

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-134				Issued on Date	15/03/2018
Assessment Reference	As Built	Prop Type Ref	SHL3W - Semi (As)			
Property	7, Kiln Row, Botley, SOUTHAMPTON, SO32 2GF					
SAP Rating	87 B	DER	13.74	TER	16.77	
Environmental	89 B	% DER<TER	18.08			
CO ₂ Emissions (t/year)	1.00	DFEE	43.42	TFEE	48.20	
General Requirements Compliance	Pass	% DFEE<TFEE	9.92			
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 93 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) 16.77 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.74 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.4 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	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.35 (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: 4.14 (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 28 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 South East: 6.69 m², No overhang
Windows facing South West: 6.06 m², No overhang
Windows facing North West: 5.40 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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.1400
Infiltration rate					0.3419 (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) =	0.3163 (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	0.4033	0.3954	0.3875	0.3479	0.3400	0.3005	0.3005	0.2926	0.3163	0.3400	0.3558	0.3716 (22b)
Effective ac	0.5813	0.5782	0.5751	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5691 (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			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			185.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.6402		(33)
E-WM-28			41.8300	0.0000	0.0000	110.0000	4601.3000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling 1			46.5100			18.0000	830.7000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 17548.2500 (34)
188.6503 (35)
9.5182 (36)
(33) + (36) = 66.1584 (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	42.6482	42.4166	42.1895	41.1229	40.9234	39.9945	39.9945	39.8224	40.3523	40.9234	41.3271	41.7491 (38)
Heat transfer coeff	108.8066	108.5750	108.3479	107.2814	107.0818	106.1529	106.1529	105.9809	106.5107	107.0818	107.4855	107.9075 (39)
Average = Sum(39)m / 12 =												107.2804 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1697	1.1672	1.1648	1.1533	1.1512	1.1412	1.1412	1.1393	1.1450	1.1512	1.1555	1.1600 (40)
HLP (average)												1.1533 (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)
2.6648 (42)
97.4900 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1533.8973 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (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	21.8495	19.7150	21.7777	20.9935	21.6339	20.8675	21.5204	21.5940	20.9362	21.7182	21.0915 (61)
Total heat required for water heating calculated for each month											
180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (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											
180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (64)
Heat gains from water heating, kWh/month											
58.3406	51.1764	53.1679	46.8548	45.3309	39.6669	37.3031	42.0306	42.3036	48.6306	52.4302	56.6666 (65)
Total per year (kWh/year) = Sum(64)m =	1789.4221 (64)										

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0140	19.5526	15.9013	12.0383	8.9988	7.5971	8.2090	10.6703	14.3217	18.1847	21.2242	22.6258	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.5253	247.0628	240.6686	227.0561	209.8728	193.7229	182.9338	180.3964	186.7906	200.4031	217.5864	233.7362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	78.4148	76.1554	71.4622	65.0762	60.9286	55.0928	50.1385	56.4927	58.7550	65.3637	72.8197	76.1648	(72)
Total internal gains	410.9268	408.7434	394.0047	370.1432	345.7728	322.3855	307.2540	313.5321	325.8400	349.9241	377.6029	398.4995	(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
Southeast			6.6900		36.7938		0.6200		0.7000		0.7700		74.0328 (77)
Southwest			6.0600		36.7938		0.6200		0.7000		0.7700		67.0611 (79)
Northwest			5.4000		11.2829		0.6200		0.7000		0.7700		18.3248 (81)
Solar gains	159.4187	277.6357	396.0408	517.8130	604.7286	611.2356	584.7686	518.2623	437.9499	311.2058	192.0553	135.7119	(83)
Total gains	570.3455	686.3791	790.0455	887.9562	950.5014	933.6212	892.0225	831.7943	763.7898	661.1299	569.6582	534.2114	(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	44.7998	44.8954	44.9895	45.4367	45.5214	45.9197	45.9197	45.9943	45.7655	45.5214	45.3504	45.1731
alpha	3.9867	3.9930	3.9993	4.0291	4.0348	4.0613	4.0613	4.0663	4.0510	4.0348	4.0234	4.0115
util living area	0.9932	0.9853	0.9671	0.9197	0.8196	0.6596	0.5049	0.5565	0.7863	0.9466	0.9871	0.9947 (86)
MIT	19.4404	19.6627	19.9925	20.3974	20.7285	20.9202	20.9790	20.9691	20.8315	20.3891	19.8343	19.3984 (87)
Th 2	19.9443	19.9463	19.9483	19.9575	19.9593	19.9673	19.9673	19.9688	19.9642	19.9593	19.9558	19.9521 (88)
util rest of house	0.9915	0.9816	0.9585	0.8979	0.7715	0.5754	0.3948	0.4445	0.7144	0.9276	0.9832	0.9934 (89)
MIT 2	17.8680	18.1920	18.6685	19.2445	19.6821	19.9075	19.9576	19.9532	19.8192	19.2458	18.4500	17.8120 (90)
Living area fraction	18.1549	18.4603	18.9101	19.4548	19.8730	20.0922	20.1440	20.1385	20.0039	19.4544	18.7026	18.1015 (91)
MIT	18.1549	18.4603	18.9101	19.4548	19.8730	20.0922	20.1440	20.1385	20.0039	19.4544	18.7026	18.1015 (92)
Temperature adjustment	18.0049	18.3103	18.7601	19.3048	19.7230	19.9422	19.9940	19.9885	19.8539	19.3044	18.5526	-0.1500
adjusted MIT	18.0049	18.3103	18.7601	19.3048	19.7230	19.9422	19.9940	19.9885	19.8539	19.3044	18.5526	17.9515 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9865	0.9731	0.9452	0.8810	0.7590	0.5732	0.3978	0.4467	0.7055	0.9116	0.9753	0.9893	(94)	
Useful gains	562.6470	667.9361	746.7463	782.2826	721.3912	535.1382	354.8193	371.5814	538.8851	602.6928	555.5797	528.5016	(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	1491.1817	1456.0235	1328.3540	1116.2420	859.1185	567.0946	360.2809	380.3121	612.8477	932.0810	1230.9842	1483.8856	(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	690.8299	529.5947	432.7162	240.4508	102.4691	0.0000	0.0000	0.0000	0.0000	245.0649	486.2913	710.8057	(98)	
Space heating												3438.2225	(98)	
Space heating per m2												(98) / (4) =	36.9622	(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													3820.2472	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	690.8299	529.5947	432.7162	240.4508	102.4691	0.0000	0.0000	0.0000	0.0000	245.0649	486.2913	710.8057	(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)	767.5887	588.4386	480.7957	267.1675	113.8546	0.0000	0.0000	0.0000	0.0000	272.2943	540.3236	789.7841	(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	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417	(64)	
Efficiency of water heater (217)m	89.2948	89.2166	89.0629	88.7235	88.0550	86.7000	86.7000	86.7000	86.7000	88.7093	89.1485	89.3257	(216)	
Fuel for water heating, kWh/month	202.5671	178.0001	185.6068	164.6979	160.9236	143.5715	135.5586	151.9788	152.7377	170.9472	182.7490	196.8545	(219)	
Water heating fuel used												2026.1929	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3820.2472	(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)													388.7741	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.54 * 1004 * 1.00) =										-433.7264			-433.7264	(233)
Total delivered energy for all uses													5876.4879	(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	3820.2472	0.2160	825.1734	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2026.1929	0.2160	437.6577	(264)
Space and water heating			1262.8311	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	388.7741	0.5190	201.7738	(268)
Energy saving/generation technologies				
PV Unit	-433.7264	0.5190	-225.1040	(269)
Total CO2, kg/year			1278.4259	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7400	(273)

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

DER			13.7400	ZC1
Total Floor Area		TFA	93.0200	
Assumed number of occupants		N	2.6648	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.5774	ZC2
CO2 emissions from cooking, equation (L16)			1.9668	ZC3
Total CO2 emissions			31.2842	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			31.2842	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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) =	0.1349 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3849 (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) =					0.3561 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate	0.4540	0.4451	0.4362	0.3917	0.3828	0.3383	0.3383	0.3294	0.3561	0.3828	0.4006	0.4184 (22b)					
Effective ac	0.6031	0.5991	0.5951	0.5767	0.5733	0.5572	0.5572	0.5542	0.5634	0.5733	0.5802	0.5875 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			18.1500	1.3258	24.0625		(27)					
Jet Floor Lo			46.5100	0.1300	6.0463		(28a)					
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.1800	13.0212		(29a)					
Plane	46.5100		46.5100	0.1300	6.0463		(30)					
Total net area of external elements Aum(A, m2)			185.6600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		51.3263		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6696 (36)					
Total fabric heat loss						(33) + (36) =	61.9959 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 44.2430	Feb 43.9494	Mar 43.6616	Apr 42.3100	May 42.0571	Jun 40.8798	Jul 40.8798	Aug 40.6618	Sep 41.3333	Oct 42.0571	Nov 42.5687	Dec 43.1035 (38)
Heat transfer coeff	106.2389	105.9453	105.6575	104.3059	104.0530	102.8757	102.8757	102.6577	103.3292	104.0530	104.5646	105.0994 (39)
Average = Sum(39)m / 12 =												104.3047 (39)
HLP	Jan 1.1421	Feb 1.1390	Mar 1.1359	Apr 1.1213	May 1.1186	Jun 1.1060	Jul 1.1060	Aug 1.1036	Sep 1.1108	Oct 1.1186	Nov 1.1241	Dec 1.1299 (40)
HLP (average)												1.1213 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy content (annual)	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1533.8973 (45)
	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.6734	47.1157	46.6990	43.2695	44.7119	46.6990	47.1157	50.6734	49.3151	50.9589 (61)
Solar input	209.9912	185.1181	194.2026	172.2479	166.7663	146.8785	140.7208	156.8707	158.6032	180.6013	191.1415	204.9732 (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	209.9912	185.1181	194.2026	172.2479	166.7663	146.8785	140.7208	156.8707	158.6032	180.6013	191.1415	204.9732 (64)
	65.6180	57.7545	60.3918	53.3854	51.5971	45.2674	43.1009	48.3068	48.8485	55.8694	59.4861	63.9495 (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	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0140	19.5526	15.9013	12.0383	8.9988	7.5971	8.2090	10.6703	14.3217	18.1847	21.2242	22.6258	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.5253	247.0628	240.6686	227.0561	209.8728	193.7229	182.9338	180.3964	186.7906	200.4031	217.5864	233.7362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	88.1962	85.9442	81.1718	74.1464	69.3510	62.8713	57.9314	64.9285	67.8451	75.0932	82.6195	85.9536	(72)
Total internal gains	420.7082	418.5322	403.7142	379.2134	354.1952	330.1640	315.0468	321.9679	334.9301	359.6536	387.4027	408.2883	(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
Southeast			6.6900		36.7938		0.6300		0.7000		0.7700		75.2269 (77)
Southwest			6.0600		36.7938		0.6300		0.7000		0.7700		68.1427 (79)
Northwest			5.4000		11.2829		0.6300		0.7000		0.7700		18.6204 (81)
Solar gains	161.9899	282.1137	402.4286	526.1648	614.4823	621.0943	594.2003	526.6213	445.0136	316.2253	195.1529	137.9008	(83)
Total gains	582.6981	700.6459	806.1428	905.3782	968.6775	951.2583	909.2471	848.5892	779.9436	675.8789	582.5557	546.1891	(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	60.8038	60.9722	61.1383	61.9306	62.0811	62.7915	62.7915	62.9249	62.5160	62.0811	61.7774	61.4630	
alpha	5.0536	5.0648	5.0759	5.1287	5.1387	5.1861	5.1861	5.1950	5.1677	5.1387	5.1185	5.0975	
util living area	0.9976	0.9935	0.9814	0.9408	0.8367	0.6569	0.4910	0.5444	0.7981	0.9646	0.9944	0.9983	(86)
MIT	19.7939	19.9786	20.2501	20.5836	20.8403	20.9659	20.9937	20.9896	20.9079	20.5632	20.1133	19.7633	(87)
Th 2	19.9666	19.9691	19.9717	19.9835	19.9857	19.9960	19.9960	19.9979	19.9920	19.9857	19.9812	19.9765	(88)
util rest of house	0.9968	0.9913	0.9750	0.9203	0.7847	0.5681	0.3826	0.4320	0.7198	0.9481	0.9922	0.9977	(89)
MIT 2	18.3619	18.6327	19.0267	19.5035	19.8340	19.9741	19.9937	19.9937	19.9214	19.4863	18.8388	18.3243	(90)
Living area fraction									fLA = Living area / (4) =			0.1824	(91)
MIT	18.6232	18.8782	19.2499	19.7005	20.0176	20.1550	20.1762	20.1754	20.1013	19.6827	19.0713	18.5868	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6232	18.8782	19.2499	19.7005	20.0176	20.1550	20.1762	20.1754	20.1013	19.6827	19.0713	18.5868	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9952	0.9880	0.9690	0.9133	0.7866	0.5829	0.4024	0.4525	0.7293	0.9417	0.9892	0.9964	(94)
Ext temp.	579.8775	692.2196	781.1446	826.8712	761.9388	554.5140	365.8843	383.9547	568.7863	636.4689	576.2877	544.2423	(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	1521.6764	1480.9252	1347.1197	1126.5592	865.4693	571.4782	367.8992	387.5746	620.1139	945.0850	1251.7711	1512.0484	(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	700.6984	530.0102	421.0855	215.7754	77.0267	0.0000	0.0000	0.0000	0.0000	229.6103	486.3481	720.0477	(98)
Space heating per m2												3380.6022	(98)
												(98) / (4) =	36.3427 (99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3619.4884 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	700.6984	530.0102	421.0855	215.7754	77.0267	0.0000	0.0000	0.0000	0.0000	229.6103	486.3481	720.0477 (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)	750.2124	567.4627	450.8410	231.0229	82.4697	0.0000	0.0000	0.0000	0.0000	245.8355	520.7153	770.9290 (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	209.9912	185.1181	194.2026	172.2479	166.7663	146.8785	140.7208	156.8707	158.6032	180.6013	191.1415	204.9732 (64)
Efficiency of water heater (217)m	87.8521	87.5495	86.9482	85.6195	83.2383	80.3000	80.3000	80.3000	80.3000	85.6567	87.3020	80.3000 (216)
Fuel for water heating, kWh/month	239.0282	211.4440	223.3543	201.1784	200.3481	182.9122	175.2438	195.3558	197.5133	210.8432	218.9429	233.0598 (219)
Water heating fuel used												2489.2238 (219)
Annual totals kWh/year												
Space heating fuel - main system												3619.4884 (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)												388.7741 (232)
Total delivered energy for all uses												6572.4863 (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	3619.4884	0.2160	781.8095 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2489.2238	0.2160	537.6723 (264)
Space and water heating			1319.4818 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	388.7741	0.5190	201.7738 (268)
Total CO2, kg/m2/year			1560.1806 (272)
Emissions per m2 for space and water heating			14.1849 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1691 (272b)
Emissions per m2 for pumps and fans			0.4185 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1849 * 1.00) + 2.1691 + 0.4185, rounded to 2 d.p.			16.7700 (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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.1400
Infiltration rate					0.3419 (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) =	0.3163 (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	0.4033	0.3954	0.3875	0.3479	0.3400	0.3005	0.3005	0.2926	0.3163	0.3400	0.3558	0.3716 (22b)
Effective ac	0.5813	0.5782	0.5751	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5691 (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			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			185.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.6402		(33)
E-WM-28			41.8300	0.0000	0.0000	110.0000	4601.3000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling 1			46.5100			9.0000	415.3500 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17132.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							184.1851 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5182 (36)
Total fabric heat loss						(33) + (36) =	66.1584 (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	42.6482	42.4166	42.1895	41.1229	40.9234	39.9945	39.9945	39.8224	40.3523	40.9234	41.3271	41.7491 (38)
Heat transfer coeff	108.8066	108.5750	108.3479	107.2814	107.0818	106.1529	106.1529	105.9809	106.5107	107.0818	107.4855	107.9075 (39)
Average = Sum(39)m / 12 =												107.2804 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1697	1.1672	1.1648	1.1533	1.1512	1.1412	1.1412	1.1393	1.1450	1.1512	1.1555	1.1600 (40)
HLP (average)												1.1533 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (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 = 1533.8973 (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	33.7944	29.5568	30.4999	26.5906	25.5143	22.0169	20.4019	23.4115	23.6911	27.6097	30.1381	32.7280 (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	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0140	19.5526	15.9013	12.0383	8.9988	7.5971	8.2090	10.6703	14.3217	18.1847	21.2242	22.6258	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.5253	247.0628	240.6686	227.0561	209.8728	193.7229	182.9338	180.3964	186.7906	200.4031	217.5864	233.7362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	45.4225	43.9833	40.9945	36.9314	34.2934	30.5790	27.4219	31.4670	32.9043	37.1098	41.8585	43.9893	(72)
Total internal gains	374.9345	373.5713	360.5370	338.9984	316.1376	294.8717	281.5373	285.5064	296.9892	318.6702	343.6417	363.3240	(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
Southeast			6.6900		36.7938		0.6200		0.7000		0.7700		74.0328 (77)
Southwest			6.0600		36.7938		0.6200		0.7000		0.7700		67.0611 (79)
Northwest			5.4000		11.2829		0.6200		0.7000		0.7700		18.3248 (81)
Solar gains	159.4187	277.6357	396.0408	517.8130	604.7286	611.2356	584.7686	518.2623	437.9499	311.2058	192.0553	135.7119	(83)
Total gains	534.3532	651.2070	756.5778	856.8114	920.8663	906.1073	866.3059	803.7687	734.9391	629.8760	535.6970	499.0359	(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	43.7394	43.8327	43.9246	44.3613	44.4439	44.8329	44.8329	44.9056	44.6823	44.4439	44.2770	44.1039	
alpha	3.9160	3.9222	3.9283	3.9574	3.9629	3.9889	3.9889	3.9937	3.9788	3.9629	3.9518	3.9403	
util living area	0.9941	0.9868	0.9698	0.9247	0.8285	0.6717	0.5170	0.5712	0.7991	0.9517	0.9888	0.9955	(86)
MIT	19.3680	19.5962	19.9361	20.3556	20.7031	20.9097	20.9755	20.9637	20.8116	20.3446	19.7720	19.3259	(87)
Th 2	19.9443	19.9463	19.9483	19.9575	19.9593	19.9673	19.9673	19.9688	19.9642	19.9593	19.9558	19.9521	(88)
util rest of house	0.9926	0.9835	0.9619	0.9043	0.7821	0.5881	0.4054	0.4580	0.7295	0.9345	0.9854	0.9943	(89)
MIT 2	18.4570	18.6850	19.0215	19.4333	19.7499	19.9202	19.9594	19.9559	19.8514	19.4321	18.8684	18.4211	(90)
Living area fraction	18.6232	18.8512	19.1883	19.6016	19.9238	20.1007	20.1448	20.1398	20.0265	fLA = Living area / (4) =			0.1824 (91)
MIT	18.6232	18.8512	19.1883	19.6016	19.9238	20.1007	20.1448	20.1398	20.0265	19.5986	19.0332	18.5862	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6232	18.8512	19.1883	19.6016	19.9238	20.1007	20.1448	20.1398	20.0265	19.5986	19.0332	18.5862	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9789	0.9546	0.8959	0.7803	0.5997	0.4254	0.4778	0.7343	0.9269	0.9813	0.9922	(94)
Useful gains	529.0158	637.4488	722.1938	767.6300	718.5363	543.4116	368.5185	384.0545	539.6713	583.8319	525.6643	495.1519	(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	1558.4625	1514.7566	1374.7560	1148.0802	880.6211	583.9189	376.2867	396.3459	631.2391	963.5824	1282.6502	1552.3784	(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	765.9084	589.5508	485.5063	273.9241	120.5911	0.0000	0.0000	0.0000	0.0000	282.5344	545.0299	786.5765	(98)
Space heating												3849.6214	(98)
Space heating per m2												(98) / (4) =	41.3849 (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	997.8372	785.5314	805.4546	0.0000	0.0000	0.0000	0.0000	(100)

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	0.8549	0.9107	0.8873	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	853.0294	715.4186	714.6783	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1160.0926	1111.4264	1040.1031	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	221.0855	294.6298	242.1160	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												757.8313 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	55.2714	73.6574	60.5290	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												189.4578 (107)
Space cooling per m2												2.0367 (108)
Energy for space heating												41.3849 (99)
Energy for space cooling												2.0367 (108)
Total												43.4216 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 222.3178 (5)
Dwelling volume			

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) =							0.1349 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3849 (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) =							0.3561 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4540	0.4451	0.4362	0.3917	0.3828	0.3383	0.3383	0.3294	0.3561	0.3828	0.4006	0.4184	(22b)				
Effective ac	0.6031	0.5991	0.5951	0.5767	0.5733	0.5572	0.5572	0.5542	0.5634	0.5733	0.5802	0.5875	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			18.1500	1.3258	24.0625		(27)					
Jet Floor Lo			46.5100	0.1300	6.0463		(28a)					
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.1800	13.0212		(29a)					
Plane	46.5100		46.5100	0.1300	6.0463		(30)					
Total net area of external elements Aum(A, m2)			185.6600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.3263		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6696 (36)					
Total fabric heat loss						(33) + (36) =	61.9959 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 44.2430	Feb 43.9494	Mar 43.6616	Apr 42.3100	May 42.0571	Jun 40.8798	Jul 40.8798	Aug 40.6618	Sep 41.3333	Oct 42.0571	Nov 42.5687	Dec 43.1035 (38)
Heat transfer coeff	106.2389	105.9453	105.6575	104.3059	104.0530	102.8757	102.8757	102.6577	103.3292	104.0530	104.5646	105.0994 (39)
Average = Sum(39)m / 12 =												104.3047 (39)
HLP	Jan 1.1421	Feb 1.1390	Mar 1.1359	Apr 1.1213	May 1.1186	Jun 1.1060	Jul 1.1060	Aug 1.1036	Sep 1.1108	Oct 1.1186	Nov 1.1241	Dec 1.1299 (40)
HLP (average)												1.1213 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
Daily hot water use	Jan 107.2390	Feb 103.3394	Mar 99.4398	Apr 95.5402	May 91.6406	Jun 87.7410	Jul 87.7410	Aug 91.6406	Sep 95.5402	Oct 99.4398	Nov 103.3394	Dec 107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)
Energy content (annual)												1533.8973 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	33.7944	29.5568	30.4999	26.5906	25.5143	22.0169	20.4019	23.4115	23.6911	27.6097	30.1381	32.7280 (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	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0140	19.5526	15.9013	12.0383	8.9988	7.5971	8.2090	10.6703	14.3217	18.1847	21.2242	22.6258 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.5253	247.0628	240.6686	227.0561	209.8728	193.7229	182.9338	180.3964	186.7906	200.4031	217.5864	233.7362 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242 (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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937 (71)
Water heating gains (Table 5)	45.4225	43.9833	40.9945	36.9314	34.2934	30.5790	27.4219	31.4670	32.9043	37.1098	41.8585	43.9893 (72)
Total internal gains	374.9345	373.5713	360.5370	338.9984	316.1376	294.8717	281.5373	285.5064	296.9892	318.6702	343.6417	363.3240 (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			
Southeast				6.6900	36.7938	0.6300	0.7000	0.7700	75.2269 (77)			
Southwest				6.0600	36.7938	0.6300	0.7000	0.7700	68.1427 (79)			
Northwest				5.4000	11.2829	0.6300	0.7000	0.7700	18.6204 (81)			
Solar gains	161.9899	282.1137	402.4286	526.1648	614.4823	621.0943	594.2003	526.6213	445.0136	316.2253	195.1529	137.9008 (83)
Total gains	536.9245	655.6850	762.9656	865.1632	930.6199	915.9660	875.7377	812.1277	742.0028	634.8954	538.7946	501.2248 (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	60.8038	60.9722	61.1383	61.9306	62.0811	62.7915	62.7915	62.9249	62.5160	62.0811	61.7774	61.4630
alpha	5.0536	5.0648	5.0759	5.1287	5.1387	5.1861	5.1861	5.1950	5.1677	5.1387	5.1185	5.0975
util living area	0.9983	0.9951	0.9852	0.9497	0.8530	0.6769	0.5086	0.5664	0.8207	0.9723	0.9961	0.9988 (86)
MIT	19.7481	19.9345	20.2101	20.5530	20.8234	20.9609	20.9926	20.9875	20.8942	20.5280	20.0700	19.7181 (87)
Th 2	19.9666	19.9691	19.9717	19.9835	19.9857	19.9960	19.9960	19.9979	19.9920	19.9857	19.9812	19.9765 (88)
util rest of house	0.9978	0.9935	0.9800	0.9315	0.8035	0.5874	0.3969	0.4506	0.7453	0.9588	0.9945	0.9984 (89)
MIT 2	18.8254	19.0130	19.2877	19.6281	19.8695	19.9786	19.9941	19.9944	19.9353	19.6121	19.1584	18.8034 (90)
Living area fraction									fLA = Living area / (4) =			0.1824 (91)
MIT	18.9937	19.1811	19.4560	19.7968	20.0435	20.1578	20.1763	20.1756	20.1102	19.7792	19.3247	18.9703 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9937	19.1811	19.4560	19.7968	20.0435	20.1578	20.1763	20.1756	20.1102	19.7792	19.3247	18.9703 (93)

8. Space heating requirement

Utilisation	0.9970	0.9917	0.9766	0.9275	0.8067	0.6027	0.4174	0.4719	0.7553	0.9552	0.9930	0.9979 (94)
Useful gains	535.3205	650.2719	745.0759	802.4015	750.7304	552.0428	365.5274	383.2078	560.4612	606.4744	535.0322	500.1571 (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	1561.0464	1513.0180	1368.8947	1136.5992	868.1708	571.7648	367.9147	387.5958	621.0319	955.1226	1278.2712	1552.3469 (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	763.1400	579.7654	464.1212	240.6224	87.3756	0.0000	0.0000	0.0000	0.0000	259.3943	535.1321	782.8293 (98)
Space heating												3712.3802 (98)
Space heating per m2										(98) / (4) =		39.9095 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

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	967.0318	761.2804	780.1987	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9071	0.9528	0.9347	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	877.2137	725.3207	729.2316	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1171.6156	1122.4505	1049.8734	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	211.9694	295.4646	238.5575	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												745.9914 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	52.9923	73.8662	59.6394	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												186.4979 (107)
Space cooling per m2												2.0049 (108)
Energy for space heating												39.9095 (99)
Energy for space cooling												2.0049 (108)
Total												41.9144 (109)
Target Fabric Energy Efficiency (TFEE)												48.2 (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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.1400
Infiltration rate					0.3419 (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)	=	0.3163 (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	0.3321	0.3084	0.3163	0.3005	0.3005	0.2926	0.2847	0.2768	0.2689	0.2926	0.2768	0.2926 (22b)
Effective ac	0.5551	0.5476	0.5500	0.5451	0.5451	0.5428	0.5405	0.5383	0.5361	0.5428	0.5383	0.5428 (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			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			185.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.6402		(33)
E-WM-28			41.8300	0.0000	0.0000	110.0000	4601.3000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling 1			46.5100			18.0000	830.7000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 17548.2500 (34)
188.6503 (35)
9.5182 (36)
(33) + (36) = 66.1584 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.7284	40.1711	40.3523	39.9945	39.9945	39.8224	39.6550	39.4922	39.3339	39.8224	39.4922	39.8224 (38)
Heat transfer coeff	106.8869	106.3295	106.5107	106.1529	106.1529	105.9809	105.8134	105.6506	105.4923	105.9809	105.6506	105.9809 (39)
Average = Sum(39)m / 12 =												106.0485 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1491	1.1431	1.1450	1.1412	1.1412	1.1393	1.1375	1.1358	1.1341	1.1393	1.1358	1.1393 (40)
HLP (average)												1.1401 (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)
2.6648 (42)
97.4900 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (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 = 1533.8973 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (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 (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 (57)
Combi loss	21.8495	19.7150	21.7777	20.9935	21.6339	20.8675	21.5204	21.5940	20.9362	21.7182	21.0915 (61)
Total heat required for water heating calculated for each month	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180 (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)
Output from w/h	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180 (64)
RHI water heating demand	58.3406	51.1764	53.1679	46.8548	45.3309	39.6669	37.3031	42.0306	42.3036	48.6306	52.4302 (64)
Heat gains from water heating, kWh/month	58.3406	51.1764	53.1679	46.8548	45.3309	39.6669	37.3031	42.0306	42.3036	48.6306	52.4302 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0350	48.8816	39.7532	30.0957	22.4969	18.9928	20.5224	26.6758	35.8042	45.4617	53.0605	56.5646	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	78.4148	76.1554	71.4622	65.0762	60.9286	55.0928	50.1385	56.4927	58.7550	65.3637	72.8197	76.1648	(72)
Total internal gains	608.3638	603.7381	580.3729	544.0123	506.6192	473.1751	453.6473	462.3677	483.3020	519.8852	560.5867	591.5402	(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
Southeast				6.6900	45.1778		0.6200		0.7000		0.7700		90.9022 (77)
Southwest				6.0600	45.1778		0.6200		0.7000		0.7700		82.3419 (79)
Northwest				5.4000	14.6176		0.6200		0.7000		0.7700		23.7407 (81)
Solar gains	196.9848	292.4763	422.5075	559.6951	624.5620	687.1643	651.6905	589.4032	494.7791	354.2043	236.6290	164.7978	(83)
Total gains	805.3486	896.2143	1002.8804	1103.7074	1131.1812	1160.3395	1105.3377	1051.7708	978.0811	874.0895	797.2157	756.3380	(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	45.6044	45.8435	45.7655	45.9197	45.9197	45.9943	46.0671	46.1381	46.2073	45.9943	46.1381	45.9943
alpha	4.0403	4.0562	4.0510	4.0613	4.0613	4.0663	4.0711	4.0759	4.0805	4.0663	4.0759	4.0663
util living area	0.9747	0.9612	0.9241	0.8407	0.7031	0.5024	0.3691	0.3865	0.6271	0.8584	0.9523	0.9789 (86)
MIT	19.8274	19.9863	20.2922	20.6323	20.8658	20.9734	20.9941	20.9930	20.9356	20.6646	20.2148	19.8004 (87)
Th 2	19.9610	19.9658	19.9642	19.9673	19.9673	19.9688	19.9703	19.9717	19.9731	19.9688	19.9717	19.9688 (88)
util rest of house	0.9686	0.9521	0.9065	0.8051	0.6415	0.4187	0.2737	0.2872	0.5427	0.8176	0.9392	0.9736 (89)
MIT 2	18.4383	18.6683	19.0978	19.5582	19.8441	19.9523	19.9682	19.9692	19.9263	19.6131	19.0023	18.4056 (90)
Living area fraction	18.6917	18.9088	19.3157	19.7542	20.0305	20.1386	20.1553	20.1560	20.1104	19.8049	19.2235	18.6600 (91)
MIT	18.6917	18.9088	19.3157	19.7542	20.0305	20.1386	20.1553	20.1560	20.1104	19.8049	19.2235	18.6600 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5417	18.7588	19.1657	19.6042	19.8805	19.9886	20.0053	20.0060	19.9604	19.6549	19.0735	18.5100 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9572	0.9382	0.8897	0.7908	0.6359	0.4203	0.2770	0.2905	0.5416	0.8030	0.9241	0.9633 (94)
Useful gains	770.8592	840.8337	892.2799	872.7948	719.2723	487.7444	306.2102	305.5789	529.7492	701.8693	736.7094	728.6137 (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	1458.1210	1431.0624	1295.7750	1072.5896	783.4580	496.9016	307.4245	307.0194	554.9328	874.8638	1180.4908	1431.8065 (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	511.3228	396.6337	300.2003	143.8523	47.7541	0.0000	0.0000	0.0000	0.0000	128.7079	319.5226	523.1754 (98)
Space heating												2371.1691 (98)
RHI space heating demand												2371 (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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.1400
Infiltration rate					0.3419 (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) =	0.3163 (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	0.4033	0.3954	0.3875	0.3479	0.3400	0.3005	0.3005	0.2926	0.3163	0.3400	0.3558	0.3716 (22b)
Effective ac	0.5813	0.5782	0.5751	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5691 (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			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			185.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.6402		(33)
E-WM-28			41.8300	0.0000	0.0000	110.0000	4601.3000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling 1			46.5100			18.0000	830.7000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 17548.2500 (34)
188.6503 (35)
9.5182 (36)
(33) + (36) = 66.1584 (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	42.6482	42.4166	42.1895	41.1229	40.9234	39.9945	39.9945	39.8224	40.3523	40.9234	41.3271	41.7491 (38)
Heat transfer coeff	108.8066	108.5750	108.3479	107.2814	107.0818	106.1529	106.1529	105.9809	106.5107	107.0818	107.4855	107.9075 (39)
Average = Sum(39)m / 12 =												107.2804 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1697	1.1672	1.1648	1.1533	1.1512	1.1412	1.1412	1.1393	1.1450	1.1512	1.1555	1.1600 (40)
HLP (average)												1.1533 (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)
2.6648 (42)
97.4900 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (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 = 1533.8973 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (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	21.8495	19.7150	21.7777	20.9935	21.6339	20.8675	21.5204	21.5940	20.9362	21.7182	21.0915 (61)
Total heat required for water heating calculated for each month											
180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (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											
180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (64)
Heat gains from water heating, kWh/month											
58.3406	51.1764	53.1679	46.8548	45.3309	39.6669	37.3031	42.0306	42.3036	48.6306	52.4302	56.6666 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0350	48.8816	39.7532	30.0957	22.4969	18.9928	20.5224	26.6758	35.8042	45.4617	53.0605	56.5646	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	78.4148	76.1554	71.4622	65.0762	60.9286	55.0928	50.1385	56.4927	58.7550	65.3637	72.8197	76.1648	(72)
Total internal gains	608.3638	603.7381	580.3729	544.0123	506.6192	473.1751	453.6473	462.3677	483.3020	519.8852	560.5867	591.5402	(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
Southeast			6.6900		36.7938		0.6200		0.7000		0.7700		74.0328 (77)
Southwest			6.0600		36.7938		0.6200		0.7000		0.7700		67.0611 (79)
Northwest			5.4000		11.2829		0.6200		0.7000		0.7700		18.3248 (81)
Solar gains	159.4187	277.6357	396.0408	517.8130	604.7286	611.2356	584.7686	518.2623	437.9499	311.2058	192.0553	135.7119	(83)
Total gains	767.7824	881.3738	976.4138	1061.8253	1111.3478	1084.4107	1038.4158	980.6299	921.2518	831.0910	752.6420	727.2521	(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	44.7998	44.8954	44.9895	45.4367	45.5214	45.9197	45.9197	45.9943	45.7655	45.5214	45.3504	45.1731
alpha	3.9867	3.9930	3.9993	4.0291	4.0348	4.0613	4.0613	4.0663	4.0510	4.0348	4.0234	4.0115
util living area	0.9811	0.9667	0.9377	0.8726	0.7552	0.5878	0.4400	0.4821	0.7028	0.8989	0.9675	0.9845 (86)
MIT	19.6734	19.8820	20.1817	20.5349	20.8039	20.9474	20.9872	20.9815	20.8904	20.5410	20.0418	19.6291 (87)
Th 2	19.9443	19.9463	19.9483	19.9575	19.9593	19.9673	19.9673	19.9688	19.9642	19.9593	19.9558	19.9521 (88)
util rest of house	0.9766	0.9589	0.9231	0.8429	0.7012	0.5064	0.3412	0.3807	0.6254	0.8686	0.9585	0.9807 (89)
MIT 2	18.2047	18.5053	18.9320	19.4236	19.7664	19.9295	19.9616	19.9599	19.8752	19.4451	18.7457	18.1462 (90)
Living area fraction	18.4727	18.7565	19.1600	19.6263	19.9557	20.1152	20.1487	20.1463	20.0604	fLA = Living area / (4) =		0.1824 (91)
MIT	18.4727	18.7565	19.1600	19.6263	19.9557	20.1152	20.1487	20.1463	20.0604	19.6450	18.9821	18.4168 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3227	18.6065	19.0100	19.4763	19.8057	19.9652	19.9987	19.9963	19.9104	19.4950	18.8321	18.2668 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9668	0.9457	0.9065	0.8268	0.6924	0.5062	0.3443	0.3835	0.6210	0.8519	0.9454	0.9721	0.9721	(94)
Useful gains	742.2685	833.4950	885.1646	877.9185	769.4765	548.9611	357.5558	376.0996	572.0579	708.0479	711.5226	706.9516	(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	1525.7579	1488.1795	1355.4273	1134.6430	867.9687	569.5284	360.7865	381.1356	618.8694	952.4926	1261.0357	1517.9105	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	582.9161	439.9480	349.8755	184.8416	73.2782	0.0000	0.0000	0.0000	0.0000	181.8668	395.6495	603.3534	(98)
Space heating												2811.7290	(98)
Space heating per m2												30.2271	(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													3124.1433	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	582.9161	439.9480	349.8755	184.8416	73.2782	0.0000	0.0000	0.0000	0.0000	181.8668	395.6495	603.3534	(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)	647.6845	488.8311	388.7505	205.3796	81.4202	0.0000	0.0000	0.0000	0.0000	202.0743	439.6105	670.3927	(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	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417	(64)	
Efficiency of water heater	89.1960	89.1005	88.9141	88.5126	87.7973	86.7000	86.7000	86.7000	86.7000	88.4689	89.0118	89.2335	(216)	
Fuel for water heating, kWh/month	202.7914	178.2321	185.9175	165.0904	161.3958	143.5715	135.5586	151.9788	152.7377	171.4118	183.0296	197.0579	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3124.1433	(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)													388.7741	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.54 * 1004 * 1.00) =										-433.7264			-433.7264	(233)
Total delivered energy for all uses													5182.9642	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3124.1433	3.4800	108.7202 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2028.7731	3.4800	70.6013 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	388.7741	13.1900	51.2793 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-433.7264	13.1900	-57.2085 (252)
Total energy cost			303.2848 (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] =	0.9229 (257)
SAP value		87.1254
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	3124.1433	0.2160	674.8150 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2028.7731	0.2160	438.2150 (264)
Space and water heating			1113.0300 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	388.7741	0.5190	201.7738 (268)
Energy saving/generation technologies			
PV Unit	-433.7264	0.5190	-225.1040 (269)
Total kg/year			1128.6248 (272)
CO2 emissions per m2			12.1300 (273)
EI value			89.0425
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency
Main heating environmental impact
Water heating energy efficiency
Water heating environmental impact

$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
 $0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
 $3.48 / 0.8809 = 3.951$, stars = 4
 $0.216 / 0.8809 = 0.2452$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.1400
Infiltration rate					0.3419 (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) =				0.3163 (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	0.3321	0.3084	0.3163	0.3005	0.3005	0.2926	0.2847	0.2768	0.2689	0.2926	0.2768	0.2926 (22b)
Effective ac	0.5551	0.5476	0.5500	0.5451	0.5451	0.5428	0.5405	0.5383	0.5361	0.5428	0.5383	0.5428 (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			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			185.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.6402		(33)
E-WM-28			41.8300	0.0000	0.0000	110.0000	4601.3000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling 1			46.5100			18.0000	830.7000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 17548.2500 (34)
188.6503 (35)
9.5182 (36)
(33) + (36) = 66.1584 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.7284	40.1711	40.3523	39.9945	39.9945	39.8224	39.6550	39.4922	39.3339	39.8224	39.4922	39.8224 (38)
Heat transfer coeff	106.8869	106.3295	106.5107	106.1529	106.1529	105.9809	105.8134	105.6506	105.4923	105.9809	105.6506	105.9809 (39)
Average = Sum(39)m / 12 =												106.0485 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1491	1.1431	1.1450	1.1412	1.1412	1.1393	1.1375	1.1358	1.1341	1.1393	1.1358	1.1393 (40)
HLP (average)												1.1401 (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)
2.6648 (42)
97.4900 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (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 = 1533.8973 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021	(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	21.8495	19.7150	21.7777	20.9935	21.6339	20.8675	21.5204	21.5940	20.9362	21.7182	21.0915	21.8274 (61)
Total heat required for water heating calculated for each month												
180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417	(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												
180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417	(64)
Heat gains from water heating, kWh/month												
58.3406	51.1764	53.1679	46.8548	45.3309	39.6669	37.3031	42.0306	42.3036	48.6306	52.4302	56.6666	(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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0350	48.8816	39.7532	30.0957	22.4969	18.9928	20.5224	26.6758	35.8042	45.4617	53.0605	56.5646	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	78.4148	76.1554	71.4622	65.0762	60.9286	55.0928	50.1385	56.4927	58.7550	65.3637	72.8197	76.1648	(72)
Total internal gains	608.3638	603.7381	580.3729	544.0123	506.6192	473.1751	453.6473	462.3677	483.3020	519.8852	560.5867	591.5402	(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				
Southeast				6.6900	45.1778	0.6200	0.7000	0.7700	90.9022 (77)				
Southwest				6.0600	45.1778	0.6200	0.7000	0.7700	82.3419 (79)				
Northwest				5.4000	14.6176	0.6200	0.7000	0.7700	23.7407 (81)				
Solar gains	196.9848	292.4763	422.5075	559.6951	624.5620	687.1643	651.6905	589.4032	494.7791	354.2043	236.6290	164.7978	(83)
Total gains	805.3486	896.2143	1002.8804	1103.7074	1131.1812	1160.3395	1105.3377	1051.7708	978.0811	874.0895	797.2157	756.3380	(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	45.6044	45.8435	45.7655	45.9197	45.9197	45.9943	46.0671	46.1381	46.2073	46.9943	46.1381	45.9943
alpha	4.0403	4.0562	4.0510	4.0613	4.0613	4.0663	4.0711	4.0759	4.0805	4.0663	4.0759	4.0663
util living area	0.9747	0.9612	0.9241	0.8407	0.7031	0.5024	0.3691	0.3865	0.6271	0.8584	0.9523	0.9789 (86)
MIT	19.8274	19.9863	20.2922	20.6323	20.8658	20.9734	20.9941	20.9930	20.9356	20.6646	20.2148	19.8004 (87)
Th 2	19.9610	19.9658	19.9642	19.9673	19.9673	19.9688	19.9703	19.9717	19.9731	19.9688	19.9717	19.9688 (88)
util rest of house	0.9686	0.9521	0.9065	0.8051	0.6415	0.4187	0.2737	0.2872	0.5427	0.8176	0.9392	0.9736 (89)
MIT 2	18.4383	18.6683	19.0978	19.5582	19.8441	19.9523	19.9682	19.9692	19.9263	19.6131	19.0023	18.4056 (90)
Living area fraction												0.1824 (91)
MIT	18.6917	18.9088	19.3157	19.7542	20.0305	20.1386	20.1553	20.1560	20.1104	19.8049	19.2235	18.6600 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5417	18.7588	19.1657	19.6042	19.8805	19.9886	20.0053	20.0060	19.9604	19.6549	19.0735	18.5100 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9572	0.9382	0.8897	0.7908	0.6359	0.4203	0.2770	0.2905	0.5416	0.8030	0.9241	0.9633	(94)
Useful gains	770.8592	840.8337	892.2799	872.7948	719.2723	487.7444	306.2102	305.5789	529.7492	701.8693	736.7094	728.6137	(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	1458.1210	1431.0624	1295.7750	1072.5896	783.4580	496.9016	307.4245	307.0194	554.9328	874.8638	1180.4908	1431.8065	(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	511.3228	396.6337	300.2003	143.8523	47.7541	0.0000	0.0000	0.0000	0.0000	128.7079	319.5226	523.1754	(98)
Space heating												2371.1691	(98)
Space heating per m2												25.4910	(99)
												(98) / (4) =	

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													2634.6323	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	511.3228	396.6337	300.2003	143.8523	47.7541	0.0000	0.0000	0.0000	0.0000	128.7079	319.5226	523.1754	(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)	568.1364	440.7041	333.5559	159.8359	53.0601	0.0000	0.0000	0.0000	0.0000	143.0088	355.0251	581.3060	(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	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417	(64)	
Efficiency of water heater (217)m	89.1137	89.0311	88.7998	88.3063	87.5088	86.7000	86.7000	86.7000	86.7000	88.1844	88.8579	89.1464	(216)	
Fuel for water heating, kWh/month	202.9788	178.3710	186.1569	165.4761	161.9280	143.5715	135.5586	151.9788	152.7377	171.9647	183.3467	197.2504	(219)	
Water heating fuel used												2031.3192	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2634.6323	(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)													388.7741	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.54 * 1122 * 1.00) =										-484.6697			-484.6697	(233)
Total delivered energy for all uses													4645.0559	(238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2634.6323	3.9300	103.5411 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2031.3192	3.9300	79.8308 (247)
Pumps and fans for heating	75.0000	17.5600	13.1700 (249)
Energy for lighting	388.7741	17.5600	68.2687 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-484.6697	17.5600	-85.1080 (252)
Total energy cost			267.7026 (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	2634.6323	0.2160	569.0806 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2031.3192	0.2160	438.7649 (264)
Space and water heating			1007.8455 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	388.7741	0.5190	201.7738 (268)
Energy saving/generation technologies			
PV Unit	-484.6697	0.5190	-251.5436 (269)
Total kg/year			997.0007 (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	2634.6323	1.2200	3214.2515 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2031.3192	1.2200	2478.2094 (264)
Space and water heating			5692.4608 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	388.7741	3.0700	1193.5366 (268)
Energy saving/generation technologies			
PV Unit	-484.6697	3.0700	-1487.9360 (269)
Primary energy kWh/year			5628.3114 (272)
Primary energy kWh/m2/year			60.5065 (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	+ 1.2	-£ 32	-196 kg (19.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£32 2.10 kg/m²	B 88	B 91
Total Savings	£32 2.10 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 445 TEST (30 Jul 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	£81	£90	-£9
Mains gas	£271	£231	£40
Space heating	£205	£205	£0
Water heating	£80	£48	£32
Lighting	£68	£68	£0
Generated (PV)	-£85	-£85	£0
Total cost of fuels	£267	£236	£31
Total cost of uses	£268	£236	£32
Delivered energy	50 kWh/m²	39 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	61 kWh/m²	49 kWh/m²	12 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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.1400
Infiltration rate					0.3419 (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)	=	0.3163 (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	0.4033	0.3954	0.3875	0.3479	0.3400	0.3005	0.3005	0.2926	0.3163	0.3400	0.3558	0.3716 (22b)
Effective ac	0.5813	0.5782	0.5751	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5691 (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			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			185.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.6402		(33)
E-WM-28			41.8300	0.0000	0.0000	110.0000	4601.3000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling 1			46.5100			18.0000	830.7000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17548.2500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.6503 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5182 (36)
Total fabric heat loss						(33) + (36) =	66.1584 (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	42.6482	42.4166	42.1895	41.1229	40.9234	39.9945	39.9945	39.8224	40.3523	40.9234	41.3271	41.7491 (38)
Heat transfer coeff	108.8066	108.5750	108.3479	107.2814	107.0818	106.1529	106.1529	105.9809	106.5107	107.0818	107.4855	107.9075 (39)
Average = Sum(39)m / 12 =												107.2804 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1697	1.1672	1.1648	1.1533	1.1512	1.1412	1.1412	1.1393	1.1450	1.1512	1.1555	1.1600 (40)
HLP (average)												1.1533 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (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 =											1533.8973 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (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	21.8495	19.7150	21.7777	20.9935	21.6339	20.8675	21.5204	21.5940	20.9362	21.7182	21.0915	21.8274 (61)
Total heat required for water heating calculated for each month	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (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												1.1823 (H8)
Utilisation factor												0.5708 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.4900 (H14)
Volume ratio Veff/V												0.7693 (H15)
Solar storage volume factor												0.9475 (H16)
Solar input												-862.4655 (H17)
Solar input	-25.0098	-41.7341	-71.0780	-95.2585	-117.6839	-115.7020	-114.1730	-99.7535	-78.1270	-53.3515	-29.6652	-20.9289 (63)
	Solar input (sum of months) = Sum(63)m =											-862.4655 (63)
Output from w/h	155.8720	117.0716	94.2289	50.8672	24.0173	8.7744	3.3564	32.0121	54.2966	98.2946	133.2528	154.9128 (64)
	Total per year (kWh/year) = Sum(64)m =											926.9566 (64)
Heat gains from water heating, kWh/month	58.3406	51.1764	53.1679	46.8548	45.3309	39.6669	37.3031	42.0306	42.3036	48.6306	52.4302	56.6666 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0350	48.8816	39.7532	30.0957	22.4969	18.9928	20.5224	26.6758	35.8042	45.4617	53.0605	56.5646	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	78.4148	76.1554	71.4622	65.0762	60.9286	55.0928	50.1385	56.4927	58.7550	65.3637	72.8197	76.1648	(72)
Total internal gains	608.3638	603.7381	580.3729	544.0123	506.6192	473.1751	453.6473	462.3677	483.3020	519.8852	560.5867	591.5402	(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	
Southeast				6.6900	36.7938	0.6200	0.7000		0.7700		74.0328 (77)	
Southwest				6.0600	36.7938	0.6200	0.7000		0.7700		67.0611 (79)	
Northwest				5.4000	11.2829	0.6200	0.7000		0.7700		18.3248 (81)	
Solar gains	159.4187	277.6357	396.0408	517.8130	604.7286	611.2356	584.7686	518.2623	437.9499	311.2058	192.0553	135.7119 (83)
Total gains	767.7824	881.3738	976.4138	1061.8253	1111.3478	1084.4107	1038.4158	980.6299	921.2518	831.0910	752.6420	727.2521 (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	44.7998	44.8954	44.9895	45.4367	45.5214	45.9197	45.9197	45.9943	45.7655	45.5214	45.3504	45.1731
alpha	3.9867	3.9930	3.9993	4.0291	4.0348	4.0613	4.0613	4.0663	4.0510	4.0348	4.0234	4.0115
util living area	0.9811	0.9667	0.9377	0.8726	0.7552	0.5878	0.4400	0.4821	0.7028	0.8989	0.9675	0.9845 (86)
MIT	19.6734	19.8820	20.1817	20.5349	20.8039	20.9474	20.9872	20.9815	20.8904	20.5410	20.0418	19.6291 (87)
Th 2	19.9443	19.9463	19.9483	19.9575	19.9593	19.9673	19.9673	19.9688	19.9642	19.9593	19.9558	19.9521 (88)
util rest of house	0.9766	0.9589	0.9231	0.8429	0.7012	0.5064	0.3412	0.3807	0.6254	0.8686	0.9585	0.9807 (89)
MIT 2	18.2047	18.5053	18.9320	19.4236	19.7664	19.9295	19.9616	19.9599	19.8752	19.4451	18.7457	18.1462 (90)
Living area fraction	18.4727	18.7565	19.1600	19.6263	19.9557	20.1152	20.1487	20.1463	20.0604	19.6450	18.9821	18.4168 (91)
MIT	18.4727	18.7565	19.1600	19.6263	19.9557	20.1152	20.1487	20.1463	20.0604	19.6450	18.9821	18.4168 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3227	18.6065	19.0100	19.4763	19.8057	19.9652	19.9987	19.9963	19.9104	19.4950	18.8321	18.2668 (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	0.9668	0.9457	0.9065	0.8268	0.6924	0.5062	0.3443	0.3835	0.6210	0.8519	0.9454	0.9721	(94)
Useful gains	742.2685	833.4950	885.1646	877.9185	769.4765	548.9611	357.5558	376.0996	572.0579	708.0479	711.5226	706.9516	(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	1525.7579	1488.1795	1355.4273	1134.6430	867.9687	569.5284	360.7865	381.1356	618.8694	952.4926	1261.0357	1517.9105	(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	582.9161	439.9480	349.8755	184.8416	73.2782	0.0000	0.0000	0.0000	0.0000	181.8668	395.6495	603.3534	(98)
Space heating												2811.7290	(98)
Space heating per m2											(98) / (4) =	30.2271	(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													3124.1433	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	582.9161	439.9480	349.8755	184.8416	73.2782	0.0000	0.0000	0.0000	0.0000	181.8668	395.6495	603.3534	(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)	647.6845	488.8311	388.7505	205.3796	81.4202	0.0000	0.0000	0.0000	0.0000	202.0743	439.6105	670.3927	(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	155.8720	117.0716	94.2289	50.8672	24.0173	8.7744	3.3564	32.0121	54.2966	98.2946	133.2528	154.9128	(64)	
Efficiency of water heater	89.2830	89.2857	89.2790	89.2668	89.1623	86.7000	86.7000	86.7000	86.7000	88.8140	89.1451	89.3056	(216)	
(217)m	89.2830	89.2857	89.2790	89.2668	89.1623	86.7000	86.7000	86.7000	86.7000	88.8140	89.1451	89.3056	(217)	
Fuel for water heating, kWh/month	174.5820	131.1201	105.5443	56.9833	26.9366	10.1204	3.8712	36.9229	62.6259	110.6747	149.4784	173.4638	(219)	
Water heating fuel used												1042.3236	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3124.1433	(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)													388.7741	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.54 * 1004 * 1.00) =										-433.7264		-433.7264	(233)	
Total delivered energy for all uses												4246.5147	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3124.1433	3.4800	108.7202	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1042.3236	3.4800	36.2729	(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	388.7741	13.1900	51.2793	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-433.7264	13.1900	-57.2085	(252)
Total energy cost			275.5514	(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] =	0.8385	(257)
SAP value		88.3027	
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	3124.1433	0.2160	674.8150 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1042.3236	0.2160	225.1419 (264)
Space and water heating			899.9569 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	388.7741	0.5190	201.7738 (268)
Energy saving/generation technologies			
PV Unit	-433.7264	0.5190	-225.1040 (269)
Total kg/year			941.5017 (272)
CO2 emissions per m2			10.1200 (273)
EI value			90.8592
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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.1400
Infiltration rate					0.3419 (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)	=	0.3163 (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	0.3321	0.3084	0.3163	0.3005	0.3005	0.2926	0.2847	0.2768	0.2689	0.2926	0.2768	0.2926 (22b)
Effective ac	0.5551	0.5476	0.5500	0.5451	0.5451	0.5428	0.5405	0.5383	0.5361	0.5428	0.5383	0.5428 (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			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			185.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.6402		(33)
E-WM-28			41.8300	0.0000	0.0000	110.0000	4601.3000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling 1			46.5100			18.0000	830.7000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17548.2500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.6503 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5182 (36)
Total fabric heat loss						(33) + (36) =	66.1584 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.7284	40.1711	40.3523	39.9945	39.9945	39.8224	39.6550	39.4922	39.3339	39.8224	39.4922	39.8224 (38)
Heat transfer coeff	106.8869	106.3295	106.5107	106.1529	106.1529	105.9809	105.8134	105.6506	105.4923	105.9809	105.6506	105.9809 (39)
Average = Sum(39)m / 12 =												106.0485 (39)
HLP	1.1491	1.1431	1.1450	1.1412	1.1412	1.1393	1.1375	1.1358	1.1341	1.1393	1.1358	1.1393 (40)
HLP (average)												1.1401 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)
	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (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 = 1533.8973 (45)											
Distribution loss (46)m = 0.15 x (45)m												
	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (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	21.8495	19.7150	21.7777	20.9935	21.6339	20.8675	21.5204	21.5940	20.9362	21.7182	21.0915	21.8274 (61)
Total heat required for water heating calculated for each month	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (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												1.3232 (H8)
Utilisation factor												0.5303 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.4900 (H14)
Volume ratio Veff/V												0.7693 (H15)
Solar storage volume factor												0.9475 (H16)
Solar input	-29.2570	-41.6015	-71.5030	-96.4741	-113.3147	-121.0380	-118.4925	-106.0544	-83.0333	-57.4064	-34.6033	-896.8358 (H17)
Solar input												-24.0577 (63)
Solar input (sum of months) = Sum (63)m =												-896.8358 (63)
Output from w/h	151.6249	117.2042	93.8039	49.6516	28.3865	3.4385	0.0000	25.7112	49.3903	94.2397	128.3147	151.7840 (64)
Total per year (kWh/year) = Sum (64)m =												893.5495 (64)
Heat gains from water heating, kWh/month	58.3406	51.1764	53.1679	46.8548	45.3309	39.6669	37.3031	42.0306	42.3036	48.6306	52.4302	56.6666 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0350	48.8816	39.7532	30.0957	22.4969	18.9928	20.5224	26.6758	35.8042	45.4617	53.0605	56.5646	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	78.4148	76.1554	71.4622	65.0762	60.9286	55.0928	50.1385	56.4927	58.7550	65.3637	72.8197	76.1648	(72)
Total internal gains	608.3638	603.7381	580.3729	544.0123	506.6192	473.1751	453.6473	462.3677	483.3020	519.8852	560.5867	591.5402	(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
Southeast				6.6900	45.1778		0.6200		0.7000		0.7700		90.9022 (77)
Southwest				6.0600	45.1778		0.6200		0.7000		0.7700		82.3419 (79)
Northwest				5.4000	14.6176		0.6200		0.7000		0.7700		23.7407 (81)
Solar gains	196.9848	292.4763	422.5075	559.6951	624.5620	687.1643	651.6905	589.4032	494.7791	354.2043	236.6290	164.7978	(83)
Total gains	805.3486	896.2143	1002.8804	1103.7074	1131.1812	1160.3395	1105.3377	1051.7708	978.0811	874.0895	797.2157	756.3380	(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	45.6044	45.8435	45.7655	45.9197	45.9197	45.9943	46.0671	46.1381	46.2073	45.9943	46.1381	45.9943	
alpha	4.0403	4.0562	4.0510	4.0613	4.0613	4.0663	4.0711	4.0759	4.0805	4.0663	4.0759	4.0663	
util living area	0.9747	0.9612	0.9241	0.8407	0.7031	0.5024	0.3691	0.3865	0.6271	0.8584	0.9523	0.9789	(86)
MIT	19.8274	19.9863	20.2922	20.6323	20.8658	20.9734	20.9941	20.9930	20.9356	20.6646	20.2148	19.8004	(87)
Th 2	19.9610	19.9658	19.9642	19.9673	19.9673	19.9688	19.9703	19.9717	19.9731	19.9688	19.9717	19.9688	(88)
util rest of house	0.9686	0.9521	0.9065	0.8051	0.6415	0.4187	0.2737	0.2872	0.5427	0.8176	0.9392	0.9736	(89)
MIT 2	18.4383	18.6683	19.0978	19.5582	19.8441	19.9523	19.9682	19.9692	19.9263	19.6131	19.0023	18.4056	(90)
Living area fraction													0.1824 (91)
MIT	18.6917	18.9088	19.3157	19.7542	20.0305	20.1386	20.1553	20.1560	20.1104	19.8049	19.2235	18.6600	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.5417	18.7588	19.1657	19.6042	19.8805	19.9886	20.0053	20.0060	19.9604	19.6549	19.0735	18.5100	(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	0.9572	0.9382	0.8897	0.7908	0.6359	0.4203	0.2770	0.2905	0.5416	0.8030	0.9241	0.9633	(94)
Useful gains	770.8592	840.8337	892.2799	872.7948	719.2723	487.7444	306.2102	305.5789	529.7492	701.8693	736.7094	728.6137	(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													
	1458.1210	1431.0624	1295.7750	1072.5896	783.4580	496.9016	307.4245	307.0194	554.9328	874.8638	1180.4908	1431.8065	(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													
	511.3228	396.6337	300.2003	143.8523	47.7541	0.0000	0.0000	0.0000	0.0000	128.7079	319.5226	523.1754	(98)
Space heating													
Space heating per m2													(98) / (4) = 25.4910 (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													2634.6323 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	511.3228	396.6337	300.2003	143.8523	47.7541	0.0000	0.0000	0.0000	0.0000	128.7079	319.5226	523.1754	(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)	568.1364	440.7041	333.5559	159.8359	53.0601	0.0000	0.0000	0.0000	0.0000	143.0088	355.0251	581.3060	(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	151.6249	117.2042	93.8039	49.6516	28.3865	3.4385	0.0000	25.7112	49.3903	94.2397	128.3147	151.7840	(64)
Efficiency of water heater	89.2233	89.2254	89.1918	89.1295	88.7407	86.7000	86.7000	86.7000	86.7000	88.5749	89.0291	89.2362	(217)
(217)m	169.9387	131.3575	105.1710	55.7072	31.9881	3.9660	0.0000	29.6554	56.9670	106.3955	144.1267	170.0924	(219)
Fuel for water heating, kWh/month													
Water heating fuel used													1005.3655 (219)
Annual totals kWh/year													
Space heating fuel - main system													2634.6323 (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)													388.7741 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 1122 * 1.00) =									-484.6697				-484.6697 (233)
Total delivered energy for all uses													3669.1022 (238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2634.6323	3.9300	103.5411	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1005.3655	3.9300	39.5109	(247)
Pumps and fans for heating	75.0000	17.5600	13.1700	(249)
Pump for solar water heating	50.0000	17.5600	8.7800	(249)
Energy for lighting	388.7741	17.5600	68.2687	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-484.6697	17.5600	-85.1080	(252)
Total energy cost			236.1627	(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	2634.6323	0.2160	569.0806	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1005.3655	0.2160	217.1589	(264)
Space and water heating			786.2395	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	388.7741	0.5190	201.7738	(268)
Energy saving/generation technologies				
PV Unit	-484.6697	0.5190	-251.5436	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Total kg/year 801.3447 (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	2634.6323	1.2200	3214.2515 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1005.3655	1.2200	1226.5459 (264)
Space and water heating			4440.7973 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	388.7741	3.0700	1193.5366 (268)
Energy saving/generation technologies			
PV Unit	-484.6697	3.0700	-1487.9360 (269)
Primary energy kWh/year			4530.1479 (272)
Primary energy kWh/m2/year			48.7008 (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	South West
Overshading	Average or unknown
Thermal mass parameter	188.7 (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	293.46 (P1)
Transmission heat loss coefficient	66.16 (37)
Summer heat loss coefficient	359.62 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	6.6900	127.3119	0.6200	0.7000	0.9000	299.4124
South West	6.0600	127.3119	0.6200	0.7000	0.9000	271.2166
North West	5.4000	106.0502	0.6200	0.7000	0.9000	201.3168

total: 771.9457

	Jun	Jul	Aug	
Solar gains	827	772	696	(P3)
Internal gains	470	451	459	
Total summer gains	1298	1223	1155	(P5)

Summer gain/loss ratio	3.61	3.40	3.21	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 188.7)	0.68	0.68	0.68	
Threshold temperature	19.69	21.38	21.19	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight