

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-167				Issued on Date	01/05/2019
Assessment Reference	As Built		Prop Type Ref	2302 - Semi (As)		
Property	53, St Andrews Road, Botley, SOUTHAMPTON, SO32 2ST					
SAP Rating	87 B	DER	14.55	TER	18.06	
Environmental	89 B	% DER<TER	19.45			
CO ₂ Emissions (t/year)	0.87	DFEE	45.47	TFEE	49.02	
General Requirements Compliance	Pass	% DFEE<TFEE	7.26			
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

Semi-Detached 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) 18.06 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.55 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (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: 4.46 (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: 4.46 m², No overhang
Windows facing East: 0.57 m², No overhang
Windows facing South: 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 0.54 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.4600
Infiltration rate					0.3841 (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)	=	0.3553 (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	0.4530	0.4442	0.4353	0.3909	0.3820	0.3376	0.3376	0.3287	0.3553	0.3820	0.3997	0.4175 (22b)
Effective ac	0.6026	0.5986	0.5947	0.5764	0.5730	0.5570	0.5570	0.5540	0.5631	0.5730	0.5799	0.5872 (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/m ² K							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	37.0249	36.7801	36.5401	35.4129	35.2020	34.2202	34.2202	34.0384	34.5984	35.2020	35.6286	36.0747 (38)
Heat transfer coeff	92.9185	92.6737	92.4337	91.3065	91.0956	90.1138	90.1138	89.9320	90.4920	91.0956	91.5222	91.9683 (39)
Average = Sum(39)m / 12 =												91.3055 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1928	1.1896	1.1866	1.1721	1.1694	1.1568	1.1568	1.1545	1.1616	1.1694	1.1749	1.1806 (40)
HLP (average)												1.1721 (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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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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	(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					4.4600	10.6334	0.6200	0.7000	0.7700		14.2636 (74)	
East					0.5700	19.6403	0.6200	0.7000	0.7700		3.3670 (76)	
South					2.2000	46.7521	0.6200	0.7000	0.7700		30.9347 (78)	
South					5.8000	46.7521	0.6200	0.7000	0.7700		81.5552 (78)	
Solar gains	130.1206	218.0747	291.8418	355.4545	396.0024	393.1279	378.9533	348.0900	313.4526	238.9721	155.1332	111.8614 (83)
Total gains	501.1941	587.0309	647.4669	689.6260	708.4276	684.6028	656.8331	631.9317	608.3323	555.5149	496.5406	471.8831 (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	43.2077	43.3218	43.4343	43.9705	44.0723	44.5525	44.5525	44.6425	44.3663	44.0723	43.8669	43.6541
alpha	3.8805	3.8881	3.8956	3.9314	3.9382	3.9702	3.9702	3.9762	3.9578	3.9382	3.9245	3.9103
util living area	0.9915	0.9837	0.9687	0.9347	0.8620	0.7253	0.5685	0.6069	0.8086	0.9456	0.9847	0.9933 (86)
MIT	19.4182	19.6275	19.9292	20.3066	20.6434	20.8787	20.9651	20.9544	20.7999	20.3636	19.8207	19.3814 (87)
Th 2	19.9258	19.9283	19.9308	19.9424	19.9446	19.9547	19.9547	19.9566	19.9508	19.9446	19.9402	19.9356 (88)
util rest of house	0.9894	0.9796	0.9605	0.9161	0.8201	0.6419	0.4486	0.4889	0.7395	0.9264	0.9801	0.9915 (89)
MIT 2	17.8259	18.1311	18.5680	19.1116	19.5690	19.8593	19.9378	19.9324	19.7747	19.2012	18.4218	17.7787 (90)
Living area fraction	18.4416	18.7097	19.0943	19.5737	19.9844	20.2535	20.3350	20.3276	20.1711	19.6507	18.9626	18.3866 (91)
MIT	18.4416	18.7097	19.0943	19.5737	19.9844	20.2535	20.3350	20.3276	20.1711	19.6507	18.9626	18.3984 (92)
Temperature adjustment	18.2916	18.5597	18.9443	19.4237	19.8344	20.1035	20.1850	20.1776	20.0211	19.5007	18.8126	-0.1500
adjusted MIT	18.2916	18.5597	18.9443	19.4237	19.8344	20.1035	20.1850	20.1776	20.0211	19.5007	18.8126	18.2484 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9846	0.9723	0.9504	0.9048	0.8150	0.6549	0.4765	0.5155	0.7448	0.9160	0.9732	0.9875	(94)
Useful gains	493.4976	570.7863	615.3743	623.9982	577.3825	448.3496	312.9486	325.7720	453.0583	508.8504	483.2351	466.0072	(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	1300.0783	1265.8926	1150.2739	960.8791	741.0113	495.9374	323.0583	339.7246	535.8104	810.8114	1071.9676	1292.0078	(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	600.0960	467.1114	397.9653	242.5542	121.7398	0.0000	0.0000	0.0000	0.0000	224.6590	423.8874	614.5444	(98)
Space heating												3092.5577	(98)
Space heating per m2												(98) / (4) = 39.6991	(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													3436.1752 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	600.0960	467.1114	397.9653	242.5542	121.7398	0.0000	0.0000	0.0000	0.0000	224.6590	423.8874	614.5444	(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)	666.7734	519.0127	442.1837	269.5047	135.2665	0.0000	0.0000	0.0000	0.0000	249.6211	470.9860	682.8271	(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	89.2480	89.1758	89.0458	88.7753	88.2418	86.7000	86.7000	86.7000	86.7000	88.6866	89.0976	86.7000	(216)
Fuel for water heating, kWh/month													
	191.1791	167.9778	175.1211	155.3193	151.5618	135.5563	128.0378	143.4793	144.1738	161.3441	172.5006	185.8048	(219)
Water heating fuel used												1912.0558	(219)
Annual totals kWh/year													
Space heating fuel - main system												3436.1752	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 1080 * 1.00) =										-466.3546		-466.3546	(233)
Total delivered energy for all uses												5307.0278	(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	3436.1752	0.2160	742.2138	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1912.0558	0.2160	413.0040	(264)
Space and water heating			1155.2179	(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	-466.3546	0.5190	-242.0381	(269)
Total CO2, kg/year			1133.8335	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5500	(273)

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

DER			14.5500	ZC1
Total Floor Area		TFA	77.9000	
Assumed number of occupants		N	2.4218	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.3545	ZC2
CO2 emissions from cooking, equation (L16)			2.2737	ZC3
Total CO2 emissions			33.1783	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			33.1783	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9600	1.0000	1.9600		(26)					
TER Opening Type (Uw = 1.40)			13.0300	1.3258	17.2746		(27)					
Jet Floor Lo			38.9500	0.1300	5.0635		(28a)					
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.1800	12.5316		(29a)					
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635		(30)					
Total net area of external elements Aum(A, m2)			162.5100				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		41.8932		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9775 (36)					
Total fabric heat loss						(33) + (36) =	50.8707 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 37.9424	Feb 37.6619	Mar 37.3870	Apr 36.0958	May 35.8542	Jun 34.7296	Jul 34.7296	Aug 34.5213	Sep 35.1628	Oct 35.8542	Nov 36.3429	Dec 36.8539 (38)
Heat transfer coeff	88.8131	88.5326	88.2577	86.9665	86.7249	85.6003	85.6003	85.3921	86.0335	86.7249	87.2137	87.7246 (39)
Average = Sum(39)m / 12 =												86.9654 (39)
HLP	Jan 1.1401	Feb 1.1365	Mar 1.1330	Apr 1.1164	May 1.1133	Jun 1.0988	Jul 1.0988	Aug 1.0962	Sep 1.1044	Oct 1.1133	Nov 1.1196	Dec 1.1261 (40)
HLP (average)												1.1164 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
Daily hot water use	Jan 100.8897	Feb 97.2210	Mar 93.5523	Apr 89.8836	May 86.2148	Jun 82.5461	Jul 82.5461	Aug 86.2148	Sep 89.8836	Oct 93.5523	Nov 97.2210	Dec 100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)
Energy content (annual)										Total = Sum(45)m =		1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	44.7483	47.6732	44.3261	43.9341	40.7077	42.0646	43.9341	44.3261	47.6732	47.9446	50.9589 (61)
Solar input	200.5754	175.6039	182.7045	162.0496	156.8926	138.1823	132.3891	147.5829	149.2128	169.9085	181.3739	195.8545 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	200.5754	175.6039	182.7045	162.0496	156.8926	138.1823	132.3891	147.5829	149.2128	169.9085	181.3739	195.8545 (64)
	62.4872	54.6966	56.8162	50.2246	48.5422	42.5872	40.5491	45.4467	45.9563	52.5615	56.3514	60.9175 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8270	17.6102	14.3216	10.8424	8.1048	6.8424	7.3935	9.6103	12.8989	16.3781	19.1157	20.3781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	83.9882	81.3937	76.3658	69.7564	65.2449	59.1489	54.5014	61.0843	63.8283	70.6472	78.2658	81.8784	(72)
Total internal gains	381.1380	378.5576	364.6191	342.5619	320.2047	298.6467	285.0641	291.6329	303.2874	325.5542	351.0185	370.0930	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			4.4600		10.6334		0.6300		0.7000		0.7700		14.4937 (74)
East			0.5700		19.6403		0.6300		0.7000		0.7700		3.4213 (76)
South			8.0000		46.7521		0.6300		0.7000		0.7700		114.3043 (78)
Solar gains	132.2193	221.5920	296.5490	361.1877	402.3895	399.4687	385.0654	353.7043	318.5082	242.8265	157.6354	113.6656	(83)
Total gains	513.3573	600.1496	661.1681	703.7495	722.5942	698.1154	670.1295	645.3372	621.7957	568.3807	508.6539	483.7587	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	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	0.9969	0.9928	0.9829	0.9544	0.8799	0.7234	0.5495	0.5900	0.8185	0.9637	0.9933	0.9977	(86)
MIT	19.8268	19.9974	20.2382	20.5383	20.7928	20.9479	20.9898	20.9853	20.8970	20.5701	20.1428	19.7999	(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	0.9959	0.9904	0.9769	0.9376	0.8355	0.6340	0.4313	0.4716	0.7430	0.9470	0.9906	0.9970	(89)
MIT 2	18.4110	18.6614	19.0117	19.4466	19.7852	19.9666	19.9979	19.9979	19.9165	19.4992	18.8842	18.3799	(90)
Living area fraction	18.9584	19.1780	19.4860	19.8687	20.1748	20.3460	20.3814	20.3797	20.2956	19.9132	19.3709	18.9290	(91)
MIT	18.9584	19.1780	19.4860	19.8687	20.1748	20.3460	20.3814	20.3797	20.2956	19.9132	19.3709	18.9290	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9584	19.1780	19.4860	19.8687	20.1748	20.3460	20.3814	20.3797	20.2956	19.9132	19.3709	18.9290	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9945	0.9879	0.9733	0.9352	0.8447	0.6667	0.4773	0.5177	0.7678	0.9454	0.9884	0.9959	(94)
Ext temp.	510.5459	592.8723	643.5028	658.1464	610.3419	465.4467	319.8822	334.0827	477.3937	537.3263	502.7381	481.7576	(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	1301.8617	1264.0663	1146.1115	953.9103	734.9747	491.8584	323.6915	339.8340	533.0293	807.6908	1070.1874	1292.0931	(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	588.7390	451.0424	373.9409	212.9500	92.7268	0.0000	0.0000	0.0000	0.0000	201.1512	408.5636	602.8896	(98)
Space heating per m2												2932.0033	(98)
												37.6380	(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													3139.1898 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	588.7390	451.0424	373.9409	212.9500	92.7268	0.0000	0.0000	0.0000	0.0000	201.1512	408.5636	602.8896	(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)	630.3415	482.9148	400.3650	227.9978	99.2792	0.0000	0.0000	0.0000	0.0000	215.3653	437.4342	645.4920	(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	87.6001	87.3222	86.8159	85.7398	83.7770	80.3000	80.3000	80.3000	80.3000	85.4770	87.0344	80.3000	(216)
Fuel for water heating, kWh/month	228.9671	201.0988	210.4504	189.0017	187.2741	172.0825	164.8682	183.7894	185.8191	198.7767	208.3935	223.3351	(219)
Water heating fuel used												2353.8566	(219)
Annual totals kWh/year													
Space heating fuel - main system												3139.1898	(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												5918.1979	(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	3139.1898	0.2160	678.0650 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2353.8566	0.2160	508.4330 (264)
Space and water heating			1186.4980 (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			1407.1517 (272)
Emissions per m2 for space and water heating			15.2310 (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) = (15.2310 * 1.00) + 2.3328 + 0.4997, rounded to 2 d.p.			18.0600 (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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.4600
Infiltration rate					0.3841 (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) =	0.3553 (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	0.4530	0.4442	0.4353	0.3909	0.3820	0.3376	0.3376	0.3287	0.3553	0.3820	0.3997	0.4175 (22b)
Effective ac	0.6026	0.5986	0.5947	0.5764	0.5730	0.5570	0.5570	0.5540	0.5631	0.5730	0.5799	0.5872 (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			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	37.0249	36.7801	36.5401	35.4129	35.2020	34.2202	34.2202	34.0384	34.5984	35.2020	35.6286	36.0747 (38)
Heat transfer coeff	92.9185	92.6737	92.4337	91.3065	91.0956	90.1138	90.1138	89.9320	90.4920	91.0956	91.5222	91.9683 (39)
Average = Sum(39)m / 12 =												91.3055 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1928	1.1896	1.1866	1.1721	1.1694	1.1568	1.1568	1.1545	1.1616	1.1694	1.1749	1.1806 (40)
HLP (average)												1.1721 (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 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					4.4600	10.6334	0.6200	0.7000	0.7700		14.2636 (74)	
East					0.5700	19.6403	0.6200	0.7000	0.7700		3.3670 (76)	
South					2.2000	46.7521	0.6200	0.7000	0.7700		30.9347 (78)	
South					5.8000	46.7521	0.6200	0.7000	0.7700		81.5552 (78)	
Solar gains	130.1206	218.0747	291.8418	355.4545	396.0024	393.1279	378.9533	348.0900	313.4526	238.9721	155.1332	111.8614 (83)
Total gains	467.0036	553.6178	615.6625	660.0048	680.2251	658.3943	632.3143	605.2425	580.8678	525.7917	464.2661	438.4609 (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	42.1597	42.2711	42.3809	42.9041	43.0034	43.4719	43.4719	43.5598	43.2902	43.0034	42.8029	42.5953	
alpha	3.8106	3.8181	3.8254	3.8603	3.8669	3.8981	3.8981	3.9040	3.8860	3.8669	3.8535	3.8397	
util living area	0.9928	0.9856	0.9718	0.9400	0.8715	0.7401	0.5849	0.6256	0.8230	0.9516	0.9868	0.9943	(86)
MIT	19.3389	19.5542	19.8656	20.2569	20.6096	20.8623	20.9589	20.9460	20.7750	20.3138	19.7522	19.3020	(87)
Th 2	19.9258	19.9283	19.9308	19.9424	19.9446	19.9547	19.9547	19.9566	19.9508	19.9446	19.9402	19.9356	(88)
util rest of house	0.9910	0.9820	0.9643	0.9229	0.8319	0.6583	0.4637	0.5069	0.7569	0.9344	0.9829	0.9929	(89)
MIT 2	18.4157	18.6311	18.9405	19.3301	19.6604	19.8791	19.9407	19.9365	19.8128	19.3921	18.8382	18.3865	(90)
Living area fraction	18.7727	18.9880	19.2982	19.6885	20.0274	20.2593	20.3344	20.3268	20.1848	19.7485	19.1916	18.7405	(92)
Temperature adjustment	18.7727	18.9880	19.2982	19.6885	20.0274	20.2593	20.3344	20.3268	20.1848	19.7485	19.1916	18.7405	(93)
adjusted MIT	18.7727	18.9880	19.2982	19.6885	20.0274	20.2593	20.3344	20.3268	20.1848	19.7485	19.1916	18.7405	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	461.5536	541.3710	590.3014	605.8547	568.2869	450.4790	322.4089	333.8146	449.3286	489.2116	454.6436	434.3698	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1344.7787	1305.5892	1182.9826	985.0585	758.5871	509.9797	336.5185	353.1448	550.6276	833.3838	1106.6517	1337.2649	(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	657.1195	513.5546	440.9548	273.0267	141.5833	0.0000	0.0000	0.0000	0.0000	256.0641	469.4458	671.7540	(98)
Space heating													3423.5028 (98)
Space heating per m2													43.9474 (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	847.0702	666.8425	683.4835	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8018	0.8718	0.8525	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	679.1951	581.3607	582.7029	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	859.9848	827.6660	797.6099	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	130.1686	183.2512	159.8909	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			473.3106 (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	32.5421	45.8128	39.9727	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												118.3276 (107)
Energy for space heating												1.5190 (108)
Energy for space cooling												43.9474 (99)
Total												1.5190 (108)
Dwelling Fabric Energy Efficiency (DFEE)												45.4664 (109)
												45.5 (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 heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							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)				
	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	0.4849	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				4.4600	10.6334	0.6300	0.7000	0.7700			14.4937 (74)	
East				0.5700	19.6403	0.6300	0.7000	0.7700			3.4213 (76)	
South				8.0000	46.7521	0.6300	0.7000	0.7700			114.3043 (78)	

Solar gains	132.2193	221.5920	296.5490	361.1877	402.3895	399.4687	385.0654	353.7043	318.5082	242.8265	157.6354	113.6656 (83)
Total gains	469.1023	557.1351	620.3696	665.7379	686.6123	664.7350	638.4265	610.8568	585.9235	529.6461	466.7683	440.2651 (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	0.9980	0.9948	0.9869	0.9630	0.8970	0.7485	0.5739	0.6186	0.8439	0.9725	0.9954	0.9985	(86)	
MIT	19.7741	19.9472	20.1928	20.5012	20.7686	20.9388	20.9875	20.9818	20.8795	20.5304	20.0936	19.7478	(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	0.9973	0.9930	0.9822	0.9487	0.8563	0.6600	0.4519	0.4967	0.7727	0.9591	0.9936	0.9980	(89)	
MIT 2	18.8526	19.0272	19.2727	19.5840	19.8310	19.9729	19.9985	19.9987	19.9308	19.6182	19.1848	18.8355	(90)	
Living area fraction									fLA = Living area / (4) =			0.3866	(91)	
MIT	19.2089	19.3829	19.6285	19.9386	20.1935	20.3464	20.3809	20.3788	20.2976	19.9709	19.5362	19.1882	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.2089	19.3829	19.6285	19.9386	20.1935	20.3464	20.3809	20.3788	20.2976	19.9709	19.5362	19.1882	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9966	0.9917	0.9802	0.9479	0.8656	0.6927	0.4996	0.5444	0.7965	0.9588	0.9925	0.9975	(94)
Useful gains	467.5120	552.5166	608.0803	631.0686	594.3075	460.4359	318.9569	332.5324	466.7105	507.8186	463.2462	439.1722	(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	1324.1042	1282.2103	1158.6887	959.9913	736.5976	491.8933	323.6485	339.7606	533.2036	812.6904	1084.6052	1314.8353	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	637.3046	490.3542	409.6527	236.8243	105.8638	0.0000	0.0000	0.0000	0.0000	226.8247	447.3785	651.4934	(98)
Space heating												3205.6962	(98)
Space heating per m2												41.1514	(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	0.8688	0.9302	0.9145	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	699.0954	589.2534	593.5070	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	867.3961	834.8101	804.1722	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	121.1765	182.6942	156.7349	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												460.6056	(104)

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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	30.2941	45.6736	39.1837	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												115.1514 (107)
Space cooling per m2												1.4782 (108)
Energy for space heating												41.1514 (99)
Energy for space cooling												1.4782 (108)
Total												42.6296 (109)
Target Fabric Energy Efficiency (TFEE)												49.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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					4.4600
Infiltration rate					0.3841 (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)	=	0.3553 (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	0.3731	0.3464	0.3553	0.3376	0.3376	0.3287	0.3198	0.3109	0.3020	0.3287	0.3109	0.3287 (22b)
Effective ac	0.5696	0.5600	0.5631	0.5570	0.5570	0.5540	0.5511	0.5483	0.5456	0.5540	0.5483	0.5540 (25)

3. Heat losses and heat loss parameter

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

Heat capacity Cm = Sum(A x k)
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	34.9959	34.4069	34.5984	34.2202	34.2202	34.0384	33.8615	33.6894	33.5221	34.0384	33.6894	34.0384 (38)
Heat transfer coeff	90.8896	90.3005	90.4920	90.1138	90.1138	89.9320	89.7551	89.5830	89.4157	89.9320	89.5830	89.9320 (39)
Average = Sum(39)m / 12 =												90.0036 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1667	1.1592	1.1616	1.1568	1.1568	1.1545	1.1522	1.1500	1.1478	1.1545	1.1500	1.1545 (40)
HLP (average)												1.1554 (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	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W				
North				4.4600	13.4839	0.6200	0.7000	0.7700	18.0873 (74)				
East				0.5700	25.1925	0.6200	0.7000	0.7700	4.3189 (76)				
South				2.2000	56.7559	0.6200	0.7000	0.7700	37.5540 (78)				
South				5.8000	56.7559	0.6200	0.7000	0.7700	99.0060 (78)				
Solar gains	158.9662	226.6273	306.5622	378.7929	404.5738	438.0313	418.2063	390.7877	348.7056	268.0595	188.8497	134.3926	(83)
Total gains	706.7353	770.0528	828.9544	868.6177	861.1047	864.7245	827.4587	808.2285	784.8863	737.0171	694.2196	667.2642	(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	44.1722	44.4604	44.3663	44.5525	44.5525	44.6425	44.7306	44.8165	44.9003	44.6425	44.8165	44.6425
alpha	3.9448	3.9640	3.9578	3.9702	3.9702	3.9762	3.9820	3.9878	3.9934	3.9762	3.9878	3.9762
util living area	0.9699	0.9573	0.9265	0.8625	0.7496	0.5602	0.4150	0.4235	0.6511	0.8568	0.9457	0.9742 (86)
MIT	19.8266	19.9716	20.2466	20.5659	20.8178	20.9574	20.9899	20.9892	20.9208	20.6493	20.2171	19.8066 (87)
Th 2	19.9467	19.9528	19.9508	19.9547	19.9547	19.9566	19.9584	19.9602	19.9620	19.9566	19.9602	19.9566 (88)
util rest of house	0.9628	0.9475	0.9094	0.8299	0.6898	0.4699	0.3080	0.3148	0.5657	0.8159	0.9312	0.9680 (89)
MIT 2	18.4286	18.6392	19.0260	19.4647	19.7826	19.9291	19.9547	19.9562	19.9032	19.5840	18.9977	18.4075 (90)
Living area fraction	18.9691	19.1544	19.4979	19.8905	20.1828	20.3267	20.3550	20.3556	20.2967	19.9959	19.4692	18.9485 (92)
MIT	18.9691	19.1544	19.4979	19.8905	20.1828	20.3267	20.3550	20.3556	20.2967	19.9959	19.4692	18.9485 (92)
Temperature adjustment	18.8191	19.0044	19.3479	19.7405	20.0328	20.1767	20.2050	20.2056	20.1467	19.8459	19.3192	-0.1500
adjusted MIT	18.8191	19.0044	19.3479	19.7405	20.0328	20.1767	20.2050	20.2056	20.1467	19.8459	19.3192	18.7985 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	673.4967	721.0396	743.9783	714.1949	598.2138	423.5209	276.2523	275.6053	456.7396	597.6424	638.6367	639.8410	(94)
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	1265.1024	1237.5137	1117.3882	922.8117	678.8121	438.5684	278.6882	278.2133	487.0184	759.5558	1022.9661	1240.9255	(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	440.1546	347.0706	277.8170	150.2041	59.9651	0.0000	0.0000	0.0000	0.0000	120.4636	276.7172	447.2069	(98)
Space heating												2119.5990	(98)
RHI space heating demand												2120	(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					4.4600
Infiltration rate					0.3841 (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) =	0.3553 (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	0.4530	0.4442	0.4353	0.3909	0.3820	0.3376	0.3376	0.3287	0.3553	0.3820	0.3997	0.4175 (22b)
Effective ac	0.6026	0.5986	0.5947	0.5764	0.5730	0.5570	0.5570	0.5540	0.5631	0.5730	0.5799	0.5872 (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	37.0249	36.7801	36.5401	35.4129	35.2020	34.2202	34.2202	34.0384	34.5984	35.2020	35.6286	36.0747 (38)
Heat transfer coeff	92.9185	92.6737	92.4337	91.3065	91.0956	90.1138	90.1138	89.9320	90.4920	91.0956	91.5222	91.9683 (39)
Average = Sum(39)m / 12 =												91.3055 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1928	1.1896	1.1866	1.1721	1.1694	1.1568	1.1568	1.1545	1.1616	1.1694	1.1749	1.1806 (40)
HLP (average)												1.1721 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.4218 (42)
91.7179 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 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					4.4600	10.6334	0.6200	0.7000	0.7700		14.2636 (74)	
East					0.5700	19.6403	0.6200	0.7000	0.7700		3.3670 (76)	
South					2.2000	46.7521	0.6200	0.7000	0.7700		30.9347 (78)	
South					5.8000	46.7521	0.6200	0.7000	0.7700		81.5552 (78)	
Solar gains	130.1206	218.0747	291.8418	355.4545	396.0024	393.1279	378.9533	348.0900	313.4526	238.9721	155.1332	111.8614 (83)
Total gains	677.8897	761.5001	814.2341	845.2794	852.5333	819.8211	788.2057	765.5308	749.6333	707.9297	660.5031	644.7330 (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	43.2077	43.3218	43.4343	43.9705	44.0723	44.5525	44.5525	44.6425	44.3663	44.0723	43.8669	43.6541
alpha	3.8805	3.8881	3.8956	3.9314	3.9382	3.9702	3.9702	3.9762	3.9578	3.9382	3.9245	3.9103
util living area	0.9770	0.9628	0.9383	0.8881	0.7950	0.6410	0.4861	0.5178	0.7197	0.8948	0.9618	0.9806 (86)
MIT	19.6662	19.8612	20.1346	20.4665	20.7446	20.9225	20.9799	20.9739	20.8718	20.5267	20.0410	19.6273 (87)
Th 2	19.9258	19.9283	19.9308	19.9424	19.9446	19.9547	19.9547	19.9566	19.9508	19.9446	19.9402	19.9356 (88)
util rest of house	0.9716	0.9543	0.9238	0.8608	0.7441	0.5568	0.3782	0.4102	0.6425	0.8637	0.9515	0.9761 (89)
MIT 2	18.1834	18.4644	18.8546	19.3232	19.6870	19.8970	19.9455	19.9436	19.8451	19.4150	18.7345	18.1342 (90)
Living area fraction	18.7567	19.0044	19.3495	19.7653	20.0959	20.2935	20.3454	20.3420	20.2421	19.8449	19.2397	18.3866 (91)
MIT	18.7567	19.0044	19.3495	19.7653	20.0959	20.2935	20.3454	20.3420	20.2421	19.8449	19.2397	18.7115 (92)
Temperature adjustment	18.6067	18.8544	19.1995	19.6153	19.9459	20.1435	20.1954	20.1920	20.0921	19.6949	19.0897	-0.1500
adjusted MIT	18.6067	18.8544	19.1995	19.6153	19.9459	20.1435	20.1954	20.1920	20.0921	19.6949	19.0897	18.5615 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9627	0.9433	0.9116	0.8510	0.7442	0.5729	0.4039	0.4354	0.6538	0.8549	0.9408	0.9681	(94)	
Useful gains	652.5984	718.3159	742.2301	719.3228	634.4401	469.6978	318.3339	333.2890	490.1441	605.2425	621.4312	624.1422	(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	1329.3556	1293.2089	1173.8630	978.3740	751.1633	499.5464	323.9963	341.0189	542.2335	828.5031	1097.3227	1320.8056	(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	503.5073	386.3281	321.1348	186.5169	86.8421	0.0000	0.0000	0.0000	0.0000	166.1059	342.6418	518.3176	(98)	
Space heating												2511.3945	(98)	
Space heating per m2												(98) / (4) =	32.2387	(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													2790.4384 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	503.5073	386.3281	321.1348	186.5169	86.8421	0.0000	0.0000	0.0000	0.0000	166.1059	342.6418	518.3176	(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)	559.4526	429.2534	356.8165	207.2410	96.4912	0.0000	0.0000	0.0000	0.0000	184.5621	380.7132	575.9084	(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	89.1412	89.0529	88.8941	88.5671	87.9699	86.7000	86.7000	86.7000	86.7000	88.4421	88.9516	86.7000	(216)
Fuel for water heating, kWh/month	191.4080	168.2095	175.4201	155.6844	152.0303	135.5563	128.0378	143.4793	144.1738	161.7900	172.7837	186.0145	(219)
Water heating fuel used												1914.5877	(219)
Annual totals kWh/year													
Space heating fuel - main system												2790.4384	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 1080 * 1.00) =										-466.3546		-466.3546	(233)
Total delivered energy for all uses												4663.8229	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2790.4384	3.4800	97.1073	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1914.5877	3.4800	66.6277	(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	-466.3546	13.1900	-61.5122	(252)
Total energy cost			278.3002	(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] =	0.9511 (257)
SAP value	86.7326	
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	2790.4384	0.2160	602.7347	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1914.5877	0.2160	413.5509	(264)
Space and water heating			1016.2856	(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	-466.3546	0.5190	-242.0381	(269)
Total kg/year			994.9012	(272)
CO2 emissions per m2			12.7700	(273)
EI value			89.1524	
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	$3.48 / 0.8808 = 3.951$, stars = 4
Water heating environmental impact	$0.216 / 0.8808 = 0.2452$, 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					4.4600
Infiltration rate					0.3841 (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)	=	0.3553 (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	0.3731	0.3464	0.3553	0.3376	0.3376	0.3287	0.3198	0.3109	0.3020	0.3287	0.3109	0.3287 (22b)
Effective ac	0.5696	0.5600	0.5631	0.5570	0.5570	0.5540	0.5511	0.5483	0.5456	0.5540	0.5483	0.5540 (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	34.9959	34.4069	34.5984	34.2202	34.2202	34.0384	33.8615	33.6894	33.5221	34.0384	33.6894	34.0384 (38)
Heat transfer coeff	90.8896	90.3005	90.4920	90.1138	90.1138	89.9320	89.7551	89.5830	89.4157	89.9320	89.5830	89.9320 (39)
Average = Sum(39)m / 12 =												90.0036 (39)
HLP	1.1667	1.1592	1.1616	1.1568	1.1568	1.1545	1.1522	1.1500	1.1478	1.1545	1.1500	1.1545 (40)
HLP (average)												1.1554 (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 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 (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				4.4600	13.4839	0.6200	0.7000		0.7700	18.0873 (74)		
East				0.5700	25.1925	0.6200	0.7000		0.7700	4.3189 (76)		
South				2.2000	56.7559	0.6200	0.7000		0.7700	37.5540 (78)		
South				5.8000	56.7559	0.6200	0.7000		0.7700	99.0060 (78)		

Solar gains	158.9662	226.6273	306.5622	378.7929	404.5738	438.0313	418.2063	390.7877	348.7056	268.0595	188.8497	134.3926 (83)
Total gains	706.7353	770.0528	828.9544	868.6177	861.1047	864.7245	827.4587	808.2285	784.8863	737.0171	694.2196	667.2642 (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	44.1722	44.4604	44.3663	44.5525	44.5525	44.6425	44.7306	44.8165	44.9003	44.6425	44.8165	44.6425
alpha	3.9448	3.9640	3.9578	3.9702	3.9702	3.9762	3.9820	3.9878	3.9934	3.9762	3.9878	3.9762
util living area	0.9699	0.9573	0.9265	0.8625	0.7496	0.5602	0.4150	0.4235	0.6511	0.8568	0.9457	0.9742 (86)
MIT	19.8266	19.9716	20.2466	20.5659	20.8178	20.9574	20.9899	20.9892	20.9208	20.6493	20.2171	19.8066 (87)
Th 2	19.9467	19.9528	19.9508	19.9547	19.9547	19.9566	19.9584	19.9602	19.9620	19.9566	19.9602	19.9566 (88)
util rest of house	0.9628	0.9475	0.9094	0.8299	0.6898	0.4699	0.3080	0.3148	0.5657	0.8159	0.9312	0.9680 (89)
MIT 2	18.4286	18.6392	19.0260	19.4647	19.7826	19.9291	19.9547	19.9562	19.9032	19.5840	18.9977	18.4075 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.9691	19.1544	19.4979	19.8905	20.1828	20.3267	20.3550	20.3556	20.2967	19.9959	19.4692	18.9485 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.8191	19.0044	19.3479	19.7405	20.0328	20.1767	20.2050	20.2056	20.1467	19.8459	19.3192	18.7985 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9530	0.9364	0.8975	0.8222	0.6947	0.4898	0.3339	0.3410	0.5819	0.8109	0.9199	0.9589	(94)	
Useful gains	673.4967	721.0396	743.9783	714.1949	598.2138	423.5209	276.2523	275.6053	456.7396	597.6424	638.6367	639.8410	(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	1265.1024	1237.5137	1117.3882	922.8117	678.8121	438.5684	278.6882	278.2133	487.0184	759.5558	1022.9661	1240.9255	(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	440.1546	347.0706	277.8170	150.2041	59.9651	0.0000	0.0000	0.0000	0.0000	120.4636	276.7172	447.2069	(98)	
Space heating												2119.5990	(98)	
Space heating per m2												(98) / (4) =	27.2092	(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													2355.1100 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	440.1546	347.0706	277.8170	150.2041	59.9651	0.0000	0.0000	0.0000	0.0000	120.4636	276.7172	447.2069	(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)	489.0607	385.6340	308.6855	166.8934	66.6279	0.0000	0.0000	0.0000	0.0000	133.8484	307.4636	496.8965	(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	89.0531	88.9790	88.7851	88.3898	87.6954	86.7000	86.7000	86.7000	86.7000	88.1778	88.7932	86.7000	(216)
Fuel for water heating, kWh/month	191.5974	168.3494	175.6354	155.9968	152.5061	135.5563	128.0378	143.4793	144.1738	162.2750	173.0920	186.2118	(219)
Water heating fuel used												1916.9111	(219)
Annual totals kWh/year													
Space heating fuel - main system												2355.1100	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 1208 * 1.00) =										-521.9212		-521.9212	(233)
Total delivered energy for all uses												4175.2514	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2355.1100	3.9200	92.3203	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1916.9111	3.9200	75.1429	(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	-521.9212	16.9600	-88.5178	(252)
Total energy cost			239.0511	(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	2355.1100	0.2160	508.7038	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.9111	0.2160	414.0528	(264)
Space and water heating			922.7566	(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	-521.9212	0.5190	-270.8771	(269)
Total kg/year			872.5331	(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	2355.1100	1.2200	2873.2343	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.9111	1.2200	2338.6315	(264)
Space and water heating			5211.8657	(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	-521.9212	3.0700	-1602.2982	(269)
Primary energy kWh/year			4914.7828	(272)
Primary energy kWh/m2/year			63.0909	(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 (21.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£30 2.42 kg/m²	B 88	B 91
Total Savings	£30 2.42 kg/m²		

Potential energy efficiency rating: B 88
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	£255	£217	£39
Space heating	£193	£193	£0
Water heating	£75	£45	£30
Lighting	£59	£59	£0
Generated (PV)	-£89	-£89	£0
Total cost of fuels	£238	£209	£31
Total cost of uses	£238	£208	£30
Delivered energy	54 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	63 kWh/m²	50 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					4.4600
Infiltration rate					0.3841 (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) =	0.3553 (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	0.4530	0.4442	0.4353	0.3909	0.3820	0.3376	0.3376	0.3287	0.3553	0.3820	0.3997	0.4175 (22b)
Effective ac	0.6026	0.5986	0.5947	0.5764	0.5730	0.5570	0.5570	0.5540	0.5631	0.5730	0.5799	0.5872 (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	37.0249	36.7801	36.5401	35.4129	35.2020	34.2202	34.2202	34.0384	34.5984	35.2020	35.6286	36.0747 (38)
Heat transfer coeff	92.9185	92.6737	92.4337	91.3065	91.0956	90.1138	90.1138	89.9320	90.4920	91.0956	91.5222	91.9683 (39)
Average = Sum(39)m / 12 =												91.3055 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1928	1.1896	1.1866	1.1721	1.1694	1.1568	1.1568	1.1545	1.1616	1.1694	1.1749	1.1806 (40)
HLP (average)												1.1721 (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 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				4.4600	10.6334	0.6200		0.7000		0.7700	14.2636 (74)	
East				0.5700	19.6403	0.6200		0.7000		0.7700	3.3670 (76)	
South				2.2000	46.7521	0.6200		0.7000		0.7700	30.9347 (78)	
South				5.8000	46.7521	0.6200		0.7000		0.7700	81.5552 (78)	
Solar gains	130.1206	218.0747	291.8418	355.4545	396.0024	393.1279	378.9533	348.0900	313.4526	238.9721	155.1332	111.8614 (83)
Total gains	677.8897	761.5001	814.2341	845.2794	852.5333	819.8211	788.2057	765.5308	749.6333	707.9297	660.5031	644.7330 (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	43.2077	43.3218	43.4343	43.9705	44.0723	44.5525	44.5525	44.6425	44.3663	44.0723	43.8669	43.6541	
alpha	3.8805	3.8881	3.8956	3.9314	3.9382	3.9702	3.9702	3.9762	3.9578	3.9382	3.9245	3.9103	
util living area	0.9770	0.9628	0.9383	0.8881	0.7950	0.6410	0.4861	0.5178	0.7197	0.8948	0.9618	0.9806	(86)
MIT	19.6662	19.8612	20.1346	20.4665	20.7446	20.9225	20.9799	20.9739	20.8718	20.5267	20.0410	19.6273	(87)
Th 2	19.9258	19.9283	19.9308	19.9424	19.9446	19.9547	19.9547	19.9566	19.9508	19.9446	19.9402	19.9356	(88)
util rest of house	0.9716	0.9543	0.9238	0.8608	0.7441	0.5568	0.3782	0.4102	0.6425	0.8637	0.9515	0.9761	(89)
MIT 2	18.1834	18.4644	18.8546	19.3232	19.6870	19.8970	19.9455	19.9436	19.8451	19.4150	18.7345	18.1342	(90)
Living area fraction	fLA = Living area / (4) =											0.3866	(91)
MIT	18.7567	19.0044	19.3495	19.7653	20.0959	20.2935	20.3454	20.3420	20.2421	19.8449	19.2397	18.7115	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6067	18.8544	19.1995	19.6153	19.9459	20.1435	20.1954	20.1920	20.0921	19.6949	19.0897	18.5615	(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	0.9627	0.9433	0.9116	0.8510	0.7442	0.5729	0.4039	0.4354	0.6538	0.8549	0.9408	0.9681	(94)
Useful gains	652.5984	718.3159	742.2301	719.3228	634.4401	469.6978	318.3339	333.2890	490.1441	605.2425	621.4312	624.1422	(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	1329.3556	1293.2089	1173.8630	978.3740	751.1633	499.5464	323.9963	341.0189	542.2335	828.5031	1097.3227	1320.8056	(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	503.5073	386.3281	321.1348	186.5169	86.8421	0.0000	0.0000	0.0000	0.0000	166.1059	342.6418	518.3176	(98)
Space heating												2511.3945	(98)
Space heating per m2											(98) / (4) =	32.2387	(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													2790.4384	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	503.5073	386.3281	321.1348	186.5169	86.8421	0.0000	0.0000	0.0000	0.0000	166.1059	342.6418	518.3176	(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)	559.4526	429.2534	356.8165	207.2410	96.4912	0.0000	0.0000	0.0000	0.0000	184.5621	380.7132	575.9084	(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	89.2354	89.2516	89.2774	89.3376	89.3855	86.7000	86.7000	86.7000	86.7000	88.8025	89.0946	86.7000	(216)	
Fuel for water heating, kWh/month	163.9144	122.3016	97.1404	50.5111	21.4173	5.6058	0.0000	31.4414	56.4257	102.6306	140.0835	163.0180	(219)	
Water heating fuel used												954.4899	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2790.4384	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.54 * 1080 * 1.00) =										-466.3546		-466.3546	(233)	
Total delivered energy for all uses												3753.7252	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2790.4384	3.4800	97.1073	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	954.4899	3.4800	33.2162	(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	-466.3546	13.1900	-61.5122	(252)
Total energy cost			251.4838	(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] =	0.8594	(257)
SAP value		88.0110	
SAP rating (Section 12)		88	(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	2790.4384	0.2160	602.7347	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	954.4899	0.2160	206.1698	(264)
Space and water heating			808.9045	(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	-466.3546	0.5190	-242.0381	(269)
Total kg/year			813.4701	(272)
CO2 emissions per m2			10.4400	(273)
EI value			91.1306	
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					4.4600
Infiltration rate					0.3841 (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)	=	0.3553 (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	0.3731	0.3464	0.3553	0.3376	0.3376	0.3287	0.3198	0.3109	0.3020	0.3287	0.3109	0.3287 (22b)
Effective ac	0.5696	0.5600	0.5631	0.5570	0.5570	0.5540	0.5511	0.5483	0.5456	0.5540	0.5483	0.5540 (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	34.9959	34.4069	34.5984	34.2202	34.2202	34.0384	33.8615	33.6894	33.5221	34.0384	33.6894	34.0384 (38)
Heat transfer coeff	90.8896	90.3005	90.4920	90.1138	90.1138	89.9320	89.7551	89.5830	89.4157	89.9320	89.5830	89.9320 (39)
Average = Sum(39)m / 12 =												90.0036 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1667	1.1592	1.1616	1.1568	1.1568	1.1545	1.1522	1.1500	1.1478	1.1545	1.1500	1.1545 (40)
HLP (average)												1.1554 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
 Average daily hot water use (litres/day)
 2.4218 (42)
 91.7179 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)												Total = Sum(45)m =	1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Combi loss	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645	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	-28.4329	-40.4298	-69.4891	-93.7569	-110.1231	-117.6288	-115.1551	-103.0673	-80.6946	-55.7895	-33.6286	-871.5756 (H17)	
Solar input												-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		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				4.4600	13.4839		0.6200		0.7000		0.7700		18.0873 (74)
East				0.5700	25.1925		0.6200		0.7000		0.7700		4.3189 (76)
South				2.2000	56.7559		0.6200		0.7000		0.7700		37.5540 (78)
South				5.8000	56.7559		0.6200		0.7000		0.7700		99.0060 (78)

Solar gains	158.9662	226.6273	306.5622	378.7929	404.5738	438.0313	418.2063	390.7877	348.7056	268.0595	188.8497	134.3926	(83)
Total gains	706.7353	770.0528	828.9544	868.6177	861.1047	864.7245	827.4587	808.2285	784.8863	737.0171	694.2196	667.2642	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9a, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.1722	44.4604	44.3663	44.5525	44.5525	44.6425	44.7306	44.8165	44.9003	44.6425	44.8165	44.6425
alpha	3.9448	3.9640	3.9578	3.9702	3.9702	3.9762	3.9820	3.9878	3.9934	3.9762	3.9878	3.9762
util living area	0.9699	0.9573	0.9265	0.8625	0.7496	0.5602	0.4150	0.4235	0.6511	0.8568	0.9457	0.9742 (86)
MIT	19.8266	19.9716	20.2466	20.5659	20.8178	20.9574	20.9899	20.9892	20.9208	20.6493	20.2171	19.8066 (87)
Th 2	19.9467	19.9528	19.9508	19.9547	19.9547	19.9566	19.9584	19.9602	19.9620	19.9566	19.9602	19.9566 (88)
util rest of house	0.9628	0.9475	0.9094	0.8299	0.6898	0.4699	0.3080	0.3148	0.5657	0.8159	0.9312	0.9680 (89)
MIT 2	18.4286	18.6392	19.0260	19.4647	19.7826	19.9291	19.9547	19.9562	19.9032	19.5840	18.9977	18.4075 (90)
Living area fraction	fLA = Living area / (4) =											0.3866 (91)
MIT	18.9691	19.1544	19.4979	19.8905	20.1828	20.3267	20.3550	20.3556	20.2967	19.9959	19.4692	18.9485 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8191	19.0044	19.3479	19.7405	20.0328	20.1767	20.2050	20.2056	20.1467	19.8459	19.3192	18.7985 (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	0.9530	0.9364	0.8975	0.8222	0.6947	0.4898	0.3339	0.3410	0.5819	0.8109	0.9199	0.9589	(94)
Useful gains	673.4967	721.0396	743.9783	714.1949	598.2138	423.5209	276.2523	275.6053	456.7396	597.6424	638.6367	639.8410	(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	1265.1024	1237.5137	1117.3882	922.8117	678.8121	438.5684	278.6882	278.2133	487.0184	759.5558	1022.9661	1240.9255	(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	440.1546	347.0706	277.8170	150.2041	59.9651	0.0000	0.0000	0.0000	0.0000	120.4636	276.7172	447.2069	(98)
Space heating												2119.5990	(98)
Space heating per m2												27.2092	(99)
											(98) / (4) =		

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													2355.1100 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	440.1546	347.0706	277.8170	150.2041	59.9651	0.0000	0.0000	0.0000	0.0000	120.4636	276.7172	447.2069	(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)	489.0607	385.6340	308.6855	166.8934	66.6279	0.0000	0.0000	0.0000	0.0000	133.8484	307.4636	496.8965	(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	89.1713	89.1866	89.1943	89.2288	89.0423	86.7000	86.7000	86.7000	86.7000	88.5832	88.9752	86.7000	(216)
(217)m	89.1713	89.1866	89.1943	89.2288	89.0423	86.7000	86.7000	86.7000	86.7000	88.5832	88.9752	89.1798	(217)
Fuel for water heating, kWh/month	159.4578	122.6258	96.9221	49.4553	26.5242	0.0000	0.0000	24.6013	51.1005	98.5526	134.9423	159.7920	(219)
Water heating fuel used	159.4578	122.6258	96.9221	49.4553	26.5242	0.0000	0.0000	24.6013	51.1005	98.5526	134.9423	159.7920	(219)
Annual totals kWh/year												923.9739	(219)
Space heating fuel - main system												2355.1100	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													350.1515 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 1208 * 1.00) =										-521.9212		-521.9212	(233)
Total delivered energy for all uses												3232.3143	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2355.1100	3.9200	92.3203	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	923.9739	3.9200	36.2198	(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	-521.9212	16.9600	-88.5178	(252)
Total energy cost			208.6080	(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	2355.1100	0.2160	508.7038	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	923.9739	0.2160	199.5784	(264)
Space and water heating			708.2821	(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	-521.9212	0.5190	-270.8771 (269)
Total kg/year			684.0087 (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	2355.1100	1.2200	2873.2343 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	923.9739	1.2200	1127.2482 (264)
Space and water heating			4000.4824 (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	-521.9212	3.0700	-1602.2982 (269)
Primary energy kWh/year			3856.8995 (272)
Primary energy kWh/m2/year			49.5109 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
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
South	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)
South	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	4.4600	87.1704	0.6200	0.7000	0.9000	136.6718
East	0.5700	125.2818	0.6200	0.7000	0.9000	25.1037
South	2.2000	118.5567	0.6200	0.7000	0.9000	91.6903
South	5.8000	118.5567	0.6200	0.7000	0.9000	241.7290

total:						495.1948
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	Jun	Jul	Aug	
Solar gains	527	495	461	(P3)
Internal gains	424	406	414	
Total summer gains	951	901	876	(P5)

	3.15	2.99	2.90	
Summer gain/loss ratio	3.15	2.99	2.90	(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	19.25	20.99	20.90	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature:	Slight
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