

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-211			Issued on Date	08/09/2023
Assessment Reference	As Built	Prop Type Ref	Semi As		
Property	47, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	83 B	DER	15.92	TER	20.13
Environmental	89 B	% DER<TER	20.90		
CO ₂ Emissions (t/year)	0.78	DFEE	46.73	TFEE	53.27
General Requirements Compliance	Pass	% DFEE<TFEE	12.27		
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk			Assessor ID	T510-0001
Client	Drew Smith				

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 58 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) 20.13 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.92 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (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	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.38 (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: 4.65 (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
Ideal LOGIC COMBI ESP1 30
Combi boiler
Efficiency: 89.6% 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

Continuous extract system (decentralised)
Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 3.67 m², No overhang
Windows facing South: 5.78 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 249.03 kWh/Year

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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	29.2100 (1b)	x 2.4100 (2b)	= 70.3961 (1b) - (3b)
First floor	29.2100 (1c)	x 2.6700 (2c)	= 77.9907 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3868 (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											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.6500
Infiltration rate												0.2325 (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) =	0.2151 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2742	0.2688	0.2635	0.2366	0.2312	0.2043	0.2043	0.1989	0.2151	0.2312	0.2419	0.2527 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5242	0.5188	0.5135	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5027 (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					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			7.3300	1.3258	9.7178		(27)					
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)					
150mm EPS B&B			29.2100	0.1800	5.2578	75.0000	2190.7500 (28a)					
140mm Timber Frame	79.8600	11.5700	68.2900	0.1900	12.9751	9.0000	614.6100 (29a)					
400mm Mineral Wool	29.2100		29.2100	0.1100	3.2131	9.0000	262.8900 (30)					
Total net area of external elements Aum(A, m2)			138.2800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7304		(33)					
Timebr Frame			30.6800	0.0000	0.0000	20.0000	613.6000 (32)					
Timber GF			52.5900			9.0000	473.3100 (32c)					
Timber FF			56.1100			9.0000	504.9900 (32c)					
Internal Floor			29.2100			18.0000	525.7800 (32d)					
Internal Ceiling			29.2100			18.0000	525.7800 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	5711.7100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.7698 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3419 (36)					
Total fabric heat loss						(33) + (36) =	46.0723 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 25.6691	Feb 25.4058	Mar 25.1425	Apr 24.4838	May 24.4838	Jun 24.4838	Jul 24.4838	Aug 24.4838	Sep 24.4838	Oct 24.4838	Nov 24.4838	Dec 24.6160 (38)
Heat transfer coeff	71.7414	71.4781	71.2149	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.6883 (39)
Average = Sum(39)m / 12 =												70.7977 (39)
HLP	Jan 1.2280	Feb 1.2235	Mar 1.2190	Apr 1.2077	May 1.2077	Jun 1.2077	Jul 1.2077	Aug 1.2077	Sep 1.2077	Oct 1.2077	Nov 1.2077	Dec 1.2100 (40)
HLP (average)												1.2119 (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												1.9366 (42)
Average daily hot water use (litres/day)												80.1949 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	88.2144	85.0066	81.7988	78.5910	75.3832	72.1754	72.1754	75.3832	78.5910	81.7988	85.0066	88.2144 (44)
Energy conte	130.8194	114.4155	118.0665	102.9332	98.7669	85.2283	78.9766	90.6268	91.7091	106.8782	116.6659	126.6916 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	19.6229	17.1623	17.7100	15.4400	14.8150	12.7842	11.8465	13.5940	13.7564	16.0317	17.4999	19.0037 (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	14.5631	13.1329	14.5066	14.0010	14.4403	13.9428	14.3879	14.4219	13.9745	14.4792	14.0558	14.5522 (61)
Total heat required for water heating calculated for each month	145.3825	127.5483	132.5731	116.9342	113.2072	99.1712	93.3645	105.0486	105.6837	121.3573	130.7217	141.2438 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	145.3825	127.5483	132.5731	116.9342	113.2072	99.1712	93.3645	105.0486	105.6837	121.3573	130.7217	141.2438 (64)
Heat gains from water heating, kWh/month	47.1382	41.3264	42.8838	37.7255	36.4501	31.8241	29.8567	33.7389	33.9869	39.1568	42.3054	45.7630 (65)
Total per year (kWh/year) = Sum(64)m =												1432.2360 (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	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6798	13.9267	11.3259	8.5745	6.4095	5.4112	5.8470	7.6001	10.2008	12.9523	15.1173	16.1156 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	168.9453	170.6984	166.2806	156.8756	145.0034	133.8453	126.3910	124.6379	129.0557	138.4607	150.3328	161.4910 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831 (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)	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651 (71)
Water heating gains (Table 5)	63.3578	61.4976	57.6395	52.3966	48.9920	44.2002	40.1300	45.3479	47.2041	52.6301	58.7574	61.5094 (72)
Total internal gains	303.0323	301.1720	290.2954	272.8960	255.4544	238.5061	227.4173	232.6353	241.5100	259.0925	279.2569	294.1654 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				3.6700	10.6334	0.7200	0.7000	0.7700		13.6302 (74)		
South				3.6600	46.7521	0.7200	0.7000	0.7700		59.7648 (78)		
South				2.1200	46.7521	0.7200	0.7000	0.7700		34.6179 (78)		
Solar gains	108.0129	180.6225	241.1624	293.6363	327.6735	325.7005	313.7762	287.7039	258.9030	197.7299	128.6903	92.9181 (83)
Total gains	411.0452	481.7945	531.4578	566.5323	583.1279	564.2066	541.1935	520.3392	500.4130	456.8224	407.9472	387.0835 (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	22.1153	22.1968	22.2789	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4448
alpha	2.4744	2.4798	2.4853	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4963
util living area	0.9523	0.9295	0.8967	0.8415	0.7550	0.6311	0.5025	0.5345	0.7043	0.8574	0.9316	0.9581 (86)
MIT	18.5663	18.8758	19.3171	19.8547	20.3440	20.7100	20.8830	20.8589	20.5917	19.9606	19.1750	18.5207 (87)
Th 2	19.8976	19.9012	19.9048	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9120 (88)
util rest of house	0.9452	0.9193	0.8812	0.8162	0.7120	0.5590	0.4002	0.4342	0.6403	0.8293	0.9200	0.9519 (89)
MIT 2	16.6698	17.1158	17.7492	18.5134	19.1825	19.6489	19.8372	19.8159	19.5143	18.6754	17.5608	16.6120 (90)
Living area fraction	17.1652	17.5756	18.1587	18.8638	19.4859	19.9260	20.1104	20.0884	19.7958	19.0111	17.9824	0.2612 (91)
MIT	17.1652	17.5756	18.1587	18.8638	19.4859	19.9260	20.1104	20.0884	19.7958	19.0111	17.9824	17.1106 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.0152	17.4256	18.0087	18.7138	19.3359	19.7760	19.9604	19.9384	19.6458	18.8611	17.8324	16.9606 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9185	0.8876	0.8462	0.7817	0.6854	0.5488	0.4050	0.4367	0.6222	0.7950	0.8889	0.9271 (94)
Ext temp.	377.5286	427.6600	449.7320	442.8767	399.6955	309.6362	219.1598	227.2144	311.3388	363.1640	362.6373	358.8788 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	912.2036	895.3042	819.5926	692.4228	538.7608	365.2016	237.0952	249.6540	391.2877	582.8744	757.2386	902.0225 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	397.7982	314.2569	275.1763	179.6732	103.4646	0.0000	0.0000	0.0000	0.0000	163.4646	284.1130	404.0989 (98)
Space heating per m2												2122.0456 (98)
												(98) / (4) = 36.3240 (99)

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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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2344.8018 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	397.7982	314.2569	275.1763	179.6732	103.4646	0.0000	0.0000	0.0000	0.0000	163.4646	284.1130	404.0989	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	439.5560	347.2452	304.0622	198.5339	114.3255	0.0000	0.0000	0.0000	0.0000	180.6239	313.9370	446.5182	(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	145.3825	127.5483	132.5731	116.9342	113.2072	99.1712	93.3645	105.0486	105.6837	121.3573	130.7217	141.2438	(64)
Efficiency of water heater (217)m	89.6208	89.5523	89.4341	89.2108	88.7993	87.3000	87.3000	87.3000	87.3000	89.1083	89.4666	87.3000	(216)
Fuel for water heating, kWh/month	162.2197	142.4288	148.2355	131.0763	127.4865	113.5981	106.9467	120.3306	121.0580	136.1908	146.1123	157.5521	(219)
Water heating fuel used												1613.2355	(219)
Annual totals kWh/year													
Space heating fuel - main system												2344.8018	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													41.3065 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													116.3065 (231)
Electricity for lighting (calculated in Appendix L)													276.9103 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													4351.2540 (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	2344.8018	0.2160	506.4772 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1613.2355	0.2160	348.4589 (264)
Space and water heating			854.9360 (265)
Pumps and fans	116.3065	0.5190	60.3631 (267)
Energy for lighting	276.9103	0.5190	143.7164 (268)
Energy saving/generation technologies			
PV Unit	-249.0300	0.5190	-129.2466 (269)
Total CO2, kg/year			929.7690 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.9200 (273)

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

DER			15.9200 ZC1
Total Floor Area		TFA	58.4200
Assumed number of occupants		N	1.9366
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			17.1368 ZC2
CO2 emissions from cooking, equation (L16)			2.8326 ZC3
Total CO2 emissions			35.8894 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			35.8894 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	29.2100 (1b)	x 2.4100 (2b)	= 70.3961 (1b) - (3b)
First floor	29.2100 (1c)	x 2.6700 (2c)	= 77.9907 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3868 (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											2 * 10 =	20.0000 (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) =										20.0000 / (5) =	0.1348 (8)
Pressure test											Yes	
Measured/design AP50											5.0000	
Infiltration rate											0.3848 (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) =	0.3559 (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	0.4538	0.4449	0.4360	0.3915	0.3826	0.3381	0.3381	0.3292	0.3559	0.3826	0.4004	0.4182 (22b)
Effective ac	0.6030	0.5990	0.5951	0.5766	0.5732	0.5572	0.5572	0.5542	0.5633	0.5732	0.5802	0.5875 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			9.4500	1.3258	12.5284		(27)					
150mm EPS B&B			29.2100	0.1300	3.7973		(28a)					
140mm Timber Frame	79.8600	11.5700	68.2900	0.1800	12.2922		(29a)					
400mm Mineral Wool	29.2100		29.2100	0.1300	3.7973		(30)					
Total net area of external elements Aum(A, m2)			138.2800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.5352		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9124 (36)					
Total fabric heat loss						(33) + (36) =	42.4476 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.5260	Feb 29.3302	Mar 29.1383	Apr 28.2368	May 28.0682	Jun 27.2831	Jul 27.2831	Aug 27.1377	Sep 27.5855	Oct 28.0682	Nov 28.4094	Dec 28.7661 (38)
Heat transfer coeff	71.9736	71.7778	71.5859	70.6844	70.5158	69.7307	69.7307	69.5853	70.0331	70.5158	70.8570	71.2137 (39)
Average = Sum(39)m / 12 =												70.6836 (39)
HLP	Jan 1.2320	Feb 1.2287	Mar 1.2254	Apr 1.2099	May 1.2070	Jun 1.1936	Jul 1.1936	Aug 1.1911	Sep 1.1988	Oct 1.2070	Nov 1.2129	Dec 1.2190 (40)
HLP (average)												1.2099 (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												1.9366 (42)
Average daily hot water use (litres/day)												80.1949 (43)
Daily hot water use	Jan 88.2144	Feb 85.0066	Mar 81.7988	Apr 78.5910	May 75.3832	Jun 72.1754	Jul 72.1754	Aug 75.3832	Sep 78.5910	Oct 81.7988	Nov 85.0066	Dec 88.2144 (44)
Energy conte	130.8194	114.4155	118.0665	102.9332	98.7669	85.2283	78.9766	90.6268	91.7091	106.8782	116.6659	126.6916 (45)
Energy content (annual)										Total = Sum(45)m =		1261.7778 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.6229	17.1623	17.7100	15.4400	14.8150	12.7842	11.8465	13.5940	13.7564	16.0317	17.4999	19.0037 (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	44.9531	39.1263	41.6838	38.7572	38.4144	35.5933	36.7798	38.4144	38.7572	41.6838	41.9211	44.9531 (61)
Solar input	175.7724	153.5418	159.7503	141.6904	137.1813	120.8217	115.7564	129.0412	130.4663	148.5619	158.5869	171.6447 (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	175.7724	153.5418	159.7503	141.6904	137.1813	120.8217	115.7564	129.0412	130.4663	148.5619	158.5869	171.6447 (64)
	54.7357	47.8247	49.6781	43.9146	42.4436	37.2368	35.4547	39.7370	40.1826	45.9579	49.2717	53.3632 (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	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6798	13.9267	11.3259	8.5745	6.4095	5.4112	5.8470	7.6001	10.2008	12.9523	15.1173	16.1156	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	168.9453	170.6984	166.2806	156.8756	145.0034	133.8453	126.3910	124.6379	129.0557	138.4607	150.3328	161.4910	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	(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)	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	(71)
Water heating gains (Table 5)	73.5695	71.1677	66.7716	60.9925	57.0479	51.7177	47.6541	53.4100	55.8091	61.7714	68.4329	71.7248	(72)
Total internal gains	313.2440	310.8422	299.4275	281.4919	263.5102	246.0236	234.9415	240.6974	250.1151	268.2338	288.9324	304.3807	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					3.6700	10.6334	0.6300	0.7000	0.7700	11.9264 (74)		
South					5.7800	46.7521	0.6300	0.7000	0.7700	82.5849 (78)		
Solar gains	94.5113	158.0447	211.0171	256.9318	286.7144	284.9880	274.5541	251.7409	226.5401	173.0136	112.6040	81.3034 (83)
Total gains	407.7553	468.8869	510.4446	538.4237	550.2246	531.0116	509.4956	492.4383	476.6552	441.2475	401.5364	385.6841 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.3671	56.5209	56.6724	57.3952	57.5324	58.1802	58.1802	58.3018	57.9290	57.5324	57.2554	56.9686	
alpha	4.7578	4.7681	4.7782	4.8263	4.8355	4.8787	4.8787	4.8868	4.8619	4.8355	4.8170	4.7979	
util living area	0.9961	0.9919	0.9826	0.9574	0.8925	0.7507	0.5809	0.6199	0.8350	0.9640	0.9921	0.9970	(86)
MIT	19.7395	19.9056	20.1493	20.4597	20.7379	20.9240	20.9827	20.9763	20.8642	20.5099	20.0677	19.7111	(87)
Th 2	19.8945	19.8971	19.8998	19.9121	19.9144	19.9251	19.9251	19.9271	19.9210	19.9144	19.9097	19.9048	(88)
util rest of house	0.9948	0.9892	0.9764	0.9411	0.8492	0.6574	0.4497	0.4899	0.7588	0.9468	0.9889	0.9960	(89)
MIT 2	18.2317	18.4750	18.8294	19.2793	19.6534	19.8732	19.9187	19.9174	19.8137	19.3574	18.7212	18.1975	(90)
Living area fraction	18.6256	18.8487	19.1742	19.5876	19.9367	20.1477	20.1966	20.1940	20.0881	19.6584	19.0729	18.5928	(91)
MIT	18.6256	18.8487	19.1742	19.5876	19.9367	20.1477	20.1966	20.1940	20.0881	19.6584	19.0729	18.5928	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6256	18.8487	19.1742	19.5876	19.9367	20.1477	20.1966	20.1940	20.0881	19.6584	19.0729	18.5928	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9926	0.9855	0.9709	0.9349	0.8503	0.6786	0.4842	0.5240	0.7723	0.9416	0.9855	0.9942	(94)
Ext temp.	404.7557	462.1050	495.6132	503.3830	467.8301	360.3316	246.7228	258.0329	368.1366	415.4619	395.7009	383.4653	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1031.0621	1001.2054	907.2925	755.4471	580.8166	386.8455	250.7967	264.0059	419.3645	638.7623	848.3637	1024.9662	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	465.9720	362.2755	306.2894	181.4862	84.0619	0.0000	0.0000	0.0000	0.0000	166.1355	325.9172	477.2767	(98)
												2369.4143	(98)
												40.5583	(99)

8c. Space cooling requirement

Not applicable

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

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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													2536.8461 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	465.9720	362.2755	306.2894	181.4862	84.0619	0.0000	0.0000	0.0000	0.0000	166.1355	325.9172	477.2767	(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)	498.8993	387.8752	327.9330	194.3107	90.0020	0.0000	0.0000	0.0000	0.0000	177.8752	348.9478	511.0029	(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	175.7724	153.5418	159.7503	141.6904	137.1813	120.8217	115.7564	129.0412	130.4663	148.5619	158.5869	171.6447	(64)
Efficiency of water heater (217)m	87.3894	87.1376	86.6635	85.6754	83.8599	80.3000	80.3000	80.3000	80.3000	85.3332	86.8254	87.4893	(217)
Fuel for water heating, kWh/month	201.1370	176.2062	184.3339	165.3805	163.5840	150.4628	144.1549	160.6989	162.4736	174.0964	182.6503	196.1893	(219)
Water heating fuel used												2061.3678	(219)
Annual totals kWh/year													
Space heating fuel - main system												2536.8461	(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)												276.9103	(232)
Total delivered energy for all uses												4950.1241	(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	2536.8461	0.2160	547.9588 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2061.3678	0.2160	445.2554 (264)
Space and water heating			993.2142 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	276.9103	0.5190	143.7164 (268)
Total CO2, kg/m2/year			1175.8556 (272)
Emissions per m2 for space and water heating			17.0013 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4601 (272b)
Emissions per m2 for pumps and fans			0.6663 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.0013 * 1.00) + 2.4601 + 0.6663, rounded to 2 d.p.			20.1300 (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	29.2100 (1b)	x 2.4100 (2b)	= 70.3961 (1b) - (3b)
First floor	29.2100 (1c)	x 2.6700 (2c)	= 77.9907 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3868 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)					20.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.6500
Infiltration rate					0.3673 (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) =	0.3397 (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	0.4332	0.4247	0.4162	0.3737	0.3652	0.3227	0.3227	0.3143	0.3397	0.3652	0.3822	0.3992 (22b)
Effective ac	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (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 Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			7.3300	1.3258	9.7178		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
150mm EPS B&B			29.2100	0.1800	5.2578	75.0000	2190.7500 (28a)
140mm Timber Frame	79.8600	11.5700	68.2900	0.1900	12.9751	9.0000	614.6100 (29a)
400mm Mineral Wool	29.2100		29.2100	0.1100	3.2131	9.0000	262.8900 (30)
Total net area of external elements Aum(A, m ²)			138.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7304		(33)
Timber Frame			30.6800	0.0000	0.0000	20.0000	613.6000 (32)
Timber GF			52.5900			9.0000	473.3100 (32c)
Timber FF			56.1100			9.0000	504.9900 (32c)
Internal Floor			29.2100			18.0000	525.7800 (32d)
Internal Ceiling			29.2100			9.0000	262.8900 (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) = 5448.8200 (34)
93.2698 (35)
9.3419 (36)
(33) + (36) = 46.0723 (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	29.0778	28.8994	28.7245	27.9032	27.7496	27.0342	27.0342	26.9018	27.3098	27.7496	28.0604	28.3854 (38)
Heat transfer coeff	75.1501	74.9717	74.7969	73.9756	73.8219	73.1066	73.1066	72.9741	73.3821	73.8219	74.1328	74.4577 (39)
Average = Sum(39)m / 12 =												73.9748 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2864	1.2833	1.2803	1.2663	1.2636	1.2514	1.2514	1.2491	1.2561	1.2636	1.2690	1.2745 (40)
HLP (average)												1.2663 (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)
1.9366 (42)
80.1949 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.2144	85.0066	81.7988	78.5910	75.3832	72.1754	72.1754	75.3832	78.5910	81.7988	85.0066	88.2144 (44)
Energy conte	130.8194	114.4155	118.0665	102.9332	98.7669	85.2283	78.9766	90.6268	91.7091	106.8782	116.6659	126.6916 (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 = 1261.7778 (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	27.7991	24.3133	25.0891	21.8733	20.9880	18.1110	16.7825	19.2582	19.4882	22.7116	24.7915	26.9220 (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	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6798	13.9267	11.3259	8.5745	6.4095	5.4112	5.8470	7.6001	10.2008	12.9523	15.1173	16.1156	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	168.9453	170.6984	166.2806	156.8756	145.0034	133.8453	126.3910	124.6379	129.0557	138.4607	150.3328	161.4910	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	(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)	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	(71)
Water heating gains (Table 5)	37.3644	36.1805	33.7220	30.3796	28.2096	25.1542	22.5572	25.8847	27.0669	30.5264	34.4326	36.1854	(72)
Total internal gains	274.0389	272.8549	263.3779	247.8790	231.6720	216.4601	206.8445	210.1721	218.3729	233.9888	251.9321	265.8414	(73)

6. Solar gains

[Jan]													
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North	3.6700				10.6334		0.7200		0.7000		0.7700		13.6302 (74)
South	3.6600				46.7521		0.7200		0.7000		0.7700		59.7648 (78)
South	2.1200				46.7521		0.7200		0.7000		0.7700		34.6179 (78)
Solar gains	108.0129	180.6225	241.1624	293.6363	327.6735	325.7005	313.7762	287.7039	258.9030	197.7299	128.6903	92.9181	(83)
Total gains	382.0518	453.4775	504.5403	541.5153	559.3455	542.1606	520.6207	497.8759	477.2759	431.7186	380.6224	358.7595	(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	20.1405	20.1884	20.2356	20.4603	20.5029	20.7035	20.7035	20.7411	20.6257	20.5029	20.4169	20.3278	
alpha	2.3427	2.3459	2.3490	2.3640	2.3669	2.3802	2.3802	2.3827	2.3750	2.3669	2.3611	2.3552	
util living area	0.9563	0.9347	0.9040	0.8524	0.7711	0.6508	0.5245	0.5576	0.7242	0.8691	0.9378	0.9618	(86)
MIT	18.2976	18.6186	19.0870	19.6739	20.2186	20.6462	20.8505	20.8214	20.5068	19.7982	18.9418	18.2371	(87)
Th 2	19.8515	19.8539	19.8563	19.8673	19.8694	19.8791	19.8791	19.8809	19.8754	19.8694	19.8652	19.8608	(88)
util rest of house	0.9498	0.9251	0.8893	0.8280	0.7290	0.5781	0.4182	0.4542	0.6609	0.8425	0.9270	0.9560	(89)
MIT 2	17.4037	17.7205	18.1811	18.7572	19.2714	19.6562	19.8114	19.7951	19.5427	18.8880	18.0516	17.3504	(90)
Living area fraction	17.6372	17.9551	18.4178	18.9966	19.5188	19.9148	20.0828	20.0631	19.7945	19.1258	18.2841	17.5820	(91)
MIT	17.6372	17.9551	18.4178	18.9966	19.5188	19.9148	20.0828	20.0631	19.7945	19.1258	18.2841	17.5820	(92)
Temperature adjustment	17.6372	17.9551	18.4178	18.9966	19.5188	19.9148	20.0828	20.0631	19.7945	19.1258	18.2841	17.5820	(93)
adjusted MIT	17.6372	17.9551	18.4178	18.9966	19.5188	19.9148	20.0828	20.0631	19.7945	19.1258	18.2841	17.5820	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9327	0.9044	0.8661	0.8055	0.7140	0.5807	0.4391	0.4726	0.6557	0.8210	0.9072	0.9403	(94)
Ext temp.	356.3459	410.1374	436.9886	436.1793	399.3448	314.8238	228.5909	235.2806	312.9442	354.4461	345.2852	337.3575	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1002.2923	978.7632	891.4116	746.9039	577.1994	388.5464	254.6173	267.3150	417.8751	629.3903	829.1088	996.3962	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	480.5841	382.1165	338.0907	223.7218	132.3238	0.0000	0.0000	0.0000	0.0000	204.5585	348.3530	490.3248	(98)
Space heating per m2												2600.0731	(98)
												44.5066	(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	687.2019	540.9888	554.6033	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7138	0.7796	0.7602	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	490.5349	421.7686	421.5967	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	706.4291	679.8581	654.4778	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	155.4438	192.0186	173.2636	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												520.7260 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	38.8610	48.0047	43.3159	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												130.1815 (107)
Space cooling per m2												2.2284 (108)
Energy for space heating												44.5066 (99)
Energy for space cooling												2.2284 (108)
Total												46.7349 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.7 (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	29.2100 (1b)	x 2.4100 (2b)	= 70.3961 (1b) - (3b)
First floor	29.2100 (1c)	x 2.6700 (2c)	= 77.9907 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3868 (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							2 * 10 =	20.0000 (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) =						20.0000 / (5) =	0.1348 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3848 (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) =	0.3559 (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	0.4538	0.4449	0.4360	0.3915	0.3826	0.3381	0.3381	0.3292	0.3559	0.3826	0.4004	0.4182 (22b)
Effective ac	0.6030	0.5990	0.5951	0.5766	0.5732	0.5572	0.5572	0.5542	0.5633	0.5732	0.5802	0.5875 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			9.4500	1.3258	12.5284		(27)					
150mm EPS B&B			29.2100	0.1300	3.7973		(28a)					
140mm Timber Frame	79.8600	11.5700	68.2900	0.1800	12.2922		(29a)					
400mm Mineral Wool	29.2100		29.2100	0.1300	3.7973		(30)					
Total net area of external elements Aum(A, m2)			138.2800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.5352		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9124 (36)					
Total fabric heat loss						(33) + (36) =	42.4476 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.5260	Feb 29.3302	Mar 29.1383	Apr 28.2368	May 28.0682	Jun 27.2831	Jul 27.2831	Aug 27.1377	Sep 27.5855	Oct 28.0682	Nov 28.4094	Dec 28.7661 (38)
Heat transfer coeff	71.9736	71.7778	71.5859	70.6844	70.5158	69.7307	69.7307	69.5853	70.0331	70.5158	70.8570	71.2137 (39)
Average = Sum(39)m / 12 =												70.6836 (39)
HLP	Jan 1.2320	Feb 1.2287	Mar 1.2254	Apr 1.2099	May 1.2070	Jun 1.1936	Jul 1.1936	Aug 1.1911	Sep 1.1988	Oct 1.2070	Nov 1.2129	Dec 1.2190 (40)
HLP (average)												1.2099 (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												1.9366 (42)
Average daily hot water use (litres/day)												80.1949 (43)
Daily hot water use	Jan 88.2144	Feb 85.0066	Mar 81.7988	Apr 78.5910	May 75.3832	Jun 72.1754	Jul 72.1754	Aug 75.3832	Sep 78.5910	Oct 81.7988	Nov 85.0066	Dec 88.2144 (44)
Energy conte	130.8194	114.4155	118.0665	102.9332	98.7669	85.2283	78.9766	90.6268	91.7091	106.8782	116.6659	126.6916 (45)
Energy content (annual)										Total = Sum(45)m =		1261.7778 (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												

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)
	27.7991	24.3133	25.0891	21.8733	20.9880	18.1110	16.7825	19.2582	19.4882	22.7116	24.7915	26.9220 (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	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	96.8313	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6798	13.9267	11.3259	8.5745	6.4095	5.4112	5.8470	7.6001	10.2008	12.9523	15.1173	16.1156	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	168.9453	170.6984	166.2806	156.8756	145.0034	133.8453	126.3910	124.6379	129.0557	138.4607	150.3328	161.4910	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	32.6831	(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)	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	(71)
Water heating gains (Table 5)	37.3644	36.1805	33.7220	30.3796	28.2096	25.1542	22.5572	25.8847	27.0669	30.5264	34.4326	36.1854	(72)
Total internal gains	274.0389	272.8549	263.3779	247.8790	231.6720	216.4601	206.8445	210.1721	218.3729	233.9888	251.9321	265.8414	(73)

6. Solar gains

[Jan]													
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North	3.6700				10.6334		0.6300		0.7000		0.7700		11.9264 (74)
South	5.7800				46.7521		0.6300		0.7000		0.7700		82.5849 (78)
Solar gains	94.5113	158.0447	211.0171	256.9318	286.7144	284.9880	274.5541	251.7409	226.5401	173.0136	112.6040	81.3034 (83)	
Total gains	368.5502	430.8996	474.3950	504.8108	518.3863	501.4481	481.3987	461.9130	444.9130	407.0024	364.5361	347.1448 (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	56.3671	56.5209	56.6724	57.3952	57.5324	58.1802	58.1802	58.3018	57.9290	57.5324	57.2554	56.9686	
alpha	4.7578	4.7681	4.7782	4.8263	4.8355	4.8787	4.8787	4.8868	4.8619	4.8355	4.8170	4.7979	
util living area	0.9975	0.9943	0.9870	0.9663	0.9100	0.7782	0.6097	0.6529	0.8618	0.9733	0.9947	0.9981	(86)
MIT	19.6785	19.8475	20.0964	20.4156	20.7071	20.9106	20.9788	20.9705	20.8409	20.4635	20.0109	19.6507	(87)
Th 2	19.8945	19.8971	19.8998	19.9121	19.9144	19.9251	19.9251	19.9271	19.9210	19.9144	19.9097	19.9048	(88)
util rest of house	0.9966	0.9923	0.9822	0.9527	0.8712	0.6870	0.4745	0.5197	0.7912	0.9600	0.9926	0.9975	(89)
MIT 2	18.6985	18.8688	19.1175	19.4391	19.7113	19.8823	19.9196	19.9186	19.8323	19.4910	19.0422	18.6790	(90)
Living area fraction									fLA = Living area / (4) =			0.2612	(91)
MIT	18.9545	19.1244	19.3732	19.6942	19.9714	20.1509	20.1963	20.1933	20.0958	19.7450	19.2952	18.9328	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9545	19.1244	19.3732	19.6942	19.9714	20.1509	20.1963	20.1933	20.0958	19.7450	19.2952	18.9328	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9956	0.9905	0.9792	0.9493	0.8736	0.7082	0.5103	0.5549	0.8046	0.9572	0.9909	0.9967	(94)
Ext temp.	366.9351	426.7982	464.5403	479.2385	452.8510	355.1304	245.6731	256.3326	357.9579	389.5988	361.2166	345.9910	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1054.7341	1020.9974	921.5401	762.9786	583.2642	387.0686	250.7711	263.9597	419.9035	644.8667	864.1163	1049.1755	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	511.7224	399.3019	340.0079	204.2929	97.0274	0.0000	0.0000	0.0000	0.0000	189.9193	362.0878	523.1693	(98)
										(98) / (4) =		44.9765	(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	655.4684	516.0070	528.8482	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8320	0.9029	0.8848	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	545.3612	465.9170	467.9379	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	658.8430	634.0142	612.4432	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	81.7069	125.0644	107.5119	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												314.2832	(104)
Cooled fraction												1.0000	(105)
												fC = cooled area / (4) =	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	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	20.4267	31.2661	26.8780	0.0000	0.0000	0.0000 (107)
Space cooling											78.5708 (107)
Space cooling per m2											1.3449 (108)
Energy for space heating											44.9765 (99)
Energy for space cooling											1.3449 (108)
Total											46.3215 (109)
Target Fabric Energy Efficiency (TFEE)											53.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	29.2100 (1b)	x 2.4100 (2b)	= 70.3961 (1b) - (3b)
First floor	29.2100 (1c)	x 2.6700 (2c)	= 77.9907 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3868 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (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) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.6500		
Number of sides sheltered															0.2325 (18)		
															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2151 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)					
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)					
Adj infilt rate																	
	0.2366	0.2204	0.2204	0.2097	0.2097	0.1989	0.1989	0.1882	0.1882	0.2043	0.1989	0.2097 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																	0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			7.3300	1.3258	9.7178		(27)					
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)					
150mm EPS B&B			29.2100	0.1800	5.2578	75.0000	2190.7500 (28a)					
140mm Timber Frame	79.8600	11.5700	68.2900	0.1900	12.9751	9.0000	614.6100 (29a)					
400mm Mineral Wool	29.2100		29.2100	0.1100	3.2131	9.0000	262.8900 (30)					
Total net area of external elements Aum(A, m2)			138.2800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7304		(33)					
Timebr Frame			30.6800	0.0000	0.0000	20.0000	613.6000 (32)					
Timber GF			52.5900			9.0000	473.3100 (32c)					
Timber FF			56.1100			9.0000	504.9900 (32c)					
Internal Floor			29.2100			18.0000	525.7800 (32d)					
Internal Ceiling			29.2100			18.0000	525.7800 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	5711.7100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.7698 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3419 (36)					
Total fabric heat loss						(33) + (36) =	46.0723 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 24.4838	Feb 24.4838	Mar 24.4838	Apr 24.4838	May 24.4838	Jun 24.4838	Jul 24.4838	Aug 24.4838	Sep 24.4838	Oct 24.4838	Nov 24.4838	Dec 24.4838 (38)
Heat transfer coeff	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	(39)
Average = Sum(39)m / 12 =												(39)
HLP	Jan 1.2077	Feb 1.2077	Mar 1.2077	Apr 1.2077	May 1.2077	Jun 1.2077	Jul 1.2077	Aug 1.2077	Sep 1.2077	Oct 1.2077	Nov 1.2077	Dec 1.2077 (40)
HLP (average)												1.2077 (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												1.9366 (42)
Average daily hot water use (litres/day)												80.1949 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	88.2144	85.0066	81.7988	78.5910	75.3832	72.1754	72.1754	75.3832	78.5910	81.7988	85.0066	88.2144 (44)
Energy conte	130.8194	114.4155	118.0665	102.9332	98.7669	85.2283	78.9766	90.6268	91.7091	106.8782	116.6659	126.6916 (45)
Energy content (annual)										Total = Sum (45)m =		1261.7778 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6229	17.1623	17.7100	15.4400	14.8150	12.7842	11.8465	13.5940	13.7564	16.0317	17.4999	19.0037 (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	14.5631	13.1329	14.5066	14.0010	14.4403	13.9428	14.3879	14.4219	13.9745	14.4792	14.0558	14.5522 (61)
Total heat required for water heating calculated for each month	145.3825	127.5483	132.5731	116.9342	113.2072	99.1712	93.3645	105.0486	105.6837	121.3573	130.7217	141.2438 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	145.3825	127.5483	132.5731	116.9342	113.2072	99.1712	93.3645	105.0486	105.6837	121.3573	130.7217	141.2438 (64)
RHI water heating demand										Total per year (kWh/year) = Sum (64)m =		1432 (64)
Heat gains from water heating, kWh/month	47.1382	41.3264	42.8838	37.7255	36.4501	31.8241	29.8567	33.7389	33.9869	39.1568	42.3054	45.7630 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1995	34.8167	28.3148	21.4361	16.0238	13.5279	14.6174	19.0003	25.5021	32.3808	37.7932	40.2890 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	252.1571	254.7737	248.1800	234.1427	216.4231	199.7691	188.6433	186.0267	192.6205	206.6578	224.3774	241.0313 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564 (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)	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651 (71)
Water heating gains (Table 5)	63.3578	61.4976	57.6395	52.3966	48.9920	44.2002	40.1300	45.3479	47.2041	52.6301	58.7574	61.5094 (72)
Total internal gains	445.0034	441.3769	424.4232	398.2643	371.7278	347.7862	333.6796	340.6638	355.6155	381.9576	411.2169	433.1186 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
North				3.6700	13.4839	0.7200	0.7000		0.7700	17.2840 (74)		
South				3.6600	56.7559	0.7200	0.7000		0.7700	72.5530 (78)		
South				2.1200	56.7559	0.7200	0.7000		0.7700	42.0253 (78)		
Solar gains	131.8623	187.5869	253.2526	313.0101	333.3416	364.7866	338.4462	321.3888	285.8686	218.8712	156.5487	107.4210 (83)
Total gains	576.8657	628.9637	677.6758	711.2744	705.0693	712.5728	672.1258	662.0526	641.4841	600.8288	567.7656	540.5396 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869 (86)
alpha	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991 (86)
util living area	0.8943	0.8696	0.8209	0.7446	0.6264	0.4551	0.3300	0.3345	0.5365	0.7337	0.8512	0.9050 (86)
MIT	19.2233	19.4249	19.8178	20.2512	20.6484	20.8920	20.9665	20.9654	20.8237	20.4100	19.7673	19.1637 (87)
Th 2	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138 (88)
util rest of house	0.8798	0.8522	0.7964	0.7082	0.5690	0.3726	0.2277	0.2310	0.4569	0.6876	0.8279	0.8916 (89)
MIT 2	17.6155	17.8990	18.4494	19.0428	19.5597	19.8350	19.8998	19.8993	19.7694	19.2675	18.3905	17.5330 (90)
Living area fraction	18.0355	18.2976	18.8068	19.3584	19.8441	20.1111	20.1784	20.1778	20.0448	19.5660	18.7501	17.9589 (91)
MIT	17.8855	18.1476	18.6568	19.2084	19.6941	19.9611	20.0284	20.0278	19.8948	19.4160	18.6001	17.8089 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8449	0.8166	0.7625	0.6812	0.5563	0.3764	0.2389	0.2423	0.4554	0.6633	0.7930	0.8574 (94)
Ext temp.	487.4129	513.6267	516.7462	484.5284	392.2035	268.1997	160.5886	160.4228	292.1132	398.5527	450.2290	463.4686 (95)
Heat loss rate W	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Month fracti	880.9259	864.1436	780.1273	649.7125	465.2530	286.5364	164.2864	164.2421	324.1904	523.2412	719.6817	868.4706 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	292.7737	235.5474	195.9555	118.9326	54.3488	0.0000	0.0000	0.0000	0.0000	92.7682	194.0059	301.3215 (98)
RHI space heating demand												1485.6536 (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	29.2100 (1b)	x 2.4100 (2b)	= 70.3961 (1b) - (3b)
First floor	29.2100 (1c)	x 2.6700 (2c)	= 77.9907 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3868 (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											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.6500
Infiltration rate												0.2325 (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) =	0.2151 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2742	0.2688	0.2635	0.2366	0.2312	0.2043	0.2043	0.1989	0.2151	0.2312	0.2419	0.2527 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5242	0.5188	0.5135	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5027 (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					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			7.3300	1.3258	9.7178		(27)					
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)					
150mm EPS B&B			29.2100	0.1800	5.2578	75.0000	2190.7500 (28a)					
140mm Timber Frame	79.8600	11.5700	68.2900	0.1900	12.9751	9.0000	614.6100 (29a)					
400mm Mineral Wool	29.2100		29.2100	0.1100	3.2131	9.0000	262.8900 (30)					
Total net area of external elements Aum(A, m2)			138.2800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7304		(33)					
Timebr Frame			30.6800	0.0000	0.0000	20.0000	613.6000 (32)					
Timber GF			52.5900			9.0000	473.3100 (32c)					
Timber FF			56.1100			9.0000	504.9900 (32c)					
Internal Floor			29.2100			18.0000	525.7800 (32d)					
Internal Ceiling			29.2100			18.0000	525.7800 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	5711.7100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.7698 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3419 (36)					
Total fabric heat loss						(33) + (36) =	46.0723 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 25.6691	Feb 25.4058	Mar 25.1425	Apr 24.4838	May 24.4838	Jun 24.4838	Jul 24.4838	Aug 24.4838	Sep 24.4838	Oct 24.4838	Nov 24.4838	Dec 24.6160 (38)
Heat transfer coeff	71.7414	71.4781	71.2149	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.6883 (39)
Average = Sum(39)m / 12 =												70.7977 (39)
HLP	Jan 1.2280	Feb 1.2235	Mar 1.2190	Apr 1.2077	May 1.2077	Jun 1.2077	Jul 1.2077	Aug 1.2077	Sep 1.2077	Oct 1.2077	Nov 1.2077	Dec 1.2100 (40)
HLP (average)												1.2119 (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												1.9366 (42)
Average daily hot water use (litres/day)												80.1949 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	88.2144	85.0066	81.7988	78.5910	75.3832	72.1754	72.1754	75.3832	78.5910	81.7988	85.0066	88.2144 (44)
Energy conte	130.8194	114.4155	118.0665	102.9332	98.7669	85.2283	78.9766	90.6268	91.7091	106.8782	116.6659	126.6916 (45)
Energy content (annual)										Total = Sum(45)m =		1261.7778 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6229	17.1623	17.7100	15.4400	14.8150	12.7842	11.8465	13.5940	13.7564	16.0317	17.4999	19.0037 (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	14.5631	13.1329	14.5066	14.0010	14.4403	13.9428	14.3879	14.4219	13.9745	14.4792	14.0558	14.5522 (61)
Total heat required for water heating calculated for each month	145.3825	127.5483	132.5731	116.9342	113.2072	99.1712	93.3645	105.0486	105.6837	121.3573	130.7217	141.2438 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	145.3825	127.5483	132.5731	116.9342	113.2072	99.1712	93.3645	105.0486	105.6837	121.3573	130.7217	141.2438 (64)
Heat gains from water heating, kWh/month	47.1382	41.3264	42.8838	37.7255	36.4501	31.8241	29.8567	33.7389	33.9869	39.1568	42.3054	45.7630 (65)
										Total per year (kWh/year) = Sum(64)m =		1432.2360 (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	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1995	34.8167	28.3148	21.4361	16.0238	13.5279	14.6174	19.0003	25.5021	32.3808	37.7932	40.2890 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	252.1571	254.7737	248.1800	234.1427	216.4231	199.7691	188.6433	186.0267	192.6205	206.6578	224.3774	241.0313 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564 (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)	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651 (71)
Water heating gains (Table 5)	63.3578	61.4976	57.6395	52.3966	48.9920	44.2002	40.1300	45.3479	47.2041	52.6301	58.7574	61.5094 (72)
Total internal gains	445.0034	441.3769	424.4232	398.2643	371.7278	347.7862	333.6796	340.6638	355.6155	381.9576	411.2169	433.1186 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				3.6700	10.6334	0.7200	0.7000	0.7700		13.6302 (74)		
South				3.6600	46.7521	0.7200	0.7000	0.7700		59.7648 (78)		
South				2.1200	46.7521	0.7200	0.7000	0.7700		34.6179 (78)		
Solar gains	108.0129	180.6225	241.1624	293.6363	327.6735	325.7005	313.7762	287.7039	258.9030	197.7299	128.6903	92.9181 (83)
Total gains	553.0163	621.9994	665.5856	691.9006	699.4013	673.4867	647.4557	628.3677	614.5185	579.6874	539.9072	526.0367 (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	22.1153	22.1968	22.2789	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4448
alpha	2.4744	2.4798	2.4853	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4963
util living area	0.9147	0.8868	0.8477	0.7847	0.6911	0.5625	0.4364	0.4633	0.6272	0.7926	0.8846	0.9225 (86)
MIT	18.9115	19.1893	19.5825	20.0558	20.4749	20.7790	20.9153	20.8985	20.6919	20.1665	19.4714	18.8681 (87)
Th 2	19.8976	19.9012	19.9048	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9120 (88)
util rest of house	0.9032	0.8719	0.8273	0.7544	0.6445	0.4912	0.3425	0.3702	0.5607	0.7575	0.8670	0.9121 (89)
MIT 2	17.1601	17.5560	18.1142	18.7785	19.3407	19.7174	19.8602	19.8458	19.6218	18.9435	17.9738	17.1069 (90)
Living area fraction									fLA = Living area / (4) =			0.2612 (91)
MIT	17.6176	17.9826	18.4977	19.1121	19.6369	19.9947	20.1358	20.1208	19.9013	19.2630	18.3650	17.5670 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4676	17.8326	18.3477	18.9621	19.4869	19.8447	19.9858	19.9708	19.7513	19.1130	18.2150	17.4170 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8695	0.8363	0.7918	0.7233	0.6239	0.4862	0.3491	0.3754	0.5497	0.7268	0.8319	0.8797 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	944.6594	924.3991	843.7327	709.9442	549.4168	370.0467	238.8876	251.9413	398.7372	600.6424	784.2332	934.2848 (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	345.0871	271.6397	235.6449	150.8111	84.0917	0.0000	0.0000	0.0000	0.0000	133.4271	241.2542	350.8216 (98)
Space heating												1812.7773 (98)
Space heating per m2										(98) / (4) =		31.0301 (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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2003.0688 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	345.0871	271.6397	235.6449	150.8111	84.0917	0.0000	0.0000	0.0000	0.0000	133.4271	241.2542	350.8216	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	381.3117	300.1543	260.3811	166.6421	92.9190	0.0000	0.0000	0.0000	0.0000	147.4333	266.5792	387.6481	(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	145.3825	127.5483	132.5731	116.9342	113.2072	99.1712	93.3645	105.0486	105.6837	121.3573	130.7217	141.2438	(64)
Efficiency of water heater	89.5273	89.4523	89.3212	89.0740	88.6358	87.3000	87.3000	87.3000	87.3000	88.9470	89.3490	87.3000	(216)
(217)m	89.5273	89.4523	89.3212	89.0740	88.6358	87.3000	87.3000	87.3000	87.3000	88.9470	89.3490	89.5577	(217)
Fuel for water heating, kWh/month	162.3890	142.5880	148.4229	131.2776	127.7217	113.5981	106.9467	120.3306	121.0580	136.4377	146.3045	157.7126	(219)
Water heating fuel used												1614.7876	(219)
Annual totals kWh/year													
Space heating fuel - main system												2003.0688	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												41.3065	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												116.3065	(231)
Electricity for lighting (calculated in Appendix L)												276.9103	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4011.0731	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2003.0688	3.4800	69.7068 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1614.7876	3.4800	56.1946 (247)
Mechanical ventilation fans	41.3065	13.1900	5.4483 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	276.9103	13.1900	36.5245 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			297.7667 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2093 (257)
SAP value		83.1308
SAP rating (Section 12)		83 (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	2003.0688	0.2160	432.6629 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1614.7876	0.2160	348.7941 (264)
Space and water heating			781.4570 (265)
Pumps and fans	116.3065	0.5190	60.3631 (267)
Energy for lighting	276.9103	0.5190	143.7164 (268)
Energy saving/generation technologies			
PV Unit	-249.0300	0.5190	-129.2466 (269)
Total kg/year			856.2899 (272)
CO2 emissions per m2			14.6600 (273)
EI value			88.9052
EI rating			89 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8859 = 3.928$, stars = 4
Water heating environmental impact	$0.216 / 0.8859 = 0.2438$, 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	29.2100 (1b)	x 2.4100 (2b)	= 70.3961 (1b) - (3b)
First floor	29.2100 (1c)	x 2.6700 (2c)	= 77.9907 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3868 (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											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.6500
Infiltration rate												0.2325 (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) =	0.2151 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
	0.2366	0.2204	0.2204	0.2097	0.2097	0.1989	0.1989	0.1882	0.1882	0.2043	0.1989	0.2097 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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 Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			7.3300	1.3258	9.7178		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
150mm EPS B&B			29.2100	0.1800	5.2578	75.0000	2190.7500 (28a)
140mm Timber Frame	79.8600	11.5700	68.2900	0.1900	12.9751	9.0000	614.6100 (29a)
400mm Mineral Wool	29.2100		29.2100	0.1100	3.2131	9.0000	262.8900 (30)
Total net area of external elements Aum(A, m ²)			138.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7304		(33)
Timebr Frame			30.6800	0.0000	0.0000	20.0000	613.6000 (32)
Timber GF			52.5900			9.0000	473.3100 (32c)
Timber FF			56.1100			9.0000	504.9900 (32c)
Internal Floor			29.2100			18.0000	525.7800 (32d)
Internal Ceiling			29.2100			18.0000	525.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	5711.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							97.7698 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3419 (36)
Total fabric heat loss						(33) + (36) =	46.0723 (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	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838 (38)
Heat transfer coeff	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562 (39)
Average = Sum(39)m / 12 =												70.5562 (39)
HLP	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077 (40)
HLP (average)												1.2077 (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												1.9366 (42)
Average daily hot water use (litres/day)												80.1949 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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

Daily hot water use	88.2144	85.0066	81.7988	78.5910	75.3832	72.1754	72.1754	75.3832	78.5910	81.7988	85.0066	88.2144 (44)
Energy conte	130.8194	114.4155	118.0665	102.9332	98.7669	85.2283	78.9766	90.6268	91.7091	106.8782	116.6659	126.6916 (45)
Energy content (annual)										Total = Sum	(45)m =	1261.7778 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6229	17.1623	17.7100	15.4400	14.8150	12.7842	11.8465	13.5940	13.7564	16.0317	17.4999	19.0037 (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	14.5631	13.1329	14.5066	14.0010	14.4403	13.9428	14.3879	14.4219	13.9745	14.4792	14.0558	14.5522 (61)
Total heat required for water heating calculated for each month	145.3825	127.5483	132.5731	116.9342	113.2072	99.1712	93.3645	105.0486	105.6837	121.3573	130.7217	141.2438 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	145.3825	127.5483	132.5731	116.9342	113.2072	99.1712	93.3645	105.0486	105.6837	121.3573	130.7217	141.2438 (64)
Heat gains from water heating, kWh/month	47.1382	41.3264	42.8838	37.7255	36.4501	31.8241	29.8567	33.7389	33.9869	39.1568	42.3054	45.7630 (65)
Total per year (kWh/year) = Sum(64)m =												1432.2360 (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	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1995	34.8167	28.3148	21.4361	16.0238	13.5279	14.6174	19.0003	25.5021	32.3808	37.7932	40.2890 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	252.1571	254.7737	248.1800	234.1427	216.4231	199.7691	188.6433	186.0267	192.6205	206.6578	224.3774	241.0313 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564 (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)	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651 (71)
Water heating gains (Table 5)	63.3578	61.4976	57.6395	52.3966	48.9920	44.2002	40.1300	45.3479	47.2041	52.6301	58.7574	61.5094 (72)
Total internal gains	445.0034	441.3769	424.4232	398.2643	371.7278	347.7862	333.6796	340.6638	355.6155	381.9576	411.2169	433.1186 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				3.6700	13.4839	0.7200	0.7000			0.7700			17.2840 (74)
South				3.6600	56.7559	0.7200	0.7000			0.7700			72.5530 (78)
South				2.1200	56.7559	0.7200	0.7000			0.7700			42.0253 (78)

Solar gains	131.8623	187.5869	253.2526	313.0101	333.3416	364.7866	338.4462	321.3888	285.8686	218.8712	156.5487	107.4210	(83)
Total gains	576.8657	628.9637	677.6758	711.2744	705.0693	712.5728	672.1258	662.0526	641.4841	600.8288	567.7656	540.5396	(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	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869
alpha	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991
util living area	0.8943	0.8696	0.8209	0.7446	0.6264	0.4551	0.3300	0.3345	0.5365	0.7337	0.8512	0.9050 (86)
MIT	19.2233	19.4249	19.8178	20.2512	20.6484	20.8920	20.9665	20.9654	20.8237	20.4100	19.7673	19.1637 (87)
Th 2	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138 (88)
util rest of house	0.8798	0.8522	0.7964	0.7082	0.5690	0.3726	0.2277	0.2310	0.4569	0.6876	0.8279	0.8916 (89)
MIT 2	17.6155	17.8990	18.4494	19.0428	19.5597	19.8350	19.8998	19.8993	19.7694	19.2675	18.3905	17.5330 (90)
Living area fraction									fLA = Living area / (4) =			0.2612 (91)
MIT	18.0355	18.2976	18.8068	19.3584	19.8441	20.1111	20.1784	20.1778	20.0448	19.5660	18.7501	17.9589 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8855	18.1476	18.6568	19.2084	19.6941	19.9611	20.0284	20.0278	19.8948	19.4160	18.6001	17.8089 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8449	0.8166	0.7625	0.6812	0.5563	0.3764	0.2389	0.2423	0.4554	0.6633	0.7930	0.8574 (94)
Ext temp.	487.4129	513.6267	516.7462	484.5284	392.2035	268.1997	160.5886	160.4228	292.1132	398.5527	450.2290	463.4686 (95)
Heat loss rate W	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Month fracti	880.9259	864.1436	780.1273	649.7125	465.2530	286.5364	164.2864	164.2421	324.1904	523.2412	719.6817	868.4706 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	292.7737	235.5474	195.9555	118.9326	54.3488	0.0000	0.0000	0.0000	0.0000	92.7682	194.0059	301.3215 (98)
Space heating per m2												1485.6536 (98)
										(98) / (4) =		25.4306 (99)

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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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1641.6062 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	292.7737	235.5474	195.9555	118.9326	54.3488	0.0000	0.0000	0.0000	0.0000	92.7682	194.0059	301.3215	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	323.5068	260.2734	216.5255	131.4172	60.0539	0.0000	0.0000	0.0000	0.0000	102.5063	214.3711	332.9519	(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	145.3825	127.5483	132.5731	116.9342	113.2072	99.1712	93.3645	105.0486	105.6837	121.3573	130.7217	141.2438	(64)
Efficiency of water heater (217)m	89.4125	89.3495	89.1809	88.8848	88.3129	87.3000	87.3000	87.3000	87.3000	88.6582	89.1840	87.3000	(216)
Fuel for water heating, kWh/month	162.5974	142.7521	148.6565	131.5571	128.1887	113.5981	106.9467	120.3306	121.0580	136.8823	146.5752	157.8962	(219)
Water heating fuel used												1617.0392	(219)
Annual totals kWh/year													
Space heating fuel - main system												1641.6062	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													41.3065 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													116.3065 (231)
Electricity for lighting (calculated in Appendix L)													276.9103 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3651.8621 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1641.6062	10.2300	167.9363 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1617.0392	10.2300	165.4231 (247)
Mechanical ventilation fans	41.3065	36.7200	15.1677 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	276.9103	36.7200	101.6814 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	36.7200	0.0000 (252)
Total energy cost			580.7486 (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	1641.6062	0.2160	354.5869 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1617.0392	0.2160	349.2805 (264)
Space and water heating			703.8674 (265)
Pumps and fans	116.3065	0.5190	60.3631 (267)
Energy for lighting	276.9103	0.5190	143.7164 (268)
Energy saving/generation technologies			
PV Unit	-249.0300	0.5190	-129.2466 (269)
Total kg/year			778.7003 (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	1641.6062	1.2200	2002.7596 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1617.0392	1.2200	1972.7878 (264)
Space and water heating			3975.5474 (265)
Pumps and fans	116.3065	3.0700	357.0609 (267)
Energy for lighting	276.9103	3.0700	850.1145 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-249.0300	3.0700	-764.5221 (269)
Primary energy kWh/year			4418.2006 (272)
Primary energy kWh/m2/year			75.6282 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 83
Current environmental impact rating:	B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 74	-168 kg (21.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£74 2.88 kg/m²	B 84	B 91
Total Savings	£74 2.88 kg/m²		

Potential energy efficiency rating:	B 84
Potential environmental impact rating:	B 91

Fuel prices for cost data on this page from database revision number 524 TEST (01 Aug 2023)
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	£144	£163	-£19
Mains gas	£436	£344	£92
Space heating	£314	£314	£0
Water heating	£165	£92	£74
Lighting	£102	£102	£0
Total cost of fuels	£580	£507	£74
Total cost of uses	£581	£508	£74
Delivered energy	63 kWh/m²	48 kWh/m²	15 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	13 kg/m²	10 kg/m²	3 kg/m²
Primary energy	76 kWh/m²	60 kWh/m²	16 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	29.2100 (1b)	x 2.4100 (2b)	= 70.3961 (1b) - (3b)
First floor	29.2100 (1c)	x 2.6700 (2c)	= 77.9907 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3868 (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											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.6500
Infiltration rate												0.2325 (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) =	0.2151 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2742	0.2688	0.2635	0.2366	0.2312	0.2043	0.2043	0.1989	0.2151	0.2312	0.2419	0.2527 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5242	0.5188	0.5135	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5027 (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					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			7.3300	1.3258	9.7178		(27)					
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)					
150mm EPS B&B			29.2100	0.1800	5.2578	75.0000	2190.7500 (28a)					
140mm Timber Frame	79.8600	11.5700	68.2900	0.1900	12.9751	9.0000	614.6100 (29a)					
400mm Mineral Wool	29.2100		29.2100	0.1100	3.2131	9.0000	262.8900 (30)					
Total net area of external elements Aum(A, m2)			138.2800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7304		(33)					
Timebr Frame			30.6800	0.0000	0.0000	20.0000	613.6000 (32)					
Timber GF			52.5900			9.0000	473.3100 (32c)					
Timber FF			56.1100			9.0000	504.9900 (32c)					
Internal Floor			29.2100			18.0000	525.7800 (32d)					
Internal Ceiling			29.2100			18.0000	525.7800 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	5711.7100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.7698 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3419 (36)					
Total fabric heat loss						(33) + (36) =	46.0723 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 25.6691	Feb 25.4058	Mar 25.1425	Apr 24.4838	May 24.4838	Jun 24.4838	Jul 24.4838	Aug 24.4838	Sep 24.4838	Oct 24.4838	Nov 24.4838	Dec 24.6160 (38)
Heat transfer coeff	71.7414	71.4781	71.2149	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.6883 (39)
Average = Sum(39)m / 12 =												70.7977 (39)
HLP	Jan 1.2280	Feb 1.2235	Mar 1.2190	Apr 1.2077	May 1.2077	Jun 1.2077	Jul 1.2077	Aug 1.2077	Sep 1.2077	Oct 1.2077	Nov 1.2077	Dec 1.2100 (40)
HLP (average)												1.2119 (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												1.9366 (42)
Average daily hot water use (litres/day)												80.1949 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	88.2144	85.0066	81.7988	78.5910	75.3832	72.1754	72.1754	75.3832	78.5910	81.7988	85.0066	88.2144 (44)
Energy conte	130.8194	114.4155	118.0665	102.9332	98.7669	85.2283	78.9766	90.6268	91.7091	106.8782	116.6659	126.6916 (45)
Energy content (annual)												1261.7778 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6229	17.1623	17.7100	15.4400	14.8150	12.7842	11.8465	13.5940	13.7564	16.0317	17.4999	19.0037 (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	14.5631	13.1329	14.5066	14.0010	14.4403	13.9428	14.3879	14.4219	13.9745	14.4792	14.0558	14.5522 (61)
Total heat required for water heating calculated for each month	145.3825	127.5483	132.5731	116.9342	113.2072	99.1712	93.3645	105.0486	105.6837	121.3573	130.7217	141.2438 (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												1.4373 (H8)
Utilisation factor												0.5013 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												80.1949 (H14)
Volume ratio Veff/V												0.9352 (H15)
Solar storage volume factor												0.9866 (H16)
Solar input												-788.6936 (H17)
Solar input	-22.8705	-38.1644	-64.9983	-87.1105	-107.6177	-105.8053	-104.4071	-91.2210	-71.4443	-48.7881	-27.1278	-19.1387 (63)
Solar input (sum of months) = Sum (63)m =												-788.6936 (63)
Output from w/h	122.5119	89.3840	67.5749	29.8237	5.5895	0.0000	0.0000	13.8276	34.2393	72.5693	103.5939	122.1050 (64)
Total per year (kWh/year) = Sum (64)m =												661.2192 (64)
Heat gains from water heating, kWh/month	47.1382	41.3264	42.8838	37.7255	36.4501	31.8241	29.8567	33.7389	33.9869	39.1568	42.3054	45.7630 (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	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1995	34.8167	28.3148	21.4361	16.0238	13.5279	14.6174	19.0003	25.5021	32.3808	37.7932	40.2890	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	252.1571	254.7737	248.1800	234.1427	216.4231	199.7691	188.6433	186.0267	192.6205	206.6578	224.3774	241.0313	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	(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)	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	(71)
Water heating gains (Table 5)	63.3578	61.4976	57.6395	52.3966	48.9920	44.2002	40.1300	45.3479	47.2041	52.6301	58.7574	61.5094	(72)
Total internal gains	445.0034	441.3769	424.4232	398.2643	371.7278	347.7862	333.6796	340.6638	355.6155	381.9576	411.2169	433.1186	(73)

6. Solar gains

[Jan]												
			Area m2	Solar flux Table 6a		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			3.6700		10.6334		0.7200		0.7000		0.7700	13.6302 (74)
South			3.6600		46.7521		0.7200		0.7000		0.7700	59.7648 (78)
South			2.1200		46.7521		0.7200		0.7000		0.7700	34.6179 (78)
Solar gains	108.0129	180.6225	241.1624	293.6363	327.6735	325.7005	313.7762	287.7039	258.9030	197.7299	128.6903	92.9181 (83)
Total gains	553.0163	621.9994	665.5856	691.9006	699.4013	673.4867	647.4557	628.3677	614.5185	579.6874	539.9072	526.0367 (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	22.1153	22.1968	22.2789	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4448
alpha	2.4744	2.4798	2.4853	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4963
util living area	0.9147	0.8868	0.8477	0.7847	0.6911	0.5625	0.4364	0.4633	0.6272	0.7926	0.8846	0.9225	(86)
MIT	18.9115	19.1893	19.5825	20.0558	20.4749	20.7790	20.9153	20.8985	20.6919	20.1665	19.4714	18.8681	(87)
Th 2	19.8976	19.9012	19.9048	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9120	(88)
util rest of house	0.9032	0.8719	0.8273	0.7544	0.6445	0.4912	0.3425	0.3702	0.5607	0.7575	0.8670	0.9121	(89)
MIT 2	17.1601	17.5560	18.1142	18.7785	19.3407	19.7174	19.8602	19.8458	19.6218	18.9435	17.9738	17.1069	(90)
Living area fraction									fLA = Living area / (4) =			0.2612	(91)
MIT	17.6176	17.9826	18.4977	19.1121	19.6369	19.9947	20.1358	20.1208	19.9013	19.2630	18.3650	17.5670	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.4676	17.8326	18.3477	18.9621	19.4869	19.8447	19.9858	19.9708	19.7513	19.1130	18.2150	17.4170	(93)

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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	0.8695	0.8363	0.7918	0.7233	0.6239	0.4862	0.3491	0.3754	0.5497	0.7268	0.8319	0.8797	(94)
Useful gains	480.8327	520.1734	527.0057	500.4843	436.3904	327.4813	226.0183	235.9111	337.8267	421.3049	449.1579	462.7504	(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	944.6594	924.3991	843.7327	709.9442	549.4168	370.0467	238.8876	251.9413	398.7372	600.6424	784.2332	934.2848	(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	345.0871	271.6397	235.6449	150.8111	84.0917	0.0000	0.0000	0.0000	0.0000	133.4271	241.2542	350.8216	(98)
Space heating												1812.7773	(98)
Space heating per m2												31.0301	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2003.0688 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	345.0871	271.6397	235.6449	150.8111	84.0917	0.0000	0.0000	0.0000	0.0000	133.4271	241.2542	350.8216	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	381.3117	300.1543	260.3811	166.6421	92.9190	0.0000	0.0000	0.0000	0.0000	147.4333	266.5792	387.6481	(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	122.5119	89.3840	67.5749	29.8237	5.5895	0.0000	0.0000	13.8276	34.2393	72.5693	103.5939	122.1050	(64)
Efficiency of water heater (217)m	89.6391	89.6861	89.7667	89.9556	90.2937	87.3000	87.3000	87.3000	87.3000	89.3463	89.5143	87.3000	(216)
Fuel for water heating, kWh/month	136.6724	99.6631	75.2783	33.1538	6.1903	0.0000	0.0000	15.8392	39.2203	81.2225	115.7289	136.1996	(219)
Water heating fuel used												739.1685	(219)
Annual totals kWh/year													
Space heating fuel - main system													2003.0688 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													41.3065 (230a)
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													166.3065 (231)
Electricity for lighting (calculated in Appendix L)													276.9103 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3185.4541 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2003.0688	3.4800	69.7068	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	739.1685	3.4800	25.7231	(247)
Mechanical ventilation fans	41.3065	13.1900	5.4483	(249)
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	276.9103	13.1900	36.5245	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			273.8901	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	1.1123 (257)
SAP value			84.4834
SAP rating (Section 12)			84 (258)
SAP band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	2003.0688	0.2160	432.6629 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	739.1685	0.2160	159.6604 (264)
Space and water heating			592.3233 (265)
Pumps and fans	166.3065	0.5190	86.3131 (267)
Energy for lighting	276.9103	0.5190	143.7164 (268)
Energy saving/generation technologies			
PV Unit	-249.0300	0.5190	-129.2466 (269)
Total kg/year			693.1062 (272)
CO2 emissions per m2			11.8600 (273)
EI value			91.0195
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	29.2100 (1b)	x 2.4100 (2b)	= 70.3961 (1b) - (3b)
First floor	29.2100 (1c)	x 2.6700 (2c)	= 77.9907 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3868 (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											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.6500
Infiltration rate												0.2325 (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) =	0.2151 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
	0.2366	0.2204	0.2204	0.2097	0.2097	0.1989	0.1989	0.1882	0.1882	0.2043	0.1989	0.2097 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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 Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			7.3300	1.3258	9.7178		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
150mm EPS B&B			29.2100	0.1800	5.2578	75.0000	2190.7500 (28a)
140mm Timber Frame	79.8600	11.5700	68.2900	0.1900	12.9751	9.0000	614.6100 (29a)
400mm Mineral Wool	29.2100		29.2100	0.1100	3.2131	9.0000	262.8900 (30)
Total net area of external elements Aum(A, m ²)			138.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7304		(33)
Timebr Frame			30.6800	0.0000	0.0000	20.0000	613.6000 (32)
Timber GF			52.5900			9.0000	473.3100 (32c)
Timber FF			56.1100			9.0000	504.9900 (32c)
Internal Floor			29.2100			18.0000	525.7800 (32d)
Internal Ceiling			29.2100			18.0000	525.7800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	5711.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							97.7698 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3419 (36)
Total fabric heat loss						(33) + (36) =	46.0723 (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	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838	24.4838 (38)
Heat transfer coeff	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562	70.5562 (39)
Average = Sum(39)m / 12 =												70.5562 (39)
HLP	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077	1.2077 (40)
HLP (average)												1.2077 (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												1.9366 (42)
Average daily hot water use (litres/day)												80.1949 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	88.2144	85.0066	81.7988	78.5910	75.3832	72.1754	72.1754	75.3832	78.5910	81.7988	85.0066	88.2144 (44)
Energy conte	130.8194	114.4155	118.0665	102.9332	98.7669	85.2283	78.9766	90.6268	91.7091	106.8782	116.6659	126.6916 (45)
Energy content (annual)												1261.7778 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6229	17.1623	17.7100	15.4400	14.8150	12.7842	11.8465	13.5940	13.7564	16.0317	17.4999	19.0037 (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	14.5631	13.1329	14.5066	14.0010	14.4403	13.9428	14.3879	14.4219	13.9745	14.4792	14.0558	14.5522 (61)
Total heat required for water heating calculated for each month	145.3825	127.5483	132.5731	116.9342	113.2072	99.1712	93.3645	105.0486	105.6837	121.3573	130.7217	141.2438 (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												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.5985 (H8)
Utilisation factor												0.4650 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												80.1949 (H14)
Volume ratio Veff/V												0.9352 (H15)
Solar storage volume factor												0.9866 (H16)
Solar input												-813.7247 (H17)
Solar input	-26.7128	-37.9839	-65.2852	-88.0848	-102.9487	-110.9973	-105.6607	-96.3028	-75.2512	-51.7509	-31.5942	-21.1521 (63)
Solar input (sum of months) = Sum (63)m =												-813.7247 (63)
Output from w/h	118.6697	89.5644	67.2880	28.8494	10.2584	0.0000	0.0000	8.7458	30.4325	69.6065	99.1275	120.0916 (64)
Total per year (kWh/year) = Sum (64)m =												642.6337 (64)
Heat gains from water heating, kWh/month	47.1382	41.3264	42.8838	37.7255	36.4501	31.8241	29.8567	33.7389	33.9869	39.1568	42.3054	45.7630 (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	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	116.1976	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.1995	34.8167	28.3148	21.4361	16.0238	13.5279	14.6174	19.0003	25.5021	32.3808	37.7932	40.2890	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	252.1571	254.7737	248.1800	234.1427	216.4231	199.7691	188.6433	186.0267	192.6205	206.6578	224.3774	241.0313	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	48.5564	(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)	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	-77.4651	(71)
Water heating gains (Table 5)	63.3578	61.4976	57.6395	52.3966	48.9920	44.2002	40.1300	45.3479	47.2041	52.6301	58.7574	61.5094	(72)
Total internal gains	445.0034	441.3769	424.4232	398.2643	371.7278	347.7862	333.6796	340.6638	355.6155	381.9576	411.2169	433.1186	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				3.6700	13.4839		0.7200		0.7000		0.7700		17.2840 (74)
South				3.6600	56.7559		0.7200		0.7000		0.7700		72.5530 (78)
South				2.1200	56.7559		0.7200		0.7000		0.7700		42.0253 (78)
Solar gains	131.8623	187.5869	253.2526	313.0101	333.3416	364.7866	338.4462	321.3888	285.8686	218.8712	156.5487		107.4210 (83)
Total gains	576.8657	628.9637	677.6758	711.2744	705.0693	712.5728	672.1258	662.0526	641.4841	600.8288	567.7656		540.5396 (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	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869	22.4869
alpha	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991	2.4991
util living area	0.8943	0.8696	0.8209	0.7446	0.6264	0.4551	0.3300	0.3345	0.5365	0.7337	0.8512	0.9050 (86)
MIT	19.2233	19.4249	19.8178	20.2512	20.6484	20.8920	20.9665	20.9654	20.8237	20.4100	19.7673	19.1637 (87)
Th 2	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138	19.9138 (88)
util rest of house	0.8798	0.8522	0.7964	0.7082	0.5690	0.3726	0.2277	0.2310	0.4569	0.6876	0.8279	0.8916 (89)
MIT 2	17.6155	17.8990	18.4494	19.0428	19.5597	19.8350	19.8998	19.8993	19.7694	19.2675	18.3905	17.5330 (90)
Living area fraction									fLA = Living area / (4) =			0.2612 (91)
MIT	18.0355	18.2976	18.8068	19.3584	19.8441	20.1111	20.1784	20.1778	20.0448	19.5660	18.7501	17.9589 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8855	18.1476	18.6568	19.2084	19.6941	19.9611	20.0284	20.0278	19.8948	19.4160	18.6001	17.8089 (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	0.8449	0.8166	0.7625	0.6812	0.5563	0.3764	0.2389	0.2423	0.4554	0.6633	0.7930	0.8574	(94)
Useful gains	487.4129	513.6267	516.7462	484.5284	392.2035	268.1997	160.5886	160.4228	292.1132	398.5527	450.2290	463.4686	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	880.9259	864.1436	780.1273	649.7125	465.2530	286.5364	164.2864	164.2421	324.1904	523.2412	719.6817	868.4706	(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	292.7737	235.5474	195.9555	118.9326	54.3488	0.0000	0.0000	0.0000	0.0000	92.7682	194.0059	301.3215	(98)
Space heating												1485.6536	(98)
Space heating per m2												25.4306	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1641.6062 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	292.7737	235.5474	195.9555	118.9326	54.3488	0.0000	0.0000	0.0000	0.0000	92.7682	194.0059	301.3215	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	323.5068	260.2734	216.5255	131.4172	60.0539	0.0000	0.0000	0.0000	0.0000	102.5063	214.3711	332.9519	(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	118.6697	89.5644	67.2880	28.8494	10.2584	0.0000	0.0000	8.7458	30.4325	69.6065	99.1275	120.0916	(64)
Efficiency of water heater (217)m	89.5532	89.5953	89.6599	89.8570	89.9763	87.3000	87.3000	87.3000	87.3000	89.0999	89.3919	87.3000	(216)
Fuel for water heating, kWh/month	132.5130	99.9656	75.0480	32.1059	11.4012	0.0000	0.0000	10.0181	34.8597	78.1218	110.8909	134.0841	(219)
Water heating fuel used												719.0082	(219)
Annual totals kWh/year													
Space heating fuel - main system												1641.6062	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													41.3065 (230a)
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													166.3065 (231)
Electricity for lighting (calculated in Appendix L)													276.9103 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													2803.8311 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1641.6062	10.2300	167.9363 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	719.0082	10.2300	73.5545 (247)
Mechanical ventilation fans	41.3065	36.7200	15.1677 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Pump for solar water heating	50.0000	36.7200	18.3600 (249)
Energy for lighting	276.9103	36.7200	101.6814 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	36.7200	0.0000 (252)
Total energy cost			507.2400 (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	1641.6062	0.2160	354.5869 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	719.0082	0.2160	155.3058 (264)
Space and water heating			509.8927 (265)

FULL SAP CALCULATION PRINTOUT

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

Pumps and fans	166.3065	0.5190	86.3131 (267)
Energy for lighting	276.9103	0.5190	143.7164 (268)
Energy saving/generation technologies			
PV Unit	-249.0300	0.5190	-129.2466 (269)
Total kg/year			610.6756 (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	1641.6062	1.2200	2002.7596 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	719.0082	1.2200	877.1900 (264)
Space and water heating			2879.9495 (265)
Pumps and fans	166.3065	3.0700	510.5609 (267)
Energy for lighting	276.9103	3.0700	850.1145 (268)
Energy saving/generation technologies			
PV Unit	-249.0300	3.0700	-764.5221 (269)
Primary energy kWh/year			3476.1028 (272)
Primary energy kWh/m2/year			59.5019 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	97.8 (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	195.87 (P1)
Transmission heat loss coefficient	46.07 (37)
Summer heat loss coefficient	241.94 (P2)

Overhangs					
Orientation	Ratio	Z_overhangs		Overhang type	
North	0.000	1.000		None	
South	0.000	1.000		None	
Solar shading					
Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	1.000	0.90	1.000	0.900	
South	1.000	0.90	1.000	0.900	

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6700	87.1704	0.7200	0.7000	0.9000	130.6023
South	3.6600	118.5567	0.7200	0.7000	0.9000	177.1424
South	2.1200	118.5567	0.7200	0.7000	0.9000	102.6071
total:						410.3519

	Jun	Jul	Aug	
Solar gains	437	410	381	(P3)
Internal gains	345	331	338	
Total summer gains	782	741	719	(P5)
Summer gain/loss ratio	3.23	3.06	2.97	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 97.8)	1.32	1.32	1.32	
Threshold temperature	19.95	21.68	21.59	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			