.8841	0.7708	0.6056	0.4568	0.5018	0.7302	0.9136	0.9704	0.9846 (86)
MIT	19.6163	19.7975	20.1036	20.4835	20.7762	20.9375	20.9841	20.9769	20.8663	20.4804	19.9820	19.5797 (87)
Th 2	19.9339	19.9362	19.9383	19.9485	19.9504	19.9593	19.9593	19.9609	19.9559	19.9504	19.9465	19.9425 (88)
util rest of house	0.9774	0.9642	0.9326	0.8562	0.7180	0.5230	0.3544	0.3969	0.6538	0.8865	0.9622	0.9809 (89)
MIT 2	18.1175	18.3797	18.8177	19.3503	19.7276	19.9136	19.9521	19.9496	19.8447	19.3603	18.6561	18.0704 (90)
Living area fraction									fLA = Living area / (4) =			0.3866 (91)
MIT	18.6970	18.9279	19.3149	19.7884	20.1330	20.3094	20.3511	20.3468	20.2397	19.7934	19.1688	18.6540 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5470	18.7779	19.1649	19.6384	19.9830	20.1594	20.2011	20.1968	20.0897	19.6434	19.0188	18.5040 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9697	0.9544	0.9207	0.8466	0.7198	0.5397	0.3788	0.4215	0.6645	0.8768	0.9526	0.9740	(94)	
Useful gains	610.2976	668.5633	714.6653	723.4896	647.8065	474.6346	318.4933	333.0826	484.7034	573.4150	577.9104	584.7106	(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	1312.5006	1275.5268	1161.3795	974.1435	749.8737	498.5327	322.9218	339.8666	539.0965	818.7116	1083.4669	1305.8682	(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	522.4390	407.8795	332.3554	180.4708	75.9380	0.0000	0.0000	0.0000	0.0000	182.5006	364.0007	536.5412	(98)	
Space heating												2602.1252	(98)	
Space heating per m2												(98) / (4) =	33.4034	(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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2891.2503 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	522.4390	407.8795	332.3554	180.4708	75.9380	0.0000	0.0000	0.0000	0.0000	182.5006	364.0007	536.5412	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	580.4878	453.1995	369.2837	200.5231	84.3755	0.0000	0.0000	0.0000	0.0000	202.7785	404.4453	596.1569	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(64)
Efficiency of water heater (217)m	89.1645	89.0892	88.9192	88.5404	87.8668	86.7000	86.7000	86.7000	86.7000	88.5193	88.9944	86.7000	(216)
Fuel for water heating, kWh/month	191.3581	168.1411	175.3706	155.7314	152.2086	135.5563	128.0378	143.4793	144.1738	161.6490	172.7006	185.9704	(219)
Water heating fuel used												1914.3771	(219)
Annual totals kWh/year													
Space heating fuel - main system												2891.2503	(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)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 908 * 1.00) =										-392.1930		-392.1930	(233)
Total delivered energy for all uses												4838.5859	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2891.2503	3.4800	100.6155	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1914.3771	3.4800	66.6203	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	350.1515	13.1900	46.1850	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-392.1930	13.1900	-51.7303	(252)
Total energy cost			291.5831	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9965 (257)
SAP value	86.0994	
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	2891.2503	0.2160	624.5101	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1914.3771	0.2160	413.5055	(264)
Space and water heating			1038.0155	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	350.1515	0.5190	181.7287	(268)
Energy saving/generation technologies				
PV Unit	-392.1930	0.5190	-203.5482	(269)
Total kg/year			1055.1210	(272)
CO2 emissions per m2			13.5400	(273)
EI value			88.4958	
EI rating			88	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact $0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency $3.48 / 0.8809 = 3.950$, stars = 4
Water heating environmental impact $0.216 / 0.8809 = 0.2452$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					3.9600
Infiltration rate					0.3591 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3322 (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	0.3488	0.3239	0.3322	0.3156	0.3156	0.3073	0.2990	0.2907	0.2824	0.3073	0.2907	0.3073 (22b)
Effective ac	0.5608	0.5525	0.5552	0.5498	0.5498	0.5472	0.5447	0.5422	0.5399	0.5472	0.5422	0.5472 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (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) = 14453.2600 (34)
185.5361 (35)
7.3755 (36)
(33) + (36) = 55.8936 (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	34.4575	33.9426	34.1100	33.7794	33.7794	33.6205	33.4659	33.3154	33.1692	33.6205	33.3154	33.6205 (38)
Heat transfer coeff	90.3511	89.8362	90.0036	89.6731	89.6731	89.5141	89.3595	89.2090	89.0628	89.5141	89.2090	89.5141 (39)
Average = Sum(39)m / 12 =												89.5767 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1598	1.1532	1.1554	1.1511	1.1511	1.1491	1.1471	1.1452	1.1433	1.1491	1.1452	1.1491 (40)
HLP (average)												1.1499 (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)
2.4218 (42)
91.7179 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (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 = 1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (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	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645	20.9866 (61)
Total heat required for water heating calculated for each month	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (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	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (64)
												Total per year (kWh/year) = Sum(64)m = 1688.5811 (64)
Heat gains from water heating, kWh/month	54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (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	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF	Specific data or Table 6c	Access factor Table 6d	Gains W	
East				4.4600	25.1925	0.6200		0.7000		0.7700	33.7932 (76)	
South				0.5700	56.7559	0.6200		0.7000		0.7700	9.7299 (78)	
West				2.2000	25.1925	0.6200		0.7000		0.7700	16.6693 (80)	
West				5.8000	25.1925	0.6200		0.7000		0.7700	43.9464 (80)	
Solar gains	104.1388	170.6106	277.4113	399.8112	461.0300	510.8679	483.2507	428.4757	338.0855	216.6661	128.8132	84.5880 (83)
Total gains	651.9079	714.0361	799.8035	889.6360	917.5609	937.5611	892.5031	845.9165	774.2662	685.6237	634.1831	617.4596 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.4355	44.6902	44.6070	44.7715	44.7715	44.8510	44.9286	45.0043	45.0782	44.8510	45.0043	44.8510
alpha	3.9624	3.9793	3.9738	3.9848	3.9848	3.9901	3.9952	4.0003	4.0052	3.9901	4.0003	3.9901
util living area	0.9766	0.9660	0.9330	0.8537	0.7194	0.5212	0.3849	0.4043	0.6561	0.8785	0.9584	0.9799 (86)
MIT	19.7641	19.9095	20.2229	20.5886	20.8454	20.9673	20.9924	20.9910	20.9194	20.6108	20.1498	19.7471 (87)
Th 2	19.9523	19.9576	19.9559	19.9593	19.9593	19.9609	19.9625	19.9641	19.9656	19.9609	19.9641	19.9609 (88)
util rest of house	0.9710	0.9579	0.9171	0.8199	0.6583	0.4351	0.2852	0.3003	0.5708	0.8415	0.9467	0.9749 (89)
MIT 2	18.3435	18.5552	18.9976	19.4971	19.8155	19.9403	19.9598	19.9608	19.9056	19.5408	18.9076	18.3255 (90)
Living area fraction	18.8928	19.0788	19.4714	19.9191	20.2137	20.3374	20.3591	20.3591	20.2976	19.9545	19.3879	18.8752 (91)
MIT	18.8928	19.0788	19.4714	19.9191	20.2137	20.3374	20.3591	20.3591	20.2976	19.9545	19.3879	18.8752 (92)
Temperature adjustment	18.7428	18.9288	19.3214	19.7691	20.0637	20.1874	20.2091	20.2091	20.1476	19.8045	19.2379	-0.1500
adjusted MIT	18.7428	18.9288	19.3214	19.7691	20.0637	20.1874	20.2091	20.2091	20.1476	19.8045	19.2379	18.7252 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9623	0.9477	0.9053	0.8129	0.6649	0.4545	0.3093	0.3253	0.5868	0.8349	0.9362	0.9670	(94)
Useful gains	627.3297	676.6747	724.0487	723.2167	610.0858	426.0893	276.0118	275.2009	454.3435	572.4295	593.7056	597.0726	(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	1250.7106	1224.3611	1108.9669	920.8622	678.2587	437.4907	277.8237	277.3630	485.1784	752.3216	1011.4409	1228.5981	(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	463.7954	368.0453	286.3792	142.3048	50.7206	0.0000	0.0000	0.0000	0.0000	133.8397	300.7694	469.8549	(98)
Space heating												2215.7092	(98)
Space heating per m2												(98) / (4) = 28.4430	(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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2461.8992 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	463.7954	368.0453	286.3792	142.3048	50.7206	0.0000	0.0000	0.0000	0.0000	133.8397	300.7694	469.8549	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	515.3282	408.9392	318.1991	158.1164	56.3563	0.0000	0.0000	0.0000	0.0000	148.7108	334.1882	522.0610	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(64)
Efficiency of water heater (217)m	89.0880	89.0199	88.8083	88.3452	87.5830	86.7000	86.7000	86.7000	86.7000	88.2641	88.8562	86.7000	(216)
Fuel for water heating, kWh/month	191.5223	168.2720	175.5895	156.0755	152.7018	135.5563	128.0378	143.4793	144.1738	162.1163	172.9691	186.1441	(219)
Water heating fuel used												1916.6379	(219)
Annual totals kWh/year													
Space heating fuel - main system												2461.8992	(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)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 1031 * 1.00) =										-445.3995		-445.3995	(233)
Total delivered energy for all uses												4358.2891	(238)

10a. Fuel costs - using BEDF prices (441)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2461.8992	3.9200	96.5064 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1916.6379	3.9200	75.1322 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	350.1515	16.9600	59.3857 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-445.3995	16.9600	-75.5398 (252)
Total energy cost			256.2046 (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	2461.8992	0.2160	531.7702 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.6379	0.2160	413.9938 (264)
Space and water heating			945.7640 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	350.1515	0.5190	181.7287 (268)
Energy saving/generation technologies			
PV Unit	-445.3995	0.5190	-231.1624 (269)
Total kg/year			935.2553 (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	2461.8992	1.2200	3003.5170 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.6379	1.2200	2338.2983 (264)
Space and water heating			5341.8152 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	350.1515	3.0700	1074.9652 (268)
Energy saving/generation technologies			
PV Unit	-445.3995	3.0700	-1367.3766 (269)
Primary energy kWh/year			5279.6539 (272)
Primary energy kWh/m2/year			67.7748 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 88

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 30	-189 kg (20.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£30 2.42 kg/m²	B 87	B 90
Total Savings	£30 2.42 kg/m²		
Potential energy efficiency rating:		B 87	
Potential environmental impact rating:			B 90

Fuel prices for cost data on this page from database revision number 441 TEST (27 Mar 2019)
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	£72	£81	-£8
Mains gas	£260	£221	£39
Space heating	£197	£197	£0
Water heating	£75	£45	£30
Lighting	£59	£59	£0
Generated (PV)	-£76	-£76	£0
Total cost of fuels	£256	£226	£31
Total cost of uses	£255	£225	£30
Delivered energy	56 kWh/m²	44 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	12 kg/m²	10 kg/m²	2 kg/m²
Primary energy	68 kWh/m²	54 kWh/m²	14 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	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					3.9600
Infiltration rate					0.3591 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3322 (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	0.4236	0.4152	0.4069	0.3654	0.3571	0.3156	0.3156	0.3073	0.3322	0.3571	0.3737	0.3903 (22b)
Effective ac	0.5897	0.5862	0.5828	0.5668	0.5638	0.5498	0.5498	0.5472	0.5552	0.5638	0.5698	0.5762 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum (m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (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) = 14453.2600 (34)
185.5361 (35)
7.3755 (36)
(33) + (36) = 55.8936 (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	36.2309	36.0169	35.8072	34.8219	34.6376	33.7794	33.7794	33.6205	34.1100	34.6376	35.0105	35.4003 (38)
Heat transfer coeff	92.1245	91.9105	91.7008	90.7155	90.5312	89.6731	89.6731	89.5141	90.0036	90.5312	90.9041	91.2940 (39)
Average = Sum(39)m / 12 =												90.7146 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1826	1.1799	1.1772	1.1645	1.1621	1.1511	1.1511	1.1491	1.1554	1.1621	1.1669	1.1719 (40)
HLP (average)												1.1645 (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)
2.4218 (42)
91.7179 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (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 =	1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (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	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645	20.9866 (61)	
Total heat required for water heating calculated for each month	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (62)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.7000 (H2)	
Collector heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0050 (H3a)	
Collector effective heat loss coefficient												1.8063 (H3b)	
Collector performance ratio												2.5804 (H4)	
Annual solar radiation per m2												1079.5246 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												1813.6014 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.2568 (H8)	
Utilisation factor												0.5487 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												91.7179 (H14)	
Volume ratio Veff/V												0.8177 (H15)	
Solar storage volume factor												0.9598 (H16)	
Solar input												-839.8420 (H17)	
Solar input	-24.3537	-40.6394	-69.2135	-92.7598	-114.5969	-112.6670	-111.1781	-97.1368	-76.0776	-51.9521	-28.8870	-20.3799 (63)	
	Solar input (sum of months) = Sum(63)m =											-839.8420 (63)	
Output from w/h	146.2697	109.1561	86.7245	45.1254	19.1439	4.8603	0.0000	27.2597	48.9211	91.1385	124.8068	145.5023 (64)	
	Total per year (kWh/year) = Sum(64)m =											848.9084 (64)	
Heat gains from water heating, kWh/month	54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (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	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W

East				4.4600	19.6403		0.6200		0.7000		0.7700		26.3454 (76)
South				0.5700	46.7521		0.6200		0.7000		0.7700		8.0149 (78)
West				2.2000	19.6403		0.6200		0.7000		0.7700		12.9955 (80)
West				5.8000	19.6403		0.6200		0.7000		0.7700		34.2609 (80)

Solar gains	81.6167	157.1071	253.8364	364.7171	443.5072	452.8010	431.5592	372.7797	293.2421	185.0032	101.2732		67.4521 (83)
Total gains	629.3858	700.5325	776.2286	854.5419	900.0381	879.4942	840.8117	790.2205	729.4228	653.9608	606.6431	600.3237	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9a, 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	43.5801	43.6815	43.7815	44.2570	44.3471	44.7715	44.7715	44.8510	44.6070	44.3471	44.1652	43.9766
alpha	3.9053	3.9121	3.9188	3.9505	3.9565	3.9848	3.9848	3.9901	3.9738	3.9565	3.9443	3.9318
util living area	0.9818	0.9710	0.9456	0.8841	0.7708	0.6056	0.4568	0.5018	0.7302	0.9136	0.9704	0.9846 (86)
MIT	19.6163	19.7975	20.1036	20.4835	20.7762	20.9375	20.9841	20.9769	20.8663	20.4804	19.9820	19.5797 (87)
Th 2	19.9339	19.9362	19.9383	19.9485	19.9504	19.9593	19.9593	19.9609	19.9559	19.9504	19.9465	19.9425 (88)
util rest of house	0.9774	0.9642	0.9326	0.8562	0.7180	0.5230	0.3544	0.3969	0.6538	0.8865	0.9622	0.9809 (89)
MIT 2	18.1175	18.3797	18.8177	19.3503	19.7276	19.9136	19.9521	19.9496	19.8447	19.3603	18.6561	18.0704 (90)
Living area fraction	fLA = Living area / (4) =											0.3866 (91)
MIT	18.6970	18.9279	19.3149	19.7884	20.1330	20.3094	20.3511	20.3468	20.2397	19.7934	19.1688	18.6540 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5470	18.7779	19.1649	19.6384	19.9830	20.1594	20.2011	20.1968	20.0897	19.6434	19.0188	18.5040 (93)

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Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9697	0.9544	0.9207	0.8466	0.7198	0.5397	0.3788	0.4215	0.6645	0.8768	0.9526	0.9740	(94)
Useful gains	610.2976	668.5633	714.6653	723.4896	647.8065	474.6346	318.4933	333.0826	484.7034	573.4150	577.9104	584.7106	(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	1312.5006	1275.5268	1161.3795	974.1435	749.8737	498.5327	322.9218	339.8666	539.0965	818.7116	1083.4669	1305.8682	(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	522.4390	407.8795	332.3554	180.4708	75.9380	0.0000	0.0000	0.0000	0.0000	182.5006	364.0007	536.5412	(98)
Space heating												2602.1252	(98)
Space heating per m2											(98) / (4) =	33.4034	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2891.2503 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	522.4390	407.8795	332.3554	180.4708	75.9380	0.0000	0.0000	0.0000	0.0000	182.5006	364.0007	536.5412	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	580.4878	453.1995	369.2837	200.5231	84.3755	0.0000	0.0000	0.0000	0.0000	202.7785	404.4453	596.1569	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	146.2697	109.1561	86.7245	45.1254	19.1439	4.8603	0.0000	27.2597	48.9211	91.1385	124.8068	145.5023	(64)
Efficiency of water heater	89.2569	89.2826	89.2966	89.3200	89.3155	86.7000	86.7000	86.7000	86.7000	88.8733	89.1338	86.7000	(216)
(217)m	89.2569	89.2826	89.2966	89.3200	89.3155	86.7000	86.7000	86.7000	86.7000	88.8733	89.1338	89.2751	(217)
Fuel for water heating, kWh/month	163.8750	122.2592	97.1195	50.5211	21.4341	5.6058	0.0000	31.4414	56.4257	102.5487	140.0219	162.9820	(219)
Water heating fuel used												954.2345	(219)
Annual totals kWh/year												2891.2503	(211)
Space heating fuel - main system												0.0000	(215)
Space heating fuel - secondary													
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 908 * 1.00) =										-392.1930		-392.1930	(233)
Total delivered energy for all uses												3928.4433	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2891.2503	3.4800	100.6155	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	954.2345	3.4800	33.2074	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	350.1515	13.1900	46.1850	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-392.1930	13.1900	-51.7303	(252)
Total energy cost			264.7651	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.9048 (257)
SAP value			87.3779
SAP rating (Section 12)			87 (258)
SAP band			B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2891.2503	0.2160	624.5101 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	954.2345	0.2160	206.1147 (264)
Space and water heating			830.6247 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	350.1515	0.5190	181.7287 (268)
Energy saving/generation technologies			
PV Unit	-392.1930	0.5190	-203.5482 (269)
Total kg/year			873.6802 (272)
CO2 emissions per m2			11.2200 (273)
EI value			90.4741
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					3.9600
Infiltration rate					0.3591 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3322 (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	0.3488	0.3239	0.3322	0.3156	0.3156	0.3073	0.2990	0.2907	0.2824	0.3073	0.2907	0.3073 (22b)
Effective ac	0.5608	0.5525	0.5552	0.5498	0.5498	0.5472	0.5447	0.5422	0.5399	0.5472	0.5422	0.5472 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (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) = 14453.2600 (34)
 185.5361 (35)
 7.3755 (36)
 (33) + (36) = 55.8936 (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	34.4575	33.9426	34.1100	33.7794	33.7794	33.6205	33.4659	33.3154	33.1692	33.6205	33.3154	33.6205 (38)
Heat transfer coeff	90.3511	89.8362	90.0036	89.6731	89.6731	89.5141	89.3595	89.2090	89.0628	89.5141	89.2090	89.5141 (39)
Average = Sum(39)m / 12 =												89.5767 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1598	1.1532	1.1554	1.1511	1.1511	1.1491	1.1471	1.1452	1.1433	1.1491	1.1452	1.1491 (40)
HLP (average)												1.1499 (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)
 2.4218 (42)
 91.7179 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (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 = 1443.0801 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (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	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645 (61)
Total heat required for water heating calculated for each month											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1208.1510 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											2029.6937 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.4065 (H8)
Collector performance factor											0.5088 (H9)
Dedicated solar storage volume											0.8793 (H10)
Effective solar volume											75.0000 (H11)
Daily hot water demand											75.0000 (H13)
Volume ratio Veff/V											91.7179 (H14)
Solar storage volume factor											0.8177 (H15)
Solar input											0.9598 (H16)
Solar input	-28.4329	-40.4298	-69.4891	-93.7569	-110.1231	-117.6288	-115.1551	-103.0673	-80.6946	-55.7895	-33.6286 (H17)
Output from w/h											-871.5756 (H17)
142.1906	109.3658	86.4489	44.1284	23.6178	0.0000	0.0000	21.3293	44.3042	87.3011	120.0652	142.5021 (64)
Heat gains from water heating, kWh/month											
54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (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	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W	
East				4.4600	25.1925	0.6200		0.7000		0.7700	33.7932 (76)	
South				0.5700	56.7559	0.6200		0.7000		0.7700	9.7299 (78)	
West				2.2000	25.1925	0.6200		0.7000		0.7700	16.6693 (80)	
West				5.8000	25.1925	0.6200		0.7000		0.7700	43.9464 (80)	
Solar gains	104.1388	170.6106	277.4113	399.8112	461.0300	510.8679	483.2507	428.4757	338.0855	216.6661	128.8132	84.5880 (83)
Total gains	651.9079	714.0361	799.8035	889.6360	917.5609	937.5611	892.5031	845.9165	774.2662	685.6237	634.1831	617.4596 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.4355	44.6902	44.6070	44.7715	44.7715	44.8510	44.9286	45.0043	45.0782	44.8510	45.0043	44.8510
alpha	3.9624	3.9793	3.9738	3.9848	3.9848	3.9901	3.9952	4.0003	4.0052	3.9901	4.0003	3.9901
util living area	0.9766	0.9660	0.9330	0.8537	0.7194	0.5212	0.3849	0.4043	0.6561	0.8785	0.9584	0.9799 (86)
MIT	19.7641	19.9095	20.2229	20.5886	20.8454	20.9673	20.9924	20.9910	20.9194	20.6108	20.1498	19.7471 (87)
Th 2	19.9523	19.9576	19.9559	19.9593	19.9593	19.9609	19.9625	19.9641	19.9656	19.9609	19.9641	19.9609 (88)
util rest of house	0.9710	0.9579	0.9171	0.8199	0.6583	0.4351	0.2852	0.3003	0.5708	0.8415	0.9467	0.9749 (89)
MIT 2	18.3435	18.5552	18.9976	19.4971	19.8155	19.9403	19.9598	19.9608	19.9056	19.5408	18.9076	18.3255 (90)
Living area fraction												0.3866 (91)
MIT	18.8928	19.0788	19.4714	19.9191	20.2137	20.3374	20.3591	20.3591	20.2976	19.9545	19.3879	18.8752 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7428	18.9288	19.3214	19.7691	20.0637	20.1874	20.2091	20.2091	20.1476	19.8045	19.2379	18.7252 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9623	0.9477	0.9053	0.8129	0.6649	0.4545	0.3093	0.3253	0.5868	0.8349	0.9362	0.9670	(94)
Useful gains	627.3297	676.6747	724.0487	723.2167	610.0858	426.0893	276.0118	275.2009	454.3435	572.4295	593.7056	597.0726	(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	1250.7106	1224.3611	1108.9669	920.8622	678.2587	437.4907	277.8237	277.3630	485.1784	752.3216	1011.4409	1228.5981	(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	463.7954	368.0453	286.3792	142.3048	50.7206	0.0000	0.0000	0.0000	0.0000	133.8397	300.7694	469.8549	(98)
Space heating												2215.7092	(98)
Space heating per m2											(98) / (4) =	28.4430	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2461.8992 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	463.7954	368.0453	286.3792	142.3048	50.7206	0.0000	0.0000	0.0000	0.0000	133.8397	300.7694	469.8549	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	515.3282	408.9392	318.1991	158.1164	56.3563	0.0000	0.0000	0.0000	0.0000	148.7108	334.1882	522.0610	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	142.1906	109.3658	86.4489	44.1284	23.6178	0.0000	0.0000	21.3293	44.3042	87.3011	120.0652	142.5021	(64)
Efficiency of water heater	89.2033	89.2220	89.2126	89.1964	88.9247	86.7000	86.7000	86.7000	86.7000	88.6677	89.0332	86.7000	(216)
(217)m	89.2033	89.2220	89.2126	89.1964	88.9247	86.7000	86.7000	86.7000	86.7000	88.6677	89.0332	89.2098	(217)
Fuel for water heating, kWh/month	159.4005	122.5771	96.9021	49.4732	26.5593	0.0000	0.0000	24.6013	51.1005	98.4588	134.8545	159.7382	(219)
Water heating fuel used	159.4005	122.5771	96.9021	49.4732	26.5593	0.0000	0.0000	24.6013	51.1005	98.4588	134.8545	159.7382	(219)
Annual totals kWh/year												923.6656	(219)
Space heating fuel - main system												2461.8992	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 1031 * 1.00) =												-445.3995	(233)
Total delivered energy for all uses												3415.3167	(238)

10a. Fuel costs - using BEDF prices (441)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2461.8992	3.9200	96.5064	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	923.6656	3.9200	36.2077	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	350.1515	16.9600	59.3857	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-445.3995	16.9600	-75.5398	(252)
Total energy cost			225.7601	(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	2461.8992	0.2160	531.7702	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	923.6656	0.2160	199.5118	(264)
Space and water heating			731.2820	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	350.1515	0.5190	181.7287	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

PV Unit	-445.3995	0.5190	-231.1624 (269)
Total kg/year			746.7233 (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	2461.8992	1.2200	3003.5170 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	923.6656	1.2200	1126.8720 (264)
Space and water heating			4130.3889 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	350.1515	3.0700	1074.9652 (268)
Energy saving/generation technologies			
PV Unit	-445.3995	3.0700	-1367.3766 (269)
Primary energy kWh/year			4221.7276 (272)
Primary energy kWh/m2/year			54.1942 (273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	185.5 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	245.76 (P1)
Transmission heat loss coefficient	55.89 (37)
Summer heat loss coefficient	301.65 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	4.4600	125.2818	0.6200	0.7000	0.9000	196.4254
South	0.5700	118.5567	0.6200	0.7000	0.9000	23.7561
West	2.2000	125.2818	0.6200	0.7000	0.9000	96.8914
West	5.8000	125.2818	0.6200	0.7000	0.9000	255.4410

total:						572.5139
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	Jun	Jul	Aug	
Solar gains	615	573	506	(P3)
Internal gains	424	406	414	
Total summer gains	1039	979	920	(P5)

	Jun	Jul	Aug	
Summer gain/loss ratio	3.44	3.24	3.05	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 185.5)	0.70	0.70	0.70	
Threshold temperature	19.55	21.25	21.05	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight