

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-172				Issued on Date	26/04/2019
Assessment Reference	As Built		Prop Type Ref	2302 - End (Op)		
Property	58, St Andrews Road, Botley, SOUTHAMPTON, SO32 2ST					
SAP Rating	86 B	DER	15.59	TER	18.53	
Environmental	88 B	% DER<TER	15.86			
CO ₂ Emissions (t/year)	0.95	DFEE	48.15	TFEE	51.81	
General Requirements Compliance	Pass	% DFEE<TFEE	7.06			
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessouthern.co.uk				Assessor ID	P637-0001
Client						

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

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DWELLING AS BUILT

End-Terrace House, total floor area 78 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.53 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.59 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.2 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.95 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Potterton Promax Ultra Combi 40 ErP
Combi boiler
Efficiency: 89.1% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

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

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Photovoltaic array 0.54 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.9500
Infiltration rate					0.4086 (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) =	0.3780 (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	0.4819	0.4725	0.4630	0.4158	0.4063	0.3591	0.3591	0.3496	0.3780	0.4063	0.4252	0.4441 (22b)
Effective ac	0.6161	0.6116	0.6072	0.5864	0.5826	0.5645	0.5645	0.5611	0.5714	0.5826	0.5904	0.5986 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14453.2600 (34)
185.5361 (35)
7.3755 (36)
(33) + (36) = 55.8936 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	37.8548	37.5778	37.3062	36.0306	35.7920	34.6810	34.6810	34.4752	35.1089	35.7920	36.2748	36.7795 (38)
Heat transfer coeff	93.7484	93.4714	93.1998	91.9242	91.6856	90.5746	90.5746	90.3689	91.0025	91.6856	92.1684	92.6731 (39)
Average = Sum(39)m / 12 =												91.9231 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2034	1.1999	1.1964	1.1800	1.1770	1.1627	1.1627	1.1601	1.1682	1.1770	1.1832	1.1896 (40)
HLP (average)												1.1800 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)

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Energy content (annual)	Total = Sum(45)m = 1443.0801 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645 (61)
Total heat required for water heating calculated for each month											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (64)
Heat gains from water heating, kWh/month											
54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8270	17.6102	14.3216	10.8424	8.1048	6.8424	7.3935	9.6103	12.8989	16.3781	19.1157	20.3781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	371.0735	368.9563	355.6250	334.1715	312.4252	291.4749	277.8798	283.8418	294.8798	316.5428	341.4074	360.0217	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF	Specific data or Table 6c	Access factor Table 6d	Gains W	
East				2.2000	19.6403		0.6200		0.7000	0.7700	12.9955 (76)	
South				0.5700	46.7521		0.6200		0.7000	0.7700	8.0149 (78)	
West				4.4600	19.6403		0.6200		0.7000	0.7700	26.3454 (80)	
East				5.8000	19.6403		0.6200		0.7000	0.7700	34.2609 (76)	
Solar gains	81.6167	157.1071	253.8364	364.7171	443.5072	452.8010	431.5592	372.7797	293.2421	185.0032	101.2732	67.4521 (83)
Total gains	452.6902	526.0633	609.4614	698.8885	755.9323	744.2759	709.4391	656.6215	588.1218	501.5460	442.6806	427.4739 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	42.8252	42.9521	43.0773	43.6750	43.7887	44.3258	44.3258	44.4267	44.1174	43.7887	43.5594	43.3221
alpha	3.8550	3.8635	3.8718	3.9117	3.9192	3.9551	3.9551	3.9618	3.9412	3.9192	3.9040	3.8881
util living area	0.9940	0.9887	0.9743	0.9328	0.8417	0.6886	0.5351	0.5907	0.8229	0.9601	0.9896	0.9952 (86)
MIT	19.3311	19.5256	19.8649	20.3076	20.6743	20.8986	20.9714	20.9580	20.7829	20.2896	19.7330	19.3020 (87)
Th 2	19.9172	19.9201	19.9229	19.9360	19.9385	19.9500	19.9500	19.9521	19.9455	19.9385	19.9335	19.9283 (88)
util rest of house	0.9925	0.9858	0.9673	0.9138	0.7964	0.6038	0.4191	0.4738	0.7558	0.9451	0.9864	0.9940 (89)
MIT 2	17.6937	17.9786	18.4713	19.1081	19.6005	19.8722	19.9364	19.9301	19.7523	19.0960	18.2910	17.6585 (90)
Living area fraction	fLA = Living area / (4) =											0.3866 (91)
MIT	18.3268	18.5768	19.0101	19.5719	20.0157	20.2690	20.3366	20.3276	20.1508	19.5575	18.8486	18.2940 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1768	18.4268	18.8601	19.4219	19.8657	20.1190	20.1866	20.1776	20.0008	19.4075	18.6986	18.1440 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9888	0.9800	0.9581	0.9024	0.7929	0.6186	0.4464	0.5004	0.7598	0.9352	0.9810	0.9909	(94)
Useful gains	447.6166	515.5388	583.9126	630.6642	599.3459	460.3843	316.6643	328.5993	446.8731	469.0356	434.2685	423.5795	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1300.9286	1264.3660	1151.9586	967.2157	748.6759	499.8847	324.8537	341.3735	536.9865	807.5251	1069.0198	1292.2319	(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	634.8642	503.2119	422.6262	242.3171	111.1015	0.0000	0.0000	0.0000	0.0000	251.8362	457.0209	646.2773	(98)
Space heating												3269.2553	(98)
Space heating per m2												(98) / (4) =	41.9673 (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													3632.5058 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	634.8642	503.2119	422.6262	242.3171	111.1015	0.0000	0.0000	0.0000	0.0000	251.8362	457.0209	646.2773	(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)	705.4046	559.1243	469.5847	269.2412	123.4461	0.0000	0.0000	0.0000	0.0000	279.8180	507.8010	718.0859	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(64)
Efficiency of water heater (217)m	89.2802	89.2210	89.0861	88.7746	88.1669	86.7000	86.7000	86.7000	86.7000	88.7757	89.1461	86.7000	(216)
Fuel for water heating, kWh/month	191.1102	167.8927	175.0419	155.3206	151.6905	135.5563	128.0378	143.4793	144.1738	161.1821	172.4067	185.7465	(219)
Water heating fuel used												1911.6385	(219)
Annual totals kWh/year													
Space heating fuel - main system												3632.5058	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 908 * 1.00) =										-392.1930		-392.1930	(233)
Total delivered energy for all uses												5577.1028	(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	3632.5058	0.2160	784.6213	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1911.6385	0.2160	412.9139	(264)
Space and water heating			1197.5352	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	350.1515	0.5190	181.7287	(268)
Energy saving/generation technologies				
PV Unit	-392.1930	0.5190	-203.5482	(269)
Total CO2, kg/year			1214.6406	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.5900	(273)

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

DER		15.5900	ZC1
Total Floor Area	TFA	77.9000	
Assumed number of occupants	N	2.4218	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3545	ZC2
CO2 emissions from cooking, equation (L16)		2.2737	ZC3
Total CO2 emissions		34.2183	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		34.2183	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

3. Heat losses and heat loss parameter

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

4. Water heating energy requirements (kWh/year)

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

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

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

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

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
East			8.0000	19.6403	0.6300	0.7000	0.7700	48.0186 (76)				
South			0.5700	46.7521	0.6300	0.7000	0.7700	8.1442 (78)				
West			4.4600	19.6403	0.6300	0.7000	0.7700	26.7703 (80)				
Solar gains	82.9331	159.6410	257.9305	370.5996	450.6605	460.1043	438.5199	378.7923	297.9718	187.9872	102.9066	68.5401 (83)
Total gains	464.0711	538.1986	622.5496	713.1615	770.8652	758.7510	723.5840	670.4252	601.2592	513.5413	453.9252	438.6331 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	60.9113	61.1043	61.2946	62.2047	62.3779	63.1975	63.1975	63.3516	62.8792	62.3779	62.0284	61.6671
alpha	5.0608	5.0736	5.0863	5.1470	5.1585	5.2132	5.2132	5.2234	5.1919	5.1585	5.1352	5.1111
util living area	0.9981	0.9955	0.9867	0.9521	0.8560	0.6797	0.5121	0.5705	0.8331	0.9757	0.9960	0.9986 (86)
MIT	19.7681	19.9249	20.1952	20.5472	20.8219	20.9609	20.9926	20.9874	20.8873	20.5134	20.0784	19.7458 (87)
Th 2	19.9682	19.9711	19.9740	19.9875	19.9900	20.0018	20.0018	20.0040	19.9972	19.9900	19.9849	19.9796 (88)
util rest of house	0.9974	0.9940	0.9819	0.9346	0.8071	0.5905	0.4003	0.4547	0.7599	0.9636	0.9943	0.9981 (89)
MIT 2	18.3254	18.5563	18.9504	19.4586	19.8179	19.9763	19.9991	19.9988	19.9074	19.4221	18.7910	18.3010 (90)
Living area fraction	18.8832	19.0854	19.4317	19.8795	20.2061	20.3570	20.3832	20.3811	20.2863	19.8440	19.2888	18.8596 (92)
MIT	18.8832	19.0854	19.4317	19.8795	20.2061	20.3570	20.3832	20.3811	20.2863	19.8440	19.2888	18.8596 (93)
Temperature adjustment												0.0000
adjusted MIT	18.8832	19.0854	19.4317	19.8795	20.2061	20.3570	20.3832	20.3811	20.2863	19.8440	19.2888	18.8596 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9964	0.9922	0.9786	0.9324	0.8187	0.6237	0.4438	0.4998	0.7834	0.9614	0.9927	0.9973 (94)
Useful gains	462.4154	533.9977	609.2499	664.9516	631.0737	473.2516	321.1183	335.0535	471.0245	493.7138	450.6161	437.4476 (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	1295.1823	1255.8745	1141.3238	954.8477	737.6929	492.7982	323.8434	339.9516	532.2280	801.6891	1063.0266	1286.0118 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	619.5786	485.1012	395.8630	208.7252	79.3247	0.0000	0.0000	0.0000	0.0000	229.1336	440.9356	631.3318 (98)
Space heating												3089.9937 (98)
Space heating per m2												39.6662 (99)

8c. Space cooling requirement

Not applicable

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3308.3444 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	619.5786	485.1012	395.8630	208.7252	79.3247	0.0000	0.0000	0.0000	0.0000	229.1336	440.9356	631.3318	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	663.3604	519.3804	423.8362	223.4745	84.9300	0.0000	0.0000	0.0000	0.0000	245.3251	472.0937	675.9441	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	200.5754	175.6039	182.7045	162.0496	156.8926	138.1823	132.3891	147.5829	149.2128	169.9085	181.3739	195.8545	(64)
Efficiency of water heater (217)m	87.7023	87.4757	86.9465	85.6895	83.4302	80.3000	80.3000	80.3000	80.3000	85.8047	87.2033	80.3000	(216)
Fuel for water heating, kWh/month	228.7004	200.7459	210.1342	189.1127	188.0526	172.0825	164.8682	183.7894	185.8191	198.0177	207.9899	223.1053	(219)
Water heating fuel used												2352.4179	(219)
Annual totals kWh/year													
Space heating fuel - main system												3308.3444	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.1515	(232)
Total delivered energy for all uses												6085.9138	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3308.3444	0.2160	714.6024 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2352.4179	0.2160	508.1223 (264)
Space and water heating			1222.7246 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	350.1515	0.5190	181.7287 (268)
Total CO2, kg/m2/year			1443.3783 (272)
Emissions per m2 for space and water heating			15.6961 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3328 (272b)
Emissions per m2 for pumps and fans			0.4997 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6961 * 1.00) + 2.3328 + 0.4997, rounded to 2 d.p.			18.5300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.9500
Infiltration rate					0.4086 (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) =	0.3780 (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	0.4819	0.4725	0.4630	0.4158	0.4063	0.3591	0.3591	0.3496	0.3780	0.4063	0.4252	0.4441 (22b)
Effective ac	0.6161	0.6116	0.6072	0.5864	0.5826	0.5645	0.5645	0.5611	0.5714	0.5826	0.5904	0.5986 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			9.0000	350.5500 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14102.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							181.0361 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3755 (36)
Total fabric heat loss							(33) + (36) = 55.8936 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	37.8548	37.5778	37.3062	36.0306	35.7920	34.6810	34.6810	34.4752	35.1089	35.7920	36.2748	36.7795 (38)
Heat transfer coeff	93.7484	93.4714	93.1998	91.9242	91.6856	90.5746	90.5746	90.3689	91.0025	91.6856	92.1684	92.6731 (39)
Average = Sum(39)m / 12 =												91.9231 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2034	1.1999	1.1964	1.1800	1.1770	1.1627	1.1627	1.1601	1.1682	1.1770	1.1832	1.1896 (40)
HLP (average)												1.1800 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1443.0801 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	31.7935	27.8068	28.6941	25.0162	24.0037	20.7134	19.1940	22.0254	22.2884	25.9750	28.3537	30.7903 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8270	17.6102	14.3216	10.8424	8.1048	6.8424	7.3935	9.6103	12.8989	16.3781	19.1157	20.3781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	42.7332	41.3792	38.5674	34.7448	32.2630	28.7685	25.7983	29.6040	30.9561	34.9126	39.3802	41.3848	(72)
Total internal gains	336.8830	335.5431	323.8207	304.5503	284.2228	265.2663	253.3610	257.1525	267.4153	286.8196	309.1329	326.5995	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					2.2000	19.6403	0.6200	0.7000	0.7700		12.9955 (76)	
South					0.5700	46.7521			0.7700		8.0149 (78)	
West					4.4600	19.6403	0.6200	0.7000	0.7700		26.3454 (80)	
East					5.8000	19.6403	0.6200	0.7000	0.7700		34.2609 (76)	
Solar gains	81.6167	157.1071	253.8364	364.7171	443.5072	452.8010	431.5592	372.7797	293.2421	185.0032	101.2732	67.4521 (83)
Total gains	418.4997	492.6501	577.6570	669.2674	727.7299	718.0674	684.9202	629.9322	560.6573	471.8228	410.4061	394.0516 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.7865	41.9104	42.0325	42.6157	42.7267	43.2508	43.2508	43.3492	43.0474	42.7267	42.5029	42.2714	
alpha	3.7858	3.7940	3.8022	3.8410	3.8484	3.8834	3.8834	3.8899	3.8698	3.8484	3.8335	3.8181	
util living area	0.9950	0.9902	0.9770	0.9381	0.8515	0.7028	0.5499	0.6086	0.8371	0.9652	0.9913	0.9961	(86)
MIT	19.2499	19.4499	19.7995	20.2583	20.6429	20.8847	20.9663	20.9503	20.7565	20.2367	19.6623	19.2211	(87)
Th 2	19.9172	19.9201	19.9229	19.9360	19.9385	19.9500	19.9500	19.9521	19.9455	19.9385	19.9335	19.9283	(88)
util rest of house	0.9937	0.9877	0.9708	0.9205	0.8083	0.6190	0.4324	0.4907	0.7733	0.9520	0.9886	0.9950	(89)
MIT 2	18.3210	18.5219	18.8700	19.3260	19.6824	19.8883	19.9387	19.9338	19.7944	19.3148	18.7445	18.3005	(90)
Living area fraction	18.6802	18.8807	19.2294	19.6865	20.0538	20.2736	20.3361	20.3269	20.1664	19.6713	19.0994	18.6565	(92)
Temperature adjustment	18.6802	18.8807	19.2294	19.6865	20.0538	20.2736	20.3361	20.3269	20.1664	19.6713	19.0994	18.6565	(93)
adjusted MIT	18.6802	18.8807	19.2294	19.6865	20.0538	20.2736	20.3361	20.3269	20.1664	19.6713	19.0994	18.6565	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	415.0435	484.9998	557.8230	612.7805	592.0363	464.3637	326.9511	337.1726	442.0601	447.2047	404.5852	391.4437	(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	1348.1165	1306.7977	1186.3790	991.5379	765.9202	513.8813	338.3919	354.8650	552.0580	831.7062	1105.9640	1339.7254	(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	694.2063	552.2482	467.6456	272.7053	129.3696	0.0000	0.0000	0.0000	0.0000	286.0691	504.9927	705.5216	(98)
Space heating												3612.7585	(98)
Space heating per m2												46.3769	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	851.4012	670.2520	686.8033	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8287	0.8902	0.8619	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	705.5208	596.6813	591.9490	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	929.7326	889.1535	826.4681	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	161.4325	217.5993	174.4822	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			553.5141 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	40.3581	54.3998	43.6206	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												138.3785 (107)
Energy for space heating												1.7764 (108)
Energy for space cooling												46.3769 (99)
Total												1.7764 (108)
Dwelling Fabric Energy Efficiency (DFEE)												48.1532 (109)
												48.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

3. Heat losses and heat loss parameter

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

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	31.7935	27.8068	28.6941	25.0162	24.0037	20.7134	19.1940	22.0254	22.2884	25.9750	28.3537	30.7903 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8270	17.6102	14.3216	10.8424	8.1048	6.8424	7.3935	9.6103	12.8989	16.3781	19.1157	20.3781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	42.7332	41.3792	38.5674	34.7448	32.2630	28.7685	25.7983	29.6040	30.9561	34.9126	39.3802	41.3848	(72)
Total internal gains	336.8830	335.5431	323.8207	304.5503	284.2228	265.2663	253.3610	257.1525	267.4153	286.8196	309.1329	326.5995	(73)

6. Solar gains

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

Solar gains	82.9331	159.6410	257.9305	370.5996	450.6605	460.1043	438.5199	378.7923	297.9718	187.9872	102.9066	68.5401 (83)
Total gains	419.8161	495.1841	581.7512	675.1499	734.8833	725.3706	691.8809	635.9448	565.3871	474.8067	412.0395	395.1396 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nilm (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	60.9113	61.1043	61.2946	62.2047	62.3779	63.1975	63.1975	63.3516	62.8792	62.3779	62.0284	61.6671		
alpha	5.0608	5.0736	5.0863	5.1470	5.1585	5.2132	5.2132	5.2234	5.1919	5.1585	5.1352	5.1111		
util living area	0.9988	0.9969	0.9900	0.9609	0.8740	0.7034	0.5337	0.5976	0.8582	0.9824	0.9974	0.9991	(86)	
MIT	19.7151	19.8740	20.1489	20.5105	20.8006	20.9542	20.9910	20.9845	20.8682	20.4714	20.0286	19.6935	(87)	
Th 2	19.9682	19.9711	19.9740	19.9875	19.9900	20.0018	20.0018	20.0040	19.9972	19.9900	19.9849	19.9796	(88)	
util rest of house	0.9984	0.9959	0.9864	0.9461	0.8283	0.6139	0.4182	0.4782	0.7899	0.9732	0.9963	0.9988	(89)	
MIT 2	18.7938	18.9546	19.2298	19.5926	19.8562	19.9810	19.9995	19.9995	19.9234	19.5625	19.1203	18.7813	(90)	
Living area fraction									fLA = Living area / (4) =			0.3866	(91)	
MIT	19.1500	19.3100	19.5852	19.9475	20.2214	20.3573	20.3829	20.3804	20.2887	19.9139	19.4715	19.1340	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.1500	19.3100	19.5852	19.9475	20.2214	20.3573	20.3829	20.3804	20.2887	19.9139	19.4715	19.1340	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	418.9428	492.6865	572.7869	638.2786	617.2738	469.6654	320.4956	333.7681	459.2703	461.6842	410.2184	394.5363	(94)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)	
Heat loss rate W	1318.8744	1275.7596	1154.8674	960.7667	739.0136	492.8266	323.8156	339.8915	532.4359	807.7490	1078.9596	1310.0799	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)	
Space heating kWh	669.5491	526.2251	433.0679	232.1914	90.5744	0.0000	0.0000	0.0000	0.0000	257.4722	481.4937	681.1645	(98)	
Space heating												3371.7382	(98)	
Space heating per m2										(98) / (4) =		43.2829	(99)	

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000		
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	804.6430	633.4424	648.9797	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8960	0.9459	0.9241	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	720.9999	599.1827	599.7211	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	938.2689	897.2893	833.4958	0.0000	0.0000	0.0000	0.0000	(103)	
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	156.4337	221.7913	173.9284	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												552.1534	(104)	

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Calculation Type: New Build (As Built)



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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.9500
Infiltration rate					0.4086 (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) =	0.3780 (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	0.3969	0.3685	0.3780	0.3591	0.3591	0.3496	0.3402	0.3307	0.3213	0.3496	0.3307	0.3496 (22b)
Effective ac	0.5788	0.5679	0.5714	0.5645	0.5645	0.5611	0.5579	0.5547	0.5516	0.5611	0.5547	0.5611 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14453.2600 (34)
185.5361 (35)
7.3755 (36)
(33) + (36) = 55.8936 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.5588	34.8922	35.1089	34.6810	34.6810	34.4752	34.2750	34.0802	33.8910	34.4752	34.0802	34.4752 (38)
Heat transfer coeff	91.4524	90.7858	91.0025	90.5746	90.5746	90.3689	90.1686	89.9738	89.7846	90.3689	89.9738	90.3689 (39)
Average = Sum(39)m / 12 =												90.4498 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1740	1.1654	1.1682	1.1627	1.1627	1.1601	1.1575	1.1550	1.1526	1.1601	1.1550	1.1601 (40)
HLP (average)												1.1611 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1443.0801 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645 (61)
Total heat required for water heating calculated for each month											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938 (64)
RHI water heating demand	Total per year (kWh/year) = Sum(64)m = 1688.5811 (64)										
Heat gains from water heating, kWh/month	54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314 (65)
											1689 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(73)

6. Solar gains

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

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.9004	44.2227	44.1174	44.3258	44.3258	44.4267	44.5254	44.6218	44.7159	44.4267	44.6218	44.4267
alpha	3.9267	3.9482	3.9412	3.9551	3.9551	3.9618	3.9684	3.9748	3.9811	3.9618	3.9748	3.9618
util living area	0.9768	0.9663	0.9340	0.8558	0.7229	0.5251	0.3880	0.4074	0.6592	0.8802	0.9588	0.9800 (86)
MIT	19.7416	19.8904	20.2052	20.5768	20.8391	20.9655	20.9919	20.9905	20.9164	20.6011	20.1369	19.7298 (87)
Th 2	19.9409	19.9478	19.9455	19.9500	19.9500	19.9521	19.9542	19.9562	19.9581	19.9521	19.9562	19.9521 (88)
util rest of house	0.9712	0.9583	0.9181	0.8221	0.6616	0.4379	0.2869	0.3019	0.5735	0.8432	0.9472	0.9751 (89)
MIT 2	18.3034	18.5211	18.9654	19.4743	19.8002	19.9303	19.9512	19.9527	19.8959	19.5213	18.8838	18.2944 (90)
Living area fraction	18.8595	19.0505	19.4448	19.9006	20.2019	20.3306	20.3536	20.3539	20.2905	19.9388	19.3683	18.8494 (91)
MIT	18.8595	19.0505	19.4448	19.9006	20.2019	20.3306	20.3536	20.3539	20.2905	19.9388	19.3683	18.8494 (92)
Temperature adjustment	18.7095	18.9005	19.2948	19.7506	20.0519	20.1806	20.2036	20.2039	20.1405	19.7888	19.2183	-0.1500
adjusted MIT	18.7095	18.9005	19.2948	19.7506	20.0519	20.1806	20.2036	20.2039	20.1405	19.7888	19.2183	18.6994 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9625	0.9480	0.9062	0.8149	0.6680	0.4576	0.3114	0.3274	0.5895	0.8365	0.9366	0.9671	(94)
Useful gains	627.4622	676.9214	724.7788	724.9262	612.9514	428.9924	277.9165	276.9796	456.4260	573.4953	593.9537	597.1480	(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	1262.9100	1234.7357	1118.8571	928.4416	684.0094	441.0514	279.8489	279.2742	488.4689	758.0828	1018.3521	1237.9992	(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	472.7732	374.8512	293.1942	146.5311	52.8672	0.0000	0.0000	0.0000	0.0000	137.3331	305.5668	476.7933	(98)
Space heating												2259.9100	(98)
RHI space heating demand												2260	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.9500
Infiltration rate					0.4086 (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)	=	0.3780 (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	0.4819	0.4725	0.4630	0.4158	0.4063	0.3591	0.3591	0.3496	0.3780	0.4063	0.4252	0.4441 (22b)
Effective ac	0.6161	0.6116	0.6072	0.5864	0.5826	0.5645	0.5645	0.5611	0.5714	0.5826	0.5904	0.5986 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14453.2600 (34)
185.5361 (35)
7.3755 (36)
(33) + (36) = 55.8936 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	37.8548	37.5778	37.3062	36.0306	35.7920	34.6810	34.6810	34.4752	35.1089	35.7920	36.2748	36.7795 (38)
Heat transfer coeff	93.7484	93.4714	93.1998	91.9242	91.6856	90.5746	90.5746	90.3689	91.0025	91.6856	92.1684	92.6731 (39)
Average = Sum(39)m / 12 =												91.9231 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2034	1.1999	1.1964	1.1800	1.1770	1.1627	1.1627	1.1601	1.1682	1.1770	1.1832	1.1896 (40)
HLP (average)												1.1800 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1443.0801 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645 (61)
Total heat required for water heating calculated for each month											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (64)
Heat gains from water heating, kWh/month											
54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					2.2000	19.6403	0.6200	0.7000	0.7700		12.9955 (76)	
South					0.5700	46.7521		0.7000	0.7700		8.0149 (78)	
West					4.4600	19.6403	0.6200	0.7000	0.7700		26.3454 (80)	
East					5.8000	19.6403	0.6200	0.7000	0.7700		34.2609 (76)	
Solar gains	81.6167	157.1071	253.8364	364.7171	443.5072	452.8010	431.5592	372.7797	293.2421	185.0032	101.2732	67.4521 (83)
Total gains	629.3858	700.5325	776.2286	854.5419	900.0381	879.4942	840.8117	790.2205	729.4228	653.9608	606.6431	600.3237 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	42.8252	42.9521	43.0773	43.6750	43.7887	44.3258	44.3258	44.4267	44.1174	43.7887	43.5594	43.3221
alpha	3.8550	3.8635	3.8718	3.9117	3.9192	3.9551	3.9551	3.9618	3.9412	3.9192	3.9040	3.8881
util living area	0.9820	0.9714	0.9467	0.8862	0.7746	0.6096	0.4606	0.5056	0.7340	0.9151	0.9708	0.9847 (86)
MIT	19.5825	19.7658	20.0762	20.4661	20.7660	20.9343	20.9831	20.9756	20.8604	20.4655	19.9597	19.5507 (87)
Th 2	19.9172	19.9201	19.9229	19.9360	19.9385	19.9500	19.9500	19.9521	19.9455	19.9385	19.9335	19.9283 (88)
util rest of house	0.9776	0.9646	0.9337	0.8585	0.7217	0.5263	0.3567	0.3993	0.6573	0.8881	0.9627	0.9811 (89)
MIT 2	18.0575	18.3233	18.7680	19.3173	19.7054	19.9019	19.9423	19.9401	19.8295	19.3314	18.6153	18.0191 (90)
Living area fraction	18.6471	18.8810	19.2738	19.7615	20.1155	20.3011	20.3447	20.3405	20.2281	19.7699	19.1351	18.6113 (92)
MIT	18.6471	18.8810	19.2738	19.7615	20.1155	20.3011	20.3447	20.3405	20.2281	19.7699	19.1351	18.6113 (91)
Temperature adjustment												-0.1500
adjusted MIT	18.4971	18.7310	19.1238	19.6115	19.9655	20.1511	20.1947	20.1905	20.0781	19.6199	18.9851	18.4613 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9698	0.9548	0.9217	0.8486	0.7232	0.5431	0.3816	0.4244	0.6678	0.8783	0.9530	0.9741	(94)
Useful gains	610.3927	668.8393	715.4333	725.1941	650.9286	477.6242	320.8646	335.3524	487.1353	574.3461	578.1238	584.7606	(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	1330.9565	1292.8057	1176.5372	984.6468	757.8241	502.7867	325.5888	342.5399	544.0221	826.9963	1095.4319	1321.6392	(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	536.0994	419.3054	343.0614	186.8060	79.5303	0.0000	0.0000	0.0000	0.0000	187.9717	372.4619	548.2377	(98)
Space heating												2673.4737	(98)
Space heating per m2												(98) / (4) =	34.3193 (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													2970.5263 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	536.0994	419.3054	343.0614	186.8060	79.5303	0.0000	0.0000	0.0000	0.0000	187.9717	372.4619	548.2377	(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)	595.6660	465.8949	381.1793	207.5622	88.3670	0.0000	0.0000	0.0000	0.0000	208.8575	413.8465	609.1530	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(64)
Efficiency of water heater (217)m	89.1805	89.1073	88.9421	88.5684	87.9019	86.7000	86.7000	86.7000	86.7000	88.5434	89.0104	86.7000	(216)
Fuel for water heating, kWh/month	191.3238	168.1070	175.3254	155.6822	152.1478	135.5563	128.0378	143.4793	144.1738	161.6051	172.6696	185.9432	(219)
Water heating fuel used												1914.0512	(219)
Annual totals kWh/year													
Space heating fuel - main system												2970.5263	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 908 * 1.00) =										-392.1930		-392.1930	(233)
Total delivered energy for all uses												4917.5360	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2970.5263	3.4800	103.3743	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1914.0512	3.4800	66.6090	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	350.1515	13.1900	46.1850	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-392.1930	13.1900	-51.7303	(252)
Total energy cost			294.3305	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$		1.0058	(257)
SAP value			85.9684	
SAP rating (Section 12)			86	(258)
SAP band			B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2970.5263	0.2160	641.6337	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1914.0512	0.2160	413.4351	(264)
Space and water heating			1055.0687	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	350.1515	0.5190	181.7287	(268)
Energy saving/generation technologies				
PV Unit	-392.1930	0.5190	-203.5482	(269)
Total kg/year			1072.1742	(272)
CO2 emissions per m2			13.7600	(273)
EI value			88.3099	
EI rating			88	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8811 = 3.950$, stars = 4
Water heating environmental impact	$0.216 / 0.8811 = 0.2452$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.9500
Infiltration rate					0.4086 (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)	=	0.3780 (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	0.3969	0.3685	0.3780	0.3591	0.3591	0.3496	0.3402	0.3307	0.3213	0.3496	0.3307	0.3496 (22b)
Effective ac	0.5788	0.5679	0.5714	0.5645	0.5645	0.5611	0.5579	0.5547	0.5516	0.5611	0.5547	0.5611 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14453.2600 (34)
185.5361 (35)
7.3755 (36)
(33) + (36) = 55.8936 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.5588	34.8922	35.1089	34.6810	34.6810	34.4752	34.2750	34.0802	33.8910	34.4752	34.0802	34.4752 (38)
Heat transfer coeff	91.4524	90.7858	91.0025	90.5746	90.5746	90.3689	90.1686	89.9738	89.7846	90.3689	89.9738	90.3689 (39)
Average = Sum(39)m / 12 =												90.4498 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1740	1.1654	1.1682	1.1627	1.1627	1.1601	1.1575	1.1550	1.1526	1.1601	1.1550	1.1601 (40)
HLP (average)												1.1611 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)												Total = Sum(45)m = 1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m												
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645	20.9866 (61)
Total heat required for water heating calculated for each month												
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(64)
Total per year (kWh/year) = Sum(64)m =												1688.5811 (64)
Heat gains from water heating, kWh/month												
54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					2.2000	25.1925	0.6200	0.7000	0.7700		16.6693 (76)	
South					0.5700	56.7559	0.6200	0.7000	0.7700		9.7299 (78)	
West					4.4600	25.1925	0.6200	0.7000	0.7700		33.7932 (80)	
East					5.8000	25.1925	0.6200	0.7000	0.7700		43.9464 (76)	

Solar gains	104.1388	170.6106	277.4113	399.8112	461.0300	510.8679	483.2507	428.4757	338.0855	216.6661	128.8132	84.5880 (83)
Total gains	651.9079	714.0361	799.8035	889.6360	917.5609	937.5611	892.5031	845.9165	774.2662	685.6237	634.1831	617.4596 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.9004	44.2227	44.1174	44.3258	44.3258	44.4267	44.5254	44.6218	44.7159	44.8267	44.9218	44.9267
alpha	3.9267	3.9482	3.9412	3.9551	3.9551	3.9618	3.9684	3.9748	3.9811	3.9818	3.9748	3.9618
util living area	0.9768	0.9663	0.9340	0.8558	0.7229	0.5251	0.3880	0.4074	0.6592	0.8802	0.9588	0.9800 (86)
MIT	19.7416	19.8904	20.2052	20.5768	20.8391	20.9655	20.9919	20.9905	20.9164	20.6011	20.1369	19.7298 (87)
Th 2	19.9409	19.9478	19.9455	19.9500	19.9500	19.9521	19.9542	19.9562	19.9581	19.9521	19.9562	19.9521 (88)
util rest of house	0.9712	0.9583	0.9181	0.8221	0.6616	0.4379	0.2869	0.3019	0.5735	0.8432	0.9472	0.9751 (89)
MIT 2	18.3034	18.5211	18.9654	19.4743	19.8002	19.9303	19.9512	19.9527	19.8959	19.5213	18.8838	18.2944 (90)
Living area fraction	18.8595	19.0505	19.4448	19.9006	20.2019	20.3306	20.3536	20.3539	20.2905	19.9388	19.3683	18.8494 (91)
MIT	18.8595	19.0505	19.4448	19.9006	20.2019	20.3306	20.3536	20.3539	20.2905	19.9388	19.3683	18.8494 (92)
Temperature adjustment	18.7095	18.9005	19.2948	19.7506	20.0519	20.1806	20.2036	20.2039	20.1405	19.7888	19.2183	-0.1500
adjusted MIT	18.7095	18.9005	19.2948	19.7506	20.0519	20.1806	20.2036	20.2039	20.1405	19.7888	19.2183	18.6994 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9625	0.9480	0.9062	0.8149	0.6680	0.4576	0.3114	0.3274	0.5895	0.8365	0.9366	0.9671	(94)
Useful gains	627.4622	676.9214	724.7788	724.9262	612.9514	428.9924	277.9165	276.9796	456.4260	573.4953	593.9537	597.1480	(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	1262.9100	1234.7357	1118.8571	928.4416	684.0094	441.0514	279.8489	279.2742	488.4689	758.0828	1018.3521	1237.9992	(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	472.7732	374.8512	293.1942	146.5311	52.8672	0.0000	0.0000	0.0000	0.0000	137.3331	305.5668	476.7933	(98)
Space heating												2259.9100	(98)
Space heating per m2												(98) / (4) = 29.0104	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2511.0112 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	472.7732	374.8512	293.1942	146.5311	52.8672	0.0000	0.0000	0.0000	0.0000	137.3331	305.5668	476.7933	(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)	525.3035	416.5013	325.7714	162.8123	58.7413	0.0000	0.0000	0.0000	0.0000	152.5923	339.5187	529.7703	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(64)
Efficiency of water heater (217)m	89.1006	89.0324	88.8261	88.3694	87.6101	86.7000	86.7000	86.7000	86.7000	88.2853	88.8680	86.7000	(216)
Fuel for water heating, kWh/month	191.4952	168.2483	175.5542	156.0328	152.6546	135.5563	128.0378	143.4793	144.1738	162.0774	172.9462	186.1244	(219)
Water heating fuel used												1916.3803	(219)
Annual totals kWh/year													
Space heating fuel - main system												2511.0112	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 1031 * 1.00) =										-445.3995		-445.3995	(233)
Total delivered energy for all uses												4407.1435	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2511.0112	3.9200	98.4316 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1916.3803	3.9200	75.1221 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	350.1515	16.9600	59.3857 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-445.3995	16.9600	-75.5398 (252)
Total energy cost			258.1197 (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	2511.0112	0.2160	542.3784 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.3803	0.2160	413.9381 (264)
Space and water heating			956.3166 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	350.1515	0.5190	181.7287 (268)
Energy saving/generation technologies			
PV Unit	-445.3995	0.5190	-231.1624 (269)
Total kg/year			945.8078 (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	2511.0112	1.2200	3063.4336 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.3803	1.2200	2337.9840 (264)
Space and water heating			5401.4176 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	350.1515	3.0700	1074.9652 (268)
Energy saving/generation technologies			
PV Unit	-445.3995	3.0700	-1367.3766 (269)
Primary energy kWh/year			5339.2562 (272)
Primary energy kWh/m2/year			68.5399 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 30	-189 kg (19.9%)

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

Fuel prices for cost data on this page from database revision number 441 TEST (27 Mar 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£72	£81	-£8
Mains gas	£262	£223	£39
Space heating	£199	£199	£0
Water heating	£75	£45	£30
Lighting	£59	£59	£0
Generated (PV)	-£76	-£76	£0
Total cost of fuels	£258	£228	£31
Total cost of uses	£257	£227	£30
Delivered energy	57 kWh/m²	44 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	12 kg/m²	10 kg/m²	2 kg/m²
Primary energy	69 kWh/m²	55 kWh/m²	14 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.9500
Infiltration rate					0.4086 (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) =	0.3780 (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	0.4819	0.4725	0.4630	0.4158	0.4063	0.3591	0.3591	0.3496	0.3780	0.4063	0.4252	0.4441 (22b)
Effective ac	0.6161	0.6116	0.6072	0.5864	0.5826	0.5645	0.5645	0.5611	0.5714	0.5826	0.5904	0.5986 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum (A, m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14453.2600 (34)
185.5361 (35)
7.3755 (36)
(33) + (36) = 55.8936 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	37.8548	37.5778	37.3062	36.0306	35.7920	34.6810	34.6810	34.4752	35.1089	35.7920	36.2748	36.7795 (38)
Heat transfer coeff	93.7484	93.4714	93.1998	91.9242	91.6856	90.5746	90.5746	90.3689	91.0025	91.6856	92.1684	92.6731 (39)
Average = Sum(39)m / 12 =												91.9231 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2034	1.1999	1.1964	1.1800	1.1770	1.1627	1.1627	1.1601	1.1682	1.1770	1.1832	1.1896 (40)
HLP (average)												1.1800 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Combi loss	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645	20.9866 (61)	
Total heat required for water heating calculated for each month	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (62)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.7000 (H2)	
Collector heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0050 (H3a)	
Collector effective heat loss coefficient												1.8063 (H3b)	
Collector performance ratio												2.5804 (H4)	
Annual solar radiation per m2												1079.5246 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												1813.6014 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.2568 (H8)	
Utilisation factor												0.5487 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												91.7179 (H14)	
Volume ratio Veff/V												0.8177 (H15)	
Solar storage volume factor												0.9598 (H16)	
Solar input												-839.8420 (H17)	
Solar input	-24.3537	-40.6394	-69.2135	-92.7598	-114.5969	-112.6670	-111.1781	-97.1368	-76.0776	-51.9521	-28.8870	-20.3799 (63)	
	Solar input (sum of months) = Sum(63)m =											-839.8420 (63)	
Output from w/h	146.2697	109.1561	86.7245	45.1254	19.1439	4.8603	0.0000	27.2597	48.9211	91.1385	124.8068	145.5023 (64)	
	Total per year (kWh/year) = Sum(64)m =											848.9084 (64)	
Heat gains from water heating, kWh/month	54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (65)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East				2.2000	19.6403	0.6200		0.7000		0.7700		12.9955 (76)	
South				0.5700	46.7521	0.6200		0.7000		0.7700		8.0149 (78)	
West				4.4600	19.6403	0.6200		0.7000		0.7700		26.3454 (80)	
East				5.8000	19.6403	0.6200		0.7000		0.7700		34.2609 (76)	

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

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	42.8252	42.9521	43.0773	43.6750	43.7887	44.3258	44.3258	44.4267	44.1174	43.7887	43.5594	43.3221
alpha	3.8550	3.8635	3.8718	3.9117	3.9192	3.9551	3.9551	3.9618	3.9412	3.9192	3.9040	3.8881
util living area	0.9820	0.9714	0.9467	0.8862	0.7746	0.6096	0.4606	0.5056	0.7340	0.9151	0.9708	0.9847 (86)
MIT	19.5825	19.7658	20.0762	20.4661	20.7660	20.9343	20.9831	20.9756	20.8604	20.4655	19.9597	19.5507 (87)
Th 2	19.9172	19.9201	19.9229	19.9360	19.9385	19.9500	19.9500	19.9521	19.9455	19.9385	19.9335	19.9283 (88)
util rest of house	0.9776	0.9646	0.9337	0.8585	0.7217	0.5263	0.3567	0.3993	0.6573	0.8881	0.9627	0.9811 (89)
MIT 2	18.0575	18.3233	18.7680	19.3173	19.7054	19.9019	19.9423	19.9401	19.8295	19.3314	18.6153	18.0191 (90)
Living area fraction	fLA = Living area / (4) =											0.3866 (91)
MIT	18.6471	18.8810	19.2738	19.7615	20.1155	20.3011	20.3447	20.3405	20.2281	19.7699	19.1351	18.6113 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4971	18.7310	19.1238	19.6115	19.9655	20.1511	20.1947	20.1905	20.0781	19.6199	18.9851	18.4613 (93)

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Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9698	0.9548	0.9217	0.8486	0.7232	0.5431	0.3816	0.4244	0.6678	0.8783	0.9530	0.9741	(94)
Useful gains	610.3927	668.8393	715.4333	725.1941	650.9286	477.6242	320.8646	335.3524	487.1353	574.3461	578.1238	584.7606	(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	1330.9565	1292.8057	1176.5372	984.6468	757.8241	502.7867	325.5888	342.5399	544.0221	826.9963	1095.4319	1321.6392	(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	536.0994	419.3054	343.0614	186.8060	79.5303	0.0000	0.0000	0.0000	0.0000	187.9717	372.4619	548.2377	(98)
Space heating												2673.4737	(98)
Space heating per m2											(98) / (4) =	34.3193	(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													2970.5263 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	536.0994	419.3054	343.0614	186.8060	79.5303	0.0000	0.0000	0.0000	0.0000	187.9717	372.4619	548.2377	(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)	595.6660	465.8949	381.1793	207.5622	88.3670	0.0000	0.0000	0.0000	0.0000	208.8575	413.8465	609.1530	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	146.2697	109.1561	86.7245	45.1254	19.1439	4.8603	0.0000	27.2597	48.9211	91.1385	124.8068	145.5023	(64)
Efficiency of water heater	89.2716	89.2979	89.3140	89.3384	89.3403	86.7000	86.7000	86.7000	86.7000	88.8952	89.1484	86.7000	(216)
(217)m	89.2716	89.2979	89.3140	89.3384	89.3403	86.7000	86.7000	86.7000	86.7000	88.8952	89.1484	89.2872	(217)
Fuel for water heating, kWh/month	163.8479	122.2381	97.1006	50.5106	21.4281	5.6058	0.0000	31.4414	56.4257	102.5236	139.9990	162.9599	(219)
Water heating fuel used												954.0809	(219)
Annual totals kWh/year													
Space heating fuel - main system												2970.5263	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													350.1515 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 908 * 1.00) =										-392.1930		-392.1930	(233)
Total delivered energy for all uses												4007.5657	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2970.5263	3.4800	103.3743	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	954.0809	3.4800	33.2020	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	350.1515	13.1900	46.1850	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-392.1930	13.1900	-51.7303	(252)
Total energy cost			267.5186	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)			0.9142 (257)
SAP value		[(255) x (256)] / [(4) + 45.0] =	87.2466
SAP rating (Section 12)			87 (258)
SAP band			B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2970.5263	0.2160	641.6337 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	954.0809	0.2160	206.0815 (264)
Space and water heating			847.7151 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	350.1515	0.5190	181.7287 (268)
Energy saving/generation technologies			
PV Unit	-392.1930	0.5190	-203.5482 (269)
Total kg/year			890.7706 (272)
CO2 emissions per m2			11.4300 (273)
EI value			90.2878
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.9500
Infiltration rate					0.4086 (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)	=	0.3780 (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	0.3969	0.3685	0.3780	0.3591	0.3591	0.3496	0.3402	0.3307	0.3213	0.3496	0.3307	0.3496 (22b)
Effective ac	0.5788	0.5679	0.5714	0.5645	0.5645	0.5611	0.5579	0.5547	0.5516	0.5611	0.5547	0.5611 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP) = Cm / TFA in kJ/m²K
 Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Total fabric heat loss
 (28)...(30) + (32) + (32a)...(32e) = 14453.2600 (34)
 185.5361 (35)
 7.3755 (36)
 (33) + (36) = 55.8936 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.5588	34.8922	35.1089	34.6810	34.6810	34.4752	34.2750	34.0802	33.8910	34.4752	34.0802	34.4752 (38)
Heat transfer coeff	91.4524	90.7858	91.0025	90.5746	90.5746	90.3689	90.1686	89.9738	89.7846	90.3689	89.9738	90.3689 (39)
Average = Sum(39)m / 12 =												90.4498 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1740	1.1654	1.1682	1.1627	1.1627	1.1601	1.1575	1.1550	1.1526	1.1601	1.1550	1.1601 (40)
HLP (average)												1.1611 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)												Total = Sum(45)m =	1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Combi loss	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645	20.9866 (61)	
Total heat required for water heating calculated for each month	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (62)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.7000 (H2)	
Collector heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0050 (H3a)	
Collector effective heat loss coefficient												1.8063 (H3b)	
Collector performance ratio												2.5804 (H4)	
Annual solar radiation per m2												1208.1510 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												2029.6937 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.4065 (H8)	
Utilisation factor												0.5088 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												91.7179 (H14)	
Volume ratio Veff/V												0.8177 (H15)	
Solar storage volume factor												0.9598 (H16)	
Solar input												-871.5756 (H17)	
Solar input	-28.4329	-40.4298	-69.4891	-93.7569	-110.1231	-117.6288	-115.1551	-103.0673	-80.6946	-55.7895	-33.6286	-23.3801 (63)	
	Solar input (sum of months) = Sum(63)m =											-871.5756 (63)	
Output from w/h	142.1906	109.3658	86.4489	44.1284	23.6178	0.0000	0.0000	21.3293	44.3042	87.3011	120.0652	142.5021 (64)	
	Total per year (kWh/year) = Sum(64)m =											821.2534 (64)	
Heat gains from water heating, kWh/month	54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (65)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(73)

6. Solar gains

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

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.9004	44.2227	44.1174	44.3258	44.3258	44.4267	44.5254	44.6218	44.7159	44.4267	44.6218	44.4267
alpha	3.9267	3.9482	3.9412	3.9551	3.9551	3.9618	3.9684	3.9748	3.9811	3.9618	3.9748	3.9618
util living area	0.9768	0.9663	0.9340	0.8558	0.7229	0.5251	0.3880	0.4074	0.6592	0.8802	0.9588	0.9800 (86)
MIT	19.7416	19.8904	20.2052	20.5768	20.8391	20.9655	20.9919	20.9905	20.9164	20.6011	20.1369	19.7298 (87)
Th 2	19.9409	19.9478	19.9455	19.9500	19.9500	19.9521	19.9542	19.9562	19.9581	19.9521	19.9562	19.9521 (88)
util rest of house	0.9712	0.9583	0.9181	0.8221	0.6616	0.4379	0.2869	0.3019	0.5735	0.8432	0.9472	0.9751 (89)
MIT 2	18.3034	18.5211	18.9654	19.4743	19.8002	19.9303	19.9512	19.9527	19.8959	19.5213	18.8838	18.2944 (90)
Living area fraction	fLA = Living area / (4) =											0.3866 (91)
MIT	18.8595	19.0505	19.4448	19.9006	20.2019	20.3306	20.3536	20.3539	20.2905	19.9388	19.3683	18.8494 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7095	18.9005	19.2948	19.7506	20.0519	20.1806	20.2036	20.2039	20.1405	19.7888	19.2183	18.6994 (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	0.9625	0.9480	0.9062	0.8149	0.6680	0.4576	0.3114	0.3274	0.5895	0.8365	0.9366	0.9671	(94)
Useful gains	627.4622	676.9214	724.7788	724.9262	612.9514	428.9924	277.9165	276.9796	456.4260	573.4953	593.9537	597.1480	(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	1262.9100	1234.7357	1118.8571	928.4416	684.0094	441.0514	279.8489	279.2742	488.4689	758.0828	1018.3521	1237.9992	(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	472.7732	374.8512	293.1942	146.5311	52.8672	0.0000	0.0000	0.0000	0.0000	137.3331	305.5668	476.7933	(98)
Space heating												2259.9100	(98)
Space heating per m2											(98) / (4) =	29.0104	(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													2511.0112 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	472.7732	374.8512	293.1942	146.5311	52.8672	0.0000	0.0000	0.0000	0.0000	137.3331	305.5668	476.7933	(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)	525.3035	416.5013	325.7714	162.8123	58.7413	0.0000	0.0000	0.0000	0.0000	152.5923	339.5187	529.7703	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	142.1906	109.3658	86.4489	44.1284	23.6178	0.0000	0.0000	21.3293	44.3042	87.3011	120.0652	142.5021	(64)
Efficiency of water heater	89.2148	89.2329	89.2267	89.2141	88.9545	86.7000	86.7000	86.7000	86.7000	88.6881	89.0439	86.7000	(216)
(217)m	89.2148	89.2329	89.2267	89.2141	88.9545	86.7000	86.7000	86.7000	86.7000	88.6881	89.0439	86.7000	(217)
Fuel for water heating, kWh/month	159.3799	122.5622	96.8869	49.4634	26.5504	0.0000	0.0000	24.6013	51.1005	98.4361	134.8382	159.7225	(219)
Water heating fuel used	159.3799	122.5622	96.8869	49.4634	26.5504	0.0000	0.0000	24.6013	51.1005	98.4361	134.8382	159.7225	(219)
Annual totals kWh/year												923.5414	(219)
Space heating fuel - main system												2511.0112	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													350.1515 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 1031 * 1.00) =										-445.3995		-445.3995	(233)
Total delivered energy for all uses												3464.3046	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2511.0112	3.9200	98.4316	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	923.5414	3.9200	36.2028	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	350.1515	16.9600	59.3857	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-445.3995	16.9600	-75.5398	(252)
Total energy cost			227.6804	(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	2511.0112	0.2160	542.3784	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	923.5414	0.2160	199.4850	(264)
Space and water heating			741.8634	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	350.1515	0.5190	181.7287	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

PV Unit	-445.3995	0.5190	-231.1624 (269)
Total kg/year			757.3047 (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	2511.0112	1.2200	3063.4336 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	923.5414	1.2200	1126.7206 (264)
Space and water heating			4190.1542 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	350.1515	3.0700	1074.9652 (268)
Energy saving/generation technologies			
PV Unit	-445.3995	3.0700	-1367.3766 (269)
Primary energy kWh/year			4281.4928 (272)
Primary energy kWh/m2/year			54.9614 (273)

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

Overheating Calculation Input Data

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

Overheating Calculation

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

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

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

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

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

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

Assessment of likelihood of high internal temperature:	Slight
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