

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-175			Issued on Date	24/04/2019
Assessment Reference	As Built	Prop Type Ref	2302 - End (Op)		
Property	61, St Andrews Road, SOUTHAMPTON, SO32 2ST				
SAP Rating	87 B	DER	14.21	TER	18.63
Environmental	89 B	% DER<TER	23.73		
CO ₂ Emissions (t/year)	0.83	DFEE	47.76	TFEE	52.32
General Requirements Compliance	Pass	% DFEE<TFEE	8.71		
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) 18.63 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.21 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 47.8 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: 4.17 (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 North: 0.57 m², No overhang
Windows facing East: 4.46 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
Photovoltaic array 0.81 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					4.1700
Infiltration rate					0.3696 (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) =	0.3419 (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	0.4359	0.4274	0.4188	0.3761	0.3676	0.3248	0.3248	0.3163	0.3419	0.3676	0.3846	0.4017 (22b)
Effective ac	0.5950	0.5913	0.5877	0.5707	0.5675	0.5528	0.5528	0.5500	0.5585	0.5675	0.5740	0.5807 (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	36.5579	36.3312	36.1090	35.0653	34.8700	33.9610	33.9610	33.7926	34.3111	34.8700	35.2650	35.6780 (38)
Heat transfer coeff	92.4515	92.2248	92.0026	90.9589	90.7636	89.8546	89.8546	89.6862	90.2047	90.7636	91.1587	91.5716 (39)
Average = Sum(39)m / 12 =												90.9580 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1868	1.1839	1.1810	1.1676	1.1651	1.1535	1.1535	1.1513	1.1580	1.1651	1.1702	1.1755 (40)
HLP (average)												1.1676 (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)

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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 (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	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)	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
North					0.5700	10.6334	0.6200	0.7000	0.7700				1.8229 (74)
East					4.4600	19.6403	0.6200	0.7000	0.7700				26.3454 (76)
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	75.4247	147.4644	243.0354	355.3276	436.6231	447.5616	425.8444	364.9541	282.8927	174.9921	94.0216	62.0462	(83)
Total gains	446.4982	516.4207	598.6604	689.4991	749.0483	739.0365	703.7242	648.7958	577.7725	491.5349	435.4290	422.0679	(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	43.4260	43.5327	43.6378	44.1386	44.2335	44.6810	44.6810	44.7649	44.5076	44.2335	44.0418	43.8432
alpha	3.8951	3.9022	3.9092	3.9426	3.9489	3.9787	3.9787	3.9843	3.9672	3.9489	3.9361	3.9229
util living area	0.9943	0.9894	0.9755	0.9344	0.8426	0.6889	0.5355	0.5933	0.8273	0.9621	0.9902	0.9954 (86)
MIT	19.3482	19.5366	19.8722	20.3118	20.6786	20.9002	20.9720	20.9582	20.7817	20.2892	19.7399	19.3165 (87)
Th 2	19.9306	19.9329	19.9352	19.9460	19.9480	19.9574	19.9574	19.9592	19.9538	19.9480	19.9439	19.9396 (88)
util rest of house	0.9929	0.9866	0.9688	0.9158	0.7977	0.6046	0.4201	0.4767	0.7612	0.9478	0.9871	0.9943 (89)
MIT 2	17.7273	18.0030	18.4903	19.1214	19.6140	19.8808	19.9441	19.9372	19.7585	19.1024	18.3080	17.6869 (90)
Living area fraction	18.3541	18.5960	19.0246	19.5816	20.0257	20.2749	20.3415	20.3320	20.1541	19.5612	18.8616	18.3170 (92)
MIT	18.3541	18.5960	19.0246	19.5816	20.0257	20.2749	20.3415	20.3320	20.1541	19.5612	18.8616	18.3170 (91)
Temperature adjustment												-0.1500
adjusted MIT	18.2041	18.4460	18.8746	19.4316	19.8757	20.1249	20.1915	20.1820	20.0041	19.4112	18.7116	18.1670 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9893	0.9811	0.9599	0.9046	0.7942	0.6192	0.4472	0.5032	0.7649	0.9381	0.9819	0.9913 (94)
Useful gains	441.7316	506.6476	574.6296	623.6981	594.8750	457.6242	314.6925	326.4737	441.9482	461.0849	427.5629	418.3992 (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	1285.4510	1249.2735	1138.4991	957.9471	742.0531	496.4419	322.7142	339.1906	532.5774	799.7402	1058.5023	1278.9779 (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	627.7273	499.0446	419.5189	240.6593	109.5005	0.0000	0.0000	0.0000	0.0000	251.9595	454.2763	640.2706 (98)
Space heating												3242.9570 (98)
Space heating per m2												(98) / (4) = 41.6297 (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	3603.2856 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	627.7273	499.0446	419.5189	240.6593	109.5005	0.0000	0.0000	0.0000	0.0000	251.9595	454.2763	640.2706 (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)	697.4748	554.4940	466.1321	267.3992	121.6672	0.0000	0.0000	0.0000	0.0000	279.9551	504.7515	711.4118 (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	89.2738	89.2160	89.0812	88.7693	88.1551	86.7000	86.7000	86.7000	86.7000	88.7761	89.1423	86.7000 (216)
Fuel for water heating, kWh/month	191.1238	167.9020	175.0515	155.3299	151.7108	135.5563	128.0378	143.4793	144.1738	161.1814	172.4141	185.7572 (219)
Water heating fuel used	1911.7180 (219)											
Annual totals kWh/year												
Space heating fuel - main system	3603.2856 (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 * 0.81 * 908 * 1.00) =	-588.2895											
Total delivered energy for all uses	5351.8656 (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	3603.2856	0.2160	778.3097 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1911.7180	0.2160	412.9311 (264)
Space and water heating			1191.2408 (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	-588.2895	0.5190	-305.3223 (269)
Total CO2, kg/year			1106.5722 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2100 (273)

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

DER			14.2100 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			32.8383 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			32.8383 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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	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	
North				0.5700	10.6334	0.6300	0.7000	0.7700			1.8523 (74)	
East				4.4600	19.6403	0.6300	0.7000	0.7700			26.7703 (76)	
West				8.0000	19.6403	0.6300	0.7000	0.7700			48.0186 (80)	
Solar gains	76.6412	149.8429	246.9553	361.0587	443.6655	454.7803	432.7129	370.8404	287.4555	177.8146	95.5381	63.0470 (83)
Total gains	457.7792	528.4005	611.5744	703.6206	763.8701	753.4271	717.7770	662.4733	590.7429	503.3688	446.5566	433.1400 (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	0.9982	0.9959	0.9877	0.9544	0.8595	0.6834	0.5159	0.5766	0.8405	0.9776	0.9962	0.9986	(86)
MIT	19.7605	19.9133	20.1828	20.5381	20.8180	20.9599	20.9923	20.9868	20.8820	20.5025	20.0697	19.7392	(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	0.9976	0.9945	0.9832	0.9376	0.8112	0.5942	0.4035	0.4600	0.7687	0.9663	0.9947	0.9982	(89)
MIT 2	18.3145	18.5395	18.9327	19.4465	19.8135	19.9755	19.9990	19.9986	19.9024	19.4071	18.7783	18.2914	(90)
Living area fraction									fLA = Living area / (4) =			0.3866	(91)
MIT	18.8736	19.0707	19.4161	19.8686	20.2019	20.3561	20.3830	20.3807	20.2811	19.8306	19.2776	18.8512	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8736	19.0707	19.4161	19.8686	20.2019	20.3561	20.3830	20.3807	20.2811	19.8306	19.2776	18.8512	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9966	0.9928	0.9800	0.9352	0.8225	0.6274	0.4472	0.5053	0.7914	0.9640	0.9932	0.9974	(94)
Ext temp.	456.2391	524.5767	599.3587	658.0525	628.2492	472.6635	321.0059	334.7648	467.5275	485.2639	443.5167	432.0324	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1294.3263	1254.5663	1139.9428	953.8973	737.3245	492.7277	323.8295	339.9166	531.7859	800.5255	1062.0531	1285.2694	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	623.5368	490.5530	402.1946	213.0083	81.1520	0.0000	0.0000	0.0000	0.0000	234.5547	445.3462	634.8083	(98)
Space heating per m2												3125.1538	(98)
												40.1175	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3345.9891 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	623.5368	490.5530	402.1946	213.0083	81.1520	0.0000	0.0000	0.0000	0.0000	234.5547	445.3462	634.8083	(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)	667.5983	525.2173	430.6152	228.0602	86.8865	0.0000	0.0000	0.0000	0.0000	251.1292	476.8161	679.6663	(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	87.7148	87.4989	86.9825	85.7405	83.4796	80.3000	80.3000	80.3000	80.3000	85.8632	87.2250	80.3000	(216)
Fuel for water heating, kWh/month	228.6676	200.6927	210.0473	189.0002	187.9413	172.0825	164.8682	183.7894	185.8191	197.8828	207.9381	223.0783	(219)
Water heating fuel used												2351.8075	(219)
Annual totals kWh/year													
Space heating fuel - main system												3345.9891	(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												6122.9482	(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	3345.9891	0.2160	722.7336 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2351.8075	0.2160	507.9904 (264)
Space and water heating			1230.7241 (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			1451.3777 (272)
Emissions per m2 for space and water heating			15.7988 (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) = (15.7988 * 1.00) + 2.3328 + 0.4997, rounded to 2 d.p.			18.6300 (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					4.1700
Infiltration rate					0.3696 (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) =	0.3419 (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	0.4359	0.4274	0.4188	0.3761	0.3676	0.3248	0.3248	0.3163	0.3419	0.3676	0.3846	0.4017 (22b)
Effective ac	0.5950	0.5913	0.5877	0.5707	0.5675	0.5528	0.5528	0.5500	0.5585	0.5675	0.5740	0.5807 (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	36.5579	36.3312	36.1090	35.0653	34.8700	33.9610	33.9610	33.7926	34.3111	34.8700	35.2650	35.6780 (38)
Heat transfer coeff	92.4515	92.2248	92.0026	90.9589	90.7636	89.8546	89.8546	89.6862	90.2047	90.7636	91.1587	91.5716 (39)
Average = Sum(39)m / 12 =												90.9580 (39)
HLP	1.1868	1.1839	1.1810	1.1676	1.1651	1.1535	1.1535	1.1513	1.1580	1.1651	1.1702	1.1755 (40)
HLP (average)												1.1676 (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
North					0.5700	10.6334	0.6200	0.7000			0.7700			1.8229 (74)
East					4.4600	19.6403	0.6200	0.7000			0.7700			26.3454 (76)
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	75.4247	147.4644	243.0354	355.3276	436.6231	447.5616	425.8444	364.9541	282.8927	174.9921	94.0216			62.0462 (83)
Total gains	412.3077	483.0075	566.8561	659.8779	720.8459	712.8279	679.2054	622.1066	550.3080	461.8117	403.1545			388.6457 (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	42.3727	42.4769	42.5794	43.0680	43.1607	43.5973	43.5973	43.6792	43.4281	43.1607	42.9736	42.7798	
alpha	3.8248	3.8318	3.8386	3.8712	3.8774	3.9065	3.9065	3.9119	3.8952	3.8774	3.8649	3.8520	
util living area	0.9953	0.9908	0.9781	0.9397	0.8525	0.7033	0.5505	0.6115	0.8416	0.9670	0.9918	0.9963	(86)
MIT	19.2671	19.4607	19.8066	20.2622	20.6473	20.8864	20.9669	20.9505	20.7549	20.2359	19.6691	19.2355	(87)
Th 2	19.9306	19.9329	19.9352	19.9460	19.9480	19.9574	19.9574	19.9592	19.9538	19.9480	19.9439	19.9396	(88)
util rest of house	0.9941	0.9885	0.9722	0.9226	0.8097	0.6199	0.4336	0.4940	0.7790	0.9546	0.9893	0.9953	(89)
MIT 2	18.3480	18.5424	18.8867	19.3380	19.6946	19.8966	19.9464	19.9409	19.8009	19.3217	18.7592	18.3234	(90)
Living area fraction	18.7034	18.8975	19.2424	19.6954	20.0630	20.2793	20.3410	20.3312	20.1697	19.6752	19.1110	18.6761	(92)
Temperature adjustment	18.7034	18.8975	19.2424	19.6954	20.0630	20.2793	20.3410	20.3312	20.1697	19.6752	19.1110	18.6761	(93)
adjusted MIT	18.7034	18.8975	19.2424	19.6954	20.0630	20.2793	20.3410	20.3312	20.1697	19.6752	19.1110	18.6761	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	409.0838	475.9568	548.3107	605.5868	587.4712	461.5633	324.9085	334.9234	436.7746	438.9292	397.7542	386.2055	(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	1331.6143	1290.9135	1172.3318	981.9337	759.0521	510.3113	336.1428	352.5763	547.5178	823.6952	1094.9080	1325.5979	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	686.3627	547.6509	464.2717	270.9697	127.6562	0.0000	0.0000	0.0000	0.0000	286.2659	501.9507	698.9079	(98)
Space heating													3584.0358 (98)
Space heating per m2													46.0082 (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	844.6330	664.9239	681.6154	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8301	0.8913	0.8617	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	701.1693	592.6503	587.3508	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	923.6086	882.4739	817.3212	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	160.1563	215.6287	171.0980	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			546.8830 (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	40.0391	53.9072	42.7745	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												136.7207 (107)
Energy for space heating												1.7551 (108)
Energy for space cooling												46.0082 (99)
Total												1.7551 (108)
Dwelling Fabric Energy Efficiency (DFEE)												47.7632 (109)
												47.8 (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 (46)
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	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				0.5700	10.6334	0.6300	0.7000			0.7700			1.8523 (74)
East				4.4600	19.6403	0.6300	0.7000			0.7700			26.7703 (76)
West				8.0000	19.6403	0.6300	0.7000			0.7700			48.0186 (80)
Solar gains	76.6412	149.8429	246.9553	361.0587	443.6655	454.7803	432.7129	370.8404	287.4555	177.8146	95.5381	63.0470	(83)
Total gains	413.5242	485.3860	570.7760	665.6090	727.8882	720.0467	686.0739	627.9929	554.8708	464.6342	404.6710	389.6464	(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	0.9989	0.9972	0.9908	0.9630	0.8774	0.7073	0.5378	0.6041	0.8654	0.9839	0.9976	0.9992	(86)
MIT	19.7075	19.8623	20.1363	20.5011	20.7962	20.9531	20.9907	20.9837	20.8621	20.4602	20.0198	19.6869	(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	0.9985	0.9962	0.9874	0.9488	0.8324	0.6178	0.4216	0.4840	0.7988	0.9755	0.9966	0.9989	(89)
MIT 2	18.7862	18.9430	19.2174	19.5839	19.8528	19.9804	19.9994	19.9993	19.9193	19.5517	19.1115	18.7747	(90)
Living area fraction									fLA = Living area / (4) =			0.3866	(91)
MIT	19.1425	19.2984	19.5727	19.9385	20.2176	20.3565	20.3827	20.3799	20.2838	19.9030	19.4627	19.1274	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1425	19.2984	19.5727	19.9385	20.2176	20.3565	20.3827	20.3799	20.2838	19.9030	19.4627	19.1274	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9981	0.9954	0.9857	0.9480	0.8437	0.6513	0.4669	0.5309	0.8204	0.9745	0.9959	0.9986	(94)
Ext temp.	412.7200	483.1388	562.6215	630.9692	614.1386	468.9704	320.3563	333.4012	455.1940	452.8015	403.0179	389.0881	(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	1318.2049	1274.7318	1153.7682	959.9806	738.6847	492.7564	323.8004	339.8526	532.0144	806.7988	1078.1942	1309.4998	(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	673.6808	531.9505	439.8132	236.8882	92.6623	0.0000	0.0000	0.0000	0.0000	263.3740	486.1269	684.7863	(98)
Space heating												3409.2822	(98)
Space heating per m2										(98) / (4) =		43.7649	(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	0.8939	0.9444	0.9212	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	719.2732	598.2307	597.8343	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	932.0461	890.5019	824.2014	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	153.1965	217.4498	168.4171	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												539.0634	(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	38.2991	54.3624	42.1043	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												134.7658 (107)
Space cooling per m2												1.7300 (108)
Energy for space heating												43.7649 (99)
Energy for space cooling												1.7300 (108)
Total												45.4948 (109)
Target Fabric Energy Efficiency (TFEE)												52.3 (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					4.1700
Infiltration rate					0.3696 (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)	=	0.3419 (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	0.3590	0.3334	0.3419	0.3248	0.3248	0.3163	0.3077	0.2992	0.2906	0.3163	0.2992	0.3163 (22b)
Effective ac	0.5644	0.5556	0.5585	0.5528	0.5528	0.5500	0.5473	0.5448	0.5422	0.5500	0.5448	0.5500 (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	34.6792	34.1338	34.3111	33.9610	33.9610	33.7926	33.6288	33.4694	33.3145	33.7926	33.4694	33.7926 (38)
Heat transfer coeff	90.5728	90.0274	90.2047	89.8546	89.8546	89.6862	89.5224	89.3630	89.2082	89.6862	89.3630	89.6862 (39)
Average = Sum(39)m / 12 =												89.7525 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1627	1.1557	1.1580	1.1535	1.1535	1.1513	1.1492	1.1472	1.1452	1.1513	1.1472	1.1513 (40)
HLP (average)												1.1521 (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 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	165.8823 (64)
RHI water heating demand											
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			
North				0.5700	13.4839	0.6200	0.7000	0.7700	2.3116 (74)			
East				4.4600	25.1925	0.6200	0.7000	0.7700	33.7932 (76)			
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	96.7205	160.8996	266.6976	390.7584	454.9668	505.9889	477.9021	420.6755	327.3775	205.8728	120.1821	78.2020 (83)
Total gains	644.4896	704.3251	789.0899	880.5832	911.4977	932.6821	887.1546	838.1163	763.5583	674.8304	625.5520	611.0736 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	44.3267	44.5952	44.5076	44.6810	44.6810	44.7649	44.8468	44.9268	45.0048	44.7649	44.9268	44.7649
alpha	3.9551	3.9730	3.9672	3.9787	3.9787	3.9843	3.9898	3.9951	4.0003	3.9843	3.9951	3.9843
util living area	0.9775	0.9675	0.9357	0.8575	0.7231	0.5244	0.3877	0.4084	0.6633	0.8835	0.9602	0.9806 (86)
MIT	19.7495	19.8930	20.2072	20.5791	20.8417	20.9665	20.9922	20.9906	20.9158	20.5992	20.1363	19.7348 (87)
Th 2	19.9500	19.9556	19.9538	19.9574	19.9574	19.9592	19.9609	19.9625	19.9641	19.9592	19.9625	19.9592 (88)
util rest of house	0.9721	0.9597	0.9203	0.8242	0.6621	0.4377	0.2872	0.3034	0.5779	0.8473	0.9489	0.9758 (89)
MIT 2	18.3209	18.5304	18.9745	19.4835	19.8099	19.9379	19.9580	19.9591	19.9012	19.5249	18.8876	18.3066 (90)
Living area fraction	18.8733	19.0572	19.4511	19.9071	20.2088	20.3356	20.3579	20.3579	20.2935	19.9403	19.3704	18.8588 (92)
MIT	18.8733	19.0572	19.4511	19.9071	20.2088	20.3356	20.3579	20.3579	20.2935	19.9403	19.3704	18.8588 (92)
Temperature adjustment	18.7233	18.9072	19.3011	19.7571	20.0588	20.1856	20.2079	20.2079	20.1435	19.7903	19.2204	-0.1500
adjusted MIT	18.7233	18.9072	19.3011	19.7571	20.0588	20.1856	20.2079	20.2079	20.1435	19.7903	19.2204	18.7088 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9635	0.9496	0.9085	0.8169	0.6685	0.4572	0.3115	0.3287	0.5937	0.8404	0.9385	0.9680 (94)
Useful gains	620.9920	668.8572	716.8537	719.3775	609.3517	426.4476	276.3483	275.4720	453.3317	567.1255	587.0782	591.5119 (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	1252.0141	1225.0224	1109.6207	921.6461	679.1961	438.1707	278.2233	277.7324	485.6025	752.4939	1011.6239	1229.4894 (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	469.4804	373.7430	292.2186	145.6334	51.9643	0.0000	0.0000	0.0000	0.0000	137.9141	305.6729	474.6553 (98)
Space heating												2251.2820 (98)
RHI space heating demand												2251 (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	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					4.1700
Infiltration rate					0.3696 (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) =	0.3419 (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	0.4359	0.4274	0.4188	0.3761	0.3676	0.3248	0.3248	0.3163	0.3419	0.3676	0.3846	0.4017 (22b)
Effective ac	0.5950	0.5913	0.5877	0.5707	0.5675	0.5528	0.5528	0.5500	0.5585	0.5675	0.5740	0.5807 (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) (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	36.5579	36.3312	36.1090	35.0653	34.8700	33.9610	33.9610	33.7926	34.3111	34.8700	35.2650	35.6780 (38)
Heat transfer coeff	92.4515	92.2248	92.0026	90.9589	90.7636	89.8546	89.8546	89.6862	90.2047	90.7636	91.1587	91.5716 (39)
Average = Sum(39)m / 12 =												90.9580 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1868	1.1839	1.1810	1.1676	1.1651	1.1535	1.1535	1.1513	1.1580	1.1651	1.1702	1.1755 (40)
HLP (average)												1.1676 (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 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	
North					0.5700	10.6334	0.6200	0.7000	0.7700		1.8229 (74)	
East					4.4600	19.6403	0.6200	0.7000	0.7700		26.3454 (76)	
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	75.4247	147.4644	243.0354	355.3276	436.6231	447.5616	425.8444	364.9541	282.8927	174.9921	94.0216	62.0462 (83)
Total gains	623.1938	690.8899	765.4276	845.1525	893.1541	874.2548	835.0969	782.3949	719.0735	643.9497	599.3915	594.9178 (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	43.4260	43.5327	43.6378	44.1386	44.2335	44.6810	44.6810	44.7649	44.5076	44.2335	44.0418	43.8432
alpha	3.8951	3.9022	3.9092	3.9426	3.9489	3.9787	3.9787	3.9843	3.9672	3.9489	3.9361	3.9229
util living area	0.9824	0.9723	0.9480	0.8876	0.7748	0.6092	0.4604	0.5070	0.7374	0.9174	0.9716	0.9851 (86)
MIT	19.6009	19.7783	20.0852	20.4714	20.7705	20.9358	20.9835	20.9760	20.8606	20.4670	19.9679	19.5662 (87)
Th 2	19.9306	19.9329	19.9352	19.9460	19.9480	19.9574	19.9574	19.9592	19.9538	19.9480	19.9439	19.9396 (88)
util rest of house	0.9782	0.9658	0.9354	0.8602	0.7222	0.5263	0.3572	0.4011	0.6613	0.8911	0.9637	0.9815 (89)
MIT 2	18.0930	18.3501	18.7898	19.3326	19.7191	19.9104	19.9499	19.9472	19.8375	19.3409	18.6343	18.0491 (90)
Living area fraction	18.6760	18.9023	19.2907	19.7729	20.1256	20.3068	20.3496	20.3450	20.2331	19.7763	19.1499	18.6357 (92)
MIT	18.5260	18.7523	19.1407	19.6229	19.9756	20.1568	20.1996	20.1950	20.0831	19.6263	18.9999	18.4857 (93)
Temperature adjustment												-0.1500
adjusted MIT												18.4857 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9706	0.9561	0.9236	0.8505	0.7237	0.5430	0.3818	0.4260	0.6716	0.8812	0.9542	0.9747 (94)
Useful gains	604.8431	660.5822	706.9244	718.7784	646.4056	474.7405	318.8471	333.2700	482.9235	567.4739	571.9590	579.8630 (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	1315.2193	1277.5290	1162.9740	975.3443	751.1248	499.3077	323.4379	340.3591	539.7017	819.2622	1084.7820	1308.1656 (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	528.5198	414.5882	339.3009	184.7274	77.9111	0.0000	0.0000	0.0000	0.0000	187.3305	369.2325	541.8571 (98)
Space heating												2643.4677 (98)
Space heating per m2												(98) / (4) = 33.9341 (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													2937.1863 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	528.5198	414.5882	339.3009	184.7274	77.9111	0.0000	0.0000	0.0000	0.0000	187.3305	369.2325	541.8571	(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)	587.2443	460.6536	377.0010	205.2527	86.5679	0.0000	0.0000	0.0000	0.0000	208.1450	410.2583	602.0635	(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	89.1717	89.0999	88.9341	88.5593	87.8862	86.7000	86.7000	86.7000	86.7000	88.5406	89.0043	86.7000	(216)
Fuel for water heating, kWh/month	191.3427	168.1209	175.3410	155.6981	152.1750	135.5563	128.0378	143.4793	144.1738	161.6102	172.6813	185.9579	(219)
Water heating fuel used												1914.1743	(219)
Annual totals kWh/year													
Space heating fuel - main system												2937.1863	(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 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												4688.2226	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2937.1863	3.4800	102.2141	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1914.1743	3.4800	66.6133	(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	-588.2895	13.1900	-77.5954	(252)
Total energy cost			267.3094	(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] =	0.9135 (257)
SAP value	87.2566	
SAP rating (Section 12)	87	(258)
SAP band	B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2937.1863	0.2160	634.4322	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1914.1743	0.2160	413.4616	(264)
Space and water heating			1047.8939	(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	-588.2895	0.5190	-305.3223	(269)
Total kg/year			963.2253	(272)
CO2 emissions per m2			12.3600	(273)
EI value			89.4978	
EI rating			89	(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 $3.48 / 0.8810 = 3.950$, stars = 4
Water heating environmental impact $0.216 / 0.8810 = 0.2452$, 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					4.1700
Infiltration rate					0.3696 (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)	=	0.3419 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3590	0.3334	0.3419	0.3248	0.3248	0.3163	0.3077	0.2992	0.2906	0.3163	0.2992	0.3163 (22b)
	0.5644	0.5556	0.5585	0.5528	0.5528	0.5500	0.5473	0.5448	0.5422	0.5500	0.5448	0.5500 (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	34.6792	34.1338	34.3111	33.9610	33.9610	33.7926	33.6288	33.4694	33.3145	33.7926	33.4694	33.7926 (38)
Heat transfer coeff	90.5728	90.0274	90.2047	89.8546	89.8546	89.6862	89.5224	89.3630	89.2082	89.6862	89.3630	89.6862 (39)
Average = Sum(39)m / 12 =												89.7525 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1627	1.1557	1.1580	1.1535	1.1535	1.1513	1.1492	1.1472	1.1452	1.1513	1.1472	1.1513 (40)
HLP (average)												1.1521 (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 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
North					0.5700	13.4839	0.6200	0.7000	0.7700			2.3116 (74)
East					4.4600	25.1925	0.6200	0.7000	0.7700			33.7932 (76)
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	96.7205	160.8996	266.6976	390.7584	454.9668	505.9889	477.9021	420.6755	327.3775	205.8728	120.1821	78.2020 (83)
Total gains	644.4896	704.3251	789.0899	880.5832	911.4977	932.6821	887.1546	838.1163	763.5583	674.8304	625.5520	611.0736 (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	44.3267	44.5952	44.5076	44.6810	44.6810	44.7649	44.8468	44.9268	45.0048	44.7649	44.9268	44.7649
alpha	3.9551	3.9730	3.9672	3.9787	3.9787	3.9843	3.9898	3.9951	4.0003	3.9843	3.9951	3.9843
util living area	0.9775	0.9675	0.9357	0.8575	0.7231	0.5244	0.3877	0.4084	0.6633	0.8835	0.9602	0.9806 (86)
MIT	19.7495	19.8930	20.2072	20.5791	20.8417	20.9665	20.9922	20.9906	20.9158	20.5992	20.1363	19.7348 (87)
Th 2	19.9500	19.9556	19.9538	19.9574	19.9574	19.9592	19.9609	19.9625	19.9641	19.9592	19.9625	19.9592 (88)
util rest of house	0.9721	0.9597	0.9203	0.8242	0.6621	0.4377	0.2872	0.3034	0.5779	0.8473	0.9489	0.9758 (89)
MIT 2	18.3209	18.5304	18.9745	19.4835	19.8099	19.9379	19.9580	19.9591	19.9012	19.5249	18.8876	18.3066 (90)
Living area fraction	18.8733	19.0572	19.4511	19.9071	20.2088	20.3356	20.3579	20.3579	20.2935	19.9403	19.3704	18.8588 (92)
MIT	18.8733	19.0572	19.4511	19.9071	20.2088	20.3356	20.3579	20.3579	20.2935	19.9403	19.3704	18.8588 (92)
Temperature adjustment	18.7233	18.9072	19.3011	19.7571	20.0588	20.1856	20.2079	20.2079	20.1435	19.7903	19.2204	18.7088 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9635	0.9496	0.9085	0.8169	0.6685	0.4572	0.3115	0.3287	0.5937	0.8404	0.9385	0.9680 (94)
Useful gains	620.9920	668.8572	716.8537	719.3775	609.3517	426.4476	276.3483	275.4720	453.3317	567.1255	587.0782	591.5119 (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	1252.0141	1225.0224	1109.6207	921.6461	679.1961	438.1707	278.2233	277.7324	485.6025	752.4939	1011.6239	1229.4894 (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	469.4804	373.7430	292.2186	145.6334	51.9643	0.0000	0.0000	0.0000	0.0000	137.9141	305.6729	474.6553 (98)
Space heating												2251.2820 (98)
Space heating per m2												(98) / (4) = 28.8996 (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													2501.4244 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	469.4804	373.7430	292.2186	145.6334	51.9643	0.0000	0.0000	0.0000	0.0000	137.9141	305.6729	474.6553	(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)	521.6449	415.2700	324.6874	161.8149	57.7381	0.0000	0.0000	0.0000	0.0000	153.2379	339.6365	527.3947	(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	89.0961	89.0304	88.8236	88.3643	87.5988	86.7000	86.7000	86.7000	86.7000	88.2888	88.8683	86.7000	(216)
Fuel for water heating, kWh/month	191.5051	168.2521	175.5592	156.0418	152.6743	135.5563	128.0378	143.4793	144.1738	162.0710	172.9457	186.1304	(219)
Water heating fuel used												1916.4268	(219)
Annual totals kWh/year													
Space heating fuel - main system												2501.4244	(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 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												4174.9034	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2501.4244	3.9200	98.0558 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1916.4268	3.9200	75.1239 (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	-668.0993	16.9600	-113.3096 (252)
Total energy cost			219.9758 (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	2501.4244	0.2160	540.3077 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.4268	0.2160	413.9482 (264)
Space and water heating			954.2559 (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	-668.0993	0.5190	-346.7435 (269)
Total kg/year			828.1660 (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	2501.4244	1.2200	3051.7378 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.4268	1.2200	2338.0407 (264)
Space and water heating			5389.7785 (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	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			4643.9289 (272)
Primary energy kWh/m2/year			59.6140 (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 87
Current environmental impact rating: B 89

(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 (22.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£30 2.42 kg/m²	B 89	B 91
Total Savings	£30 2.42 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

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	£261	£222	£39
Space heating	£199	£199	£0
Water heating	£75	£45	£30
Lighting	£59	£59	£0
Generated (PV)	-£113	-£113	£0
Total cost of fuels	£220	£190	£31
Total cost of uses	£220	£190	£30
Delivered energy	54 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	2 kg/m²
Primary energy	60 kWh/m²	46 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	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					4.1700
Infiltration rate					0.3696 (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) =	0.3419 (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	0.4359	0.4274	0.4188	0.3761	0.3676	0.3248	0.3248	0.3163	0.3419	0.3676	0.3846	0.4017 (22b)
Effective ac	0.5950	0.5913	0.5877	0.5707	0.5675	0.5528	0.5528	0.5500	0.5585	0.5675	0.5740	0.5807 (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) (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	36.5579	36.3312	36.1090	35.0653	34.8700	33.9610	33.9610	33.7926	34.3111	34.8700	35.2650	35.6780 (38)
Heat transfer coeff	92.4515	92.2248	92.0026	90.9589	90.7636	89.8546	89.8546	89.6862	90.2047	90.7636	91.1587	91.5716 (39)
Average = Sum(39)m / 12 =												90.9580 (39)
HLP	1.1868	1.1839	1.1810	1.1676	1.1651	1.1535	1.1535	1.1513	1.1580	1.1651	1.1702	1.1755 (40)
HLP (average)												1.1676 (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 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			
North				0.5700	10.6334	0.6200	0.7000	0.7700	1.8229 (74)			
East				4.4600	19.6403	0.6200	0.7000	0.7700	26.3454 (76)			
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	75.4247	147.4644	243.0354	355.3276	436.6231	447.5616	425.8444	364.9541	282.8927	174.9921	94.0216	62.0462 (83)
Total gains	623.1938	690.8899	765.4276	845.1525	893.1541	874.2548	835.0969	782.3949	719.0735	643.9497	599.3915	594.9178 (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	43.4260	43.5327	43.6378	44.1386	44.2335	44.6810	44.6810	44.7649	44.5076	44.2335	44.0418	43.8432
alpha	3.8951	3.9022	3.9092	3.9426	3.9489	3.9787	3.9787	3.9843	3.9672	3.9489	3.9361	3.9229
util living area	0.9824	0.9723	0.9480	0.8876	0.7748	0.6092	0.4604	0.5070	0.7374	0.9174	0.9716	0.9851 (86)
MIT	19.6009	19.7783	20.0852	20.4714	20.7705	20.9358	20.9835	20.9760	20.8606	20.4670	19.9679	19.5662 (87)
Th 2	19.9306	19.9329	19.9352	19.9460	19.9480	19.9574	19.9574	19.9592	19.9538	19.9480	19.9439	19.9396 (88)
util rest of house	0.9782	0.9658	0.9354	0.8602	0.7222	0.5263	0.3572	0.4011	0.6613	0.8911	0.9637	0.9815 (89)
MIT 2	18.0930	18.3501	18.7898	19.3326	19.7191	19.9104	19.9499	19.9472	19.8375	19.3409	18.6343	18.0491 (90)
Living area fraction	fLA = Living area / (4) =											0.3866 (91)
MIT	18.6760	18.9023	19.2907	19.7729	20.1256	20.3068	20.3496	20.3450	20.2331	19.7763	19.1499	18.6357 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5260	18.7523	19.1407	19.6229	19.9756	20.1568	20.1996	20.1950	20.0831	19.6263	18.9999	18.4857 (93)

FULL SAP CALCULATION PRINTOUT

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	0.9706	0.9561	0.9236	0.8505	0.7237	0.5430	0.3818	0.4260	0.6716	0.8812	0.9542	0.9747	(94)
Useful gains	604.8431	660.5822	706.9244	718.7784	646.4056	474.7405	318.8471	333.2700	482.9235	567.4739	571.9590	579.8630	(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	1315.2193	1277.5290	1162.9740	975.3443	751.1248	499.3077	323.4379	340.3591	539.7017	819.2622	1084.7820	1308.1656	(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	528.5198	414.5882	339.3009	184.7274	77.9111	0.0000	0.0000	0.0000	0.0000	187.3305	369.2325	541.8571	(98)
Space heating												2643.4677	(98)
Space heating per m2											(98) / (4) =	33.9341	(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													2937.1863 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	528.5198	414.5882	339.3009	184.7274	77.9111	0.0000	0.0000	0.0000	0.0000	187.3305	369.2325	541.8571	(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)	587.2443	460.6536	377.0010	205.2527	86.5679	0.0000	0.0000	0.0000	0.0000	208.1450	410.2583	602.0635	(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	89.2635	89.2917	89.3080	89.3325	89.3293	86.7000	86.7000	86.7000	86.7000	88.8926	89.1428	86.7000	(216)
(217)m	89.2635	89.2917	89.3080	89.3325	89.3293	86.7000	86.7000	86.7000	86.7000	88.8926	89.1428	89.2807	(217)
Fuel for water heating, kWh/month	163.8628	122.2467	97.1071	50.5140	21.4307	5.6058	0.0000	31.4414	56.4257	102.5265	140.0076	162.9719	(219)
Water heating fuel used	163.8628	122.2467	97.1071	50.5140	21.4307	5.6058	0.0000	31.4414	56.4257	102.5265	140.0076	162.9719	(219)
Annual totals kWh/year												954.1404	(219)
Space heating fuel - main system												2937.1863	(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 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												3778.1887	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2937.1863	3.4800	102.2141	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	954.1404	3.4800	33.2041	(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	-588.2895	13.1900	-77.5954	(252)
Total energy cost			240.4953	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.8219	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	88.5349	
SAP rating (Section 12)		89	(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	2937.1863	0.2160	634.4322 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	954.1404	0.2160	206.0943 (264)
Space and water heating			840.5266 (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	-588.2895	0.5190	-305.3223 (269)
Total kg/year			781.8079 (272)
CO2 emissions per m2			10.0400 (273)
EI value			91.4758
EI rating			91 (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					4.1700
Infiltration rate					0.3696 (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)	=	0.3419 (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	0.3590	0.3334	0.3419	0.3248	0.3248	0.3163	0.3077	0.2992	0.2906	0.3163	0.2992	0.3163 (22b)
Effective ac	0.5644	0.5556	0.5585	0.5528	0.5528	0.5500	0.5473	0.5448	0.5422	0.5500	0.5448	0.5500 (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	34.6792	34.1338	34.3111	33.9610	33.9610	33.7926	33.6288	33.4694	33.3145	33.7926	33.4694	33.7926 (38)
Heat transfer coeff	90.5728	90.0274	90.2047	89.8546	89.8546	89.6862	89.5224	89.3630	89.2082	89.6862	89.3630	89.6862 (39)
Average = Sum(39)m / 12 =												89.7525 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1627	1.1557	1.1580	1.1535	1.1535	1.1513	1.1492	1.1472	1.1452	1.1513	1.1472	1.1513 (40)
HLP (average)												1.1521 (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 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	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												1208.1510 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												2029.6937 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.4065 (H8)	
Utilisation factor												0.5088 (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												-871.5756 (H17)	
Solar input	-28.4329	-40.4298	-69.4891	-93.7569	-110.1231	-117.6288	-115.1551	-103.0673	-80.6946	-55.7895	-33.6286	-23.3801 (63)	
	Solar input (sum of months) = Sum(63)m =											-871.5756 (63)	
Output from w/h	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)	
	Total per year (kWh/year) = Sum(64)m =											821.2534 (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		Specific data or Table 6c	FF	Access factor Table 6d		Gains W
North				0.5700	13.4839	0.6200			0.7000	0.7700		2.3116 (74)
East				4.4600	25.1925	0.6200			0.7000	0.7700		33.7932 (76)
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	96.7205	160.8996	266.6976	390.7584	454.9668	505.9889	477.9021	420.6755	327.3775	205.8728	120.1821	78.2020 (83)
Total gains	644.4896	704.3251	789.0899	880.5832	911.4977	932.6821	887.1546	838.1163	763.5583	674.8304	625.5520	611.0736 (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	44.3267	44.5952	44.5076	44.6810	44.6810	44.7649	44.8468	44.9268	45.0048	44.7649	44.9268	44.7649
alpha	3.9551	3.9730	3.9672	3.9787	3.9787	3.9843	3.9898	3.9951	4.0003	3.9843	3.9951	3.9843
util living area	0.9775	0.9675	0.9357	0.8575	0.7231	0.5244	0.3877	0.4084	0.6633	0.8835	0.9602	0.9806 (86)
MIT	19.7495	19.8930	20.2072	20.5791	20.8417	20.9665	20.9922	20.9906	20.9158	20.5992	20.1363	19.7348 (87)
Th 2	19.9500	19.9556	19.9538	19.9574	19.9574	19.9592	19.9609	19.9625	19.9641	19.9592	19.9625	19.9592 (88)
util rest of house	0.9721	0.9597	0.9203	0.8242	0.6621	0.4377	0.2872	0.3034	0.5779	0.8473	0.9489	0.9758 (89)
MIT 2	18.3209	18.5304	18.9745	19.4835	19.8099	19.9379	19.9580	19.9591	19.9012	19.5249	18.8876	18.3066 (90)
Living area fraction	18.8733	19.0572	19.4511	19.9071	20.2088	20.3356	20.3579	20.3579	20.2935	19.9403	19.3704	18.8588 (92)
MIT	18.7233	18.9072	19.3011	19.7571	20.0588	20.1856	20.2079	20.2079	20.1435	19.7903	19.2204	18.7088 (93)
Temperature adjustment												-0.1500
adjusted MIT	18.7233	18.9072	19.3011	19.7571	20.0588	20.1856	20.2079	20.2079	20.1435	19.7903	19.2204	18.7088 (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	0.9635	0.9496	0.9085	0.8169	0.6685	0.4572	0.3115	0.3287	0.5937	0.8404	0.9385	0.9680	(94)
Useful gains	620.9920	668.8572	716.8537	719.3775	609.3517	426.4476	276.3483	275.4720	453.3317	567.1255	587.0782	591.5119	(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	1252.0141	1225.0224	1109.6207	921.6461	679.1961	438.1707	278.2233	277.7324	485.6025	752.4939	1011.6239	1229.4894	(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	469.4804	373.7430	292.2186	145.6334	51.9643	0.0000	0.0000	0.0000	0.0000	137.9141	305.6729	474.6553	(98)
Space heating												2251.2820	(98)
Space heating per m2											(98) / (4) =	28.8996	(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													2501.4244	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	469.4804	373.7430	292.2186	145.6334	51.9643	0.0000	0.0000	0.0000	0.0000	137.9141	305.6729	474.6553	(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)	521.6449	415.2700	324.6874	161.8149	57.7381	0.0000	0.0000	0.0000	0.0000	153.2379	339.6365	527.3947	(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	89.2107	89.2311	89.2247	89.2104	88.9422	86.7000	86.7000	86.7000	86.7000	88.6914	89.0442	86.7000	(216)	
(217)m	89.2107	89.2311	89.2247	89.2104	88.9422	86.7000	86.7000	86.7000	86.7000	88.6914	89.0442	89.2159	(217)	
Fuel for water heating, kWh/month	159.3874	122.5646	96.8891	49.4655	26.5541	0.0000	0.0000	24.6013	51.1005	98.4324	134.8378	159.7273	(219)	
Water heating fuel used												923.5599	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2501.4244	(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 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)	
Total delivered energy for all uses												3232.0366	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2501.4244	3.9200	98.0558	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	923.5599	3.9200	36.2035	(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	-668.0993	16.9600	-113.3096	(252)
Total energy cost			189.5354	(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	2501.4244	0.2160	540.3077	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	923.5599	0.2160	199.4889	(264)
Space and water heating			739.7966	(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	-668.0993	0.5190	-346.7435 (269)
Total kg/year			639.6567 (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	2501.4244	1.2200	3051.7378 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	923.5599	1.2200	1126.7431 (264)
Space and water heating			4178.4809 (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	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			3586.1313 (272)
Primary energy kWh/m2/year			46.0351 (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
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
East	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
North	0.5700	87.1704	0.6200	0.7000	0.9000	17.4670
East	4.4600	125.2818	0.6200	0.7000	0.9000	196.4254
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:						566.2248

	Jun	Jul	Aug	
Solar gains	609	566	497	(P3)
Internal gains	424	406	414	
Total summer gains	1033	972	911	(P5)
Summer gain/loss ratio	3.42	3.22	3.02	(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	19.53	21.23	21.02	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			