

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-159				Issued on Date	12/11/2019
Assessment Reference	As Built	Prop Type Ref	P306i - Semi (As)			
Property	75, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating	88 B	DER	13.48	TER	17.44	
Environmental	89 B	% DER<TER	22.72			
CO ₂ Emissions (t/year)	0.93	DFEE	44.96	TFEE	50.87	
General Requirements Compliance	Pass	% DFEE<TFEE	11.61			
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk				Assessor ID	T511-0001
Client						

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 93 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.44 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.48 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)45.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.34 (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: 4.89 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Potterton Promax Ultra Combi 40 ErP

Combi boiler

Efficiency: 89.1% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:

Average

Windows facing East: 7.97 m², No overhang

Windows facing South West: 0.68 m², No overhang

Windows facing West: 5.76 m², No overhang

Windows facing North West: 0.68 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Door U-value 0.90 W/m²K

Photovoltaic array 0.81 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (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)					40.0000 / (5) = 0.1805 (8)
Pressure test					Yes
Measured/design AP50					4.8900
Infiltration rate					0.4250 (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) =	0.3932 (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	0.5013	0.4915	0.4816	0.4325	0.4227	0.3735	0.3735	0.3637	0.3932	0.4227	0.4423	0.4620 (22b)
Effective ac	0.6256	0.6208	0.6160	0.5935	0.5893	0.5698	0.5698	0.5661	0.5773	0.5893	0.5978	0.6067 (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			1.9600	0.9000	1.7640		(26)
Window (Uw = 1.40)			11.9400	1.3258	15.8295		(27)
French (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500 (28a)
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520 (29a)
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300 (30)
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m ²)			190.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296		(33)
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000 (32)
GF Masonry			41.2600			39.0000	1609.1400 (32c)
GF Timber			34.3700			9.0000	309.3300 (32c)
1F Timber			81.4300			9.0000	732.8700 (32c)
1F Metal			34.9000			20.0000	698.0000 (32c)
Internal Floor			45.7700			18.0000	823.8600 (32d)
Internal Floor			45.7700			18.0000	823.8600 (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) =	17303.7820 (34)
	186.9871 (35)
	8.5835 (36)
(33) + (36) =	63.0131 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 45.7416 Feb 45.3849 Mar 45.0352 Apr 43.3930 May 43.0857 Jun 41.6553 Jul 41.6553 Aug 41.3904 Sep 42.2063 Oct 43.0857 Nov 43.7073 Dec 44.3571 (38)
Heat transfer coeff	108.7547 108.3979 108.0483 106.4060 106.0988 104.6684 104.6684 104.4035 105.2194 106.0988 106.7204 107.3702 (39)
Average = Sum(39)m / 12 =	106.4046 (39)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Daily hot water use	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0464	18.9901	20.9755	20.2193	20.8354	20.0965	20.7248	20.7965	20.1634	20.9175	20.3157	21.0249 (61)
Total heat required for water heating calculated for each month												
Solar input	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (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	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (64)
Heat gains from water heating, kWh/month	58.0635	50.9284	52.8984	46.6012	45.0736	39.4244	37.0581	41.7783	42.0569	48.3680	52.1681	56.3920 (65)
Total per year (kWh/year) = Sum(64)m =												1777.7885 (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	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5802	20.0555	16.3102	12.3479	9.2302	7.7925	8.4201	10.9448	14.6900	18.6524	21.7701	23.2078 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.6738	246.2024	239.8305	226.2654	209.1420	193.0483	182.2968	179.7682	186.1401	199.7052	216.8287	232.9223 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566 (71)
Water heating gains (Table 5)	78.0424	75.7863	71.1000	64.7239	60.5828	54.7560	49.8092	56.1536	58.4124	65.0108	72.4557	75.7958 (72)
Total internal gains	410.1801	407.9280	393.1245	369.2209	344.8387	321.4806	306.4099	312.7503	325.1263	349.2521	376.9382	397.8095 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East				4.8200	19.6403	0.7100	0.7000		0.7700		32.6050 (76)	
Southwest				0.6800	36.7938	0.7100	0.7000		0.7700		8.6173 (79)	
West				5.7600	19.6403	0.7100	0.7000		0.7700		38.9636 (80)	
Northwest				0.6800	11.2829	0.7100	0.7000		0.7700		2.6425 (81)	
East				3.1500	19.6403	0.7100	0.7000		0.7700		21.3082 (76)	
Solar gains	104.1367	201.7443	328.9873	477.1838	584.0710	597.9468	569.2258	489.1712	381.5517	238.3831	129.4531	85.9101 (83)
Total gains	514.3168	609.6723	722.1118	846.4048	928.9097	919.4274	875.6357	801.9216	706.6779	587.6352	506.3913	483.7196 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.1968	44.3422	44.4857	45.1723	45.3031	45.9222	45.9222	46.0387	45.6818	45.3031	45.0393	44.7667
alpha	3.9465	3.9561	3.9657	4.0115	4.0202	4.0615	4.0615	4.0692	4.0455	4.0202	4.0026	3.9844
util living area	0.9951	0.9898	0.9745	0.9275	0.8242	0.6602	0.5069	0.5667	0.8125	0.9612	0.9910	0.9961 (86)
MIT	19.3562	19.5599	19.9106	20.3631	20.7196	20.9199	20.9787	20.9671	20.8070	20.3169	19.7569	19.3284 (87)
Th 2	19.9399	19.9430	19.9460	19.9603	19.9630	19.9755	19.9755	19.9779	19.9707	19.9630	19.9576	19.9519 (88)
util rest of house	0.9938	0.9871	0.9675	0.9074	0.7770	0.5767	0.3974	0.4545	0.7445	0.9467	0.9882	0.9951 (89)
MIT 2	17.7438	18.0424	18.5517	19.2014	19.6752	19.9151	19.9656	19.9609	19.8003	19.1510	18.3406	17.7112 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.0601	18.3401	18.8182	19.4292	19.8800	20.1122	20.1643	20.1582	19.9977	19.3797	18.6184	18.0284 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9101	18.1901	18.6682	19.2792	19.7300	19.9622	20.0143	20.0082	19.8477	19.2297	18.4684	17.8784 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9899	0.9805	0.9559	0.8909	0.7648	0.5755	0.4017	0.4580	0.7350	0.9325	0.9821	0.9919 (94)
Useful gains	509.1117	597.7912	690.2509	754.0598	710.4072	529.1616	351.7559	367.2767	519.4173	547.9574	497.3432	479.8202 (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	1480.1588	1440.6157	1314.7532	1104.4108	851.9749	561.2529	357.3699	376.7131	604.7692	915.5968	1213.2364	1468.6474 (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	722.4591	566.3781	464.6297	252.2528	105.3264	0.0000	0.0000	0.0000	0.0000	273.5237	515.4432	735.6875 (98)
Space heating												3635.7003 (98)

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Space heating per m2 (98) / (4) = 39.2879 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4039.6670 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	722.4591	566.3781	464.6297	252.2528	105.3264	0.0000	0.0000	0.0000	0.0000	273.5237	515.4432	735.6875	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	802.7323	629.3090	516.2552	280.2808	117.0293	0.0000	0.0000	0.0000	0.0000	303.9152	572.7146	817.4305	(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	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168	(64)
Efficiency of water heater (217)m	89.3223	89.2594	89.1139	88.7659	88.0825	86.7000	86.7000	86.7000	86.7000	88.7995	89.1884	86.7000	(216)
Fuel for water heating, kWh/month	201.3484	176.8777	184.3679	163.5435	159.7699	142.5096	134.4811	150.8755	151.6607	169.6606	181.5676	195.6604	(219)
Water heating fuel used												2012.3229	(219)
Annual totals kWh/year													
Space heating fuel - main system												4039.6670	(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)												398.7732	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 + 0.81 + 908 + 1.00) =												-588.2895	(233)
Total delivered energy for all uses												5937.4736	(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	4039.6670	0.2160	872.5681 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2012.3229	0.2160	434.6618 (264)
Space and water heating			1307.2298 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	398.7732	0.5190	206.9633 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total CO2, kg/year			1247.7958 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4800 (273)

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

DER		13.4800	ZC1
Total Floor Area		92.5400	
Assumed number of occupants		2.6589	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		15.6036	ZC2
CO2 emissions from cooking, equation (L16)		1.9755	ZC3
Total CO2 emissions		31.0591	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.0591	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1354 (8)
Pressure test																	Yes
Measured/design AP50																	5.0000
Infiltration rate																	0.3854 (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) =		0.3565 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
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	(22)				
Adj infilt rate	0.4545	0.4456	0.4367	0.3922	0.3832	0.3387	0.3387	0.3298	0.3565	0.3832	0.4011	0.4189	(22b)				
Effective ac	0.6033	0.5993	0.5954	0.5769	0.5734	0.5574	0.5574	0.5544	0.5635	0.5734	0.5804	0.5877	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9600	1.0000	1.9600		(26)					
TER Opening Type (Uw = 1.40)			15.0900	1.3258	20.0057		(27)					
Heat Loss Floor			46.7700	0.1300	6.0801		(28a)					
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.1800	14.3712		(30)					
External Plane Roof	45.7700		45.7700	0.1300	5.9501		(30)					
Bay	1.0100		1.0100	0.1300	0.1313		(30)					
Total net area of external elements Aum(A, m2)			190.4400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.4984		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6954 (36)					
Total fabric heat loss						(33) + (36) =	59.1938 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 44.1082	Feb 43.8149	Mar 43.5274	Apr 42.1772	May 41.9246	Jun 40.7485	Jul 40.7485	Aug 40.5307	Sep 41.2015	Oct 41.9246	Nov 42.4356	Dec 42.9699 (38)
Heat transfer coeff	103.3020	103.0087	102.7212	101.3710	101.1183	99.9423	99.9423	99.7245	100.3953	101.1183	101.6294	102.1637 (39)
Average = Sum(39)m / 12 =												101.3698 (39)
HLP	Jan 1.1163	Feb 1.1131	Mar 1.1100	Apr 1.0954	May 1.0927	Jun 1.0800	Jul 1.0800	Aug 1.0776	Sep 1.0849	Oct 1.0927	Nov 1.0982	Dec 1.1040 (40)
HLP (average)												1.0954 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (43)
Daily hot water use	Jan 107.0842	Feb 103.1902	Mar 99.2962	Apr 95.4022	May 91.5083	Jun 87.6143	Jul 87.6143	Aug 91.5083	Sep 95.4022	Oct 99.2962	Nov 103.1902	Dec 107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum(45)m =		1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (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)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.6003	47.0477	46.6316	43.2071	44.6473	46.6316	47.0477	50.6003	49.3151	50.9589	50.9589	50.9589	(61)
Total heat required for water heating calculated for each month	209.7616	184.9173	193.9222	171.9992	166.5256	146.6664	140.5176	156.6442	158.3742	180.3405	190.9367	204.7508	204.7508	204.7508	(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	0.0000	0.0000	(63)
Output from w/h	209.7616	184.9173	193.9222	171.9992	166.5256	146.6664	140.5176	156.6442	158.3742	180.3405	190.9367	204.7508	204.7508	204.7508	(64)
Heat gains from water heating, kWh/month	65.5416	57.6877	60.3046	53.3083	51.5226	45.2020	43.0387	48.2371	48.7780	55.7887	59.4180	63.8755	63.8755	63.8755	(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	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5802	20.0555	16.3102	12.3479	9.2302	7.7925	8.4201	10.9448	14.6900	18.6524	21.7701	23.2078	23.2078	23.2078	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.6738	246.2024	239.8305	226.2654	209.1420	193.0483	182.2968	179.7682	186.1401	199.7052	216.8287	232.9223	232.9223	232.9223	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	(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	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	(71)
Water heating gains (Table 5)	88.0936	85.8448	81.0546	74.0393	69.2509	62.7806	57.8477	64.8348	67.7472	74.9848	82.5250	85.8542	85.8542	85.8542	(72)
Total internal gains	420.2313	417.9865	403.0790	378.5364	353.5068	329.5051	314.4483	321.4315	334.4611	359.2261	387.0074	407.8680	407.8680	407.8680	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF	Specific data or Table 6c	Access factor Table 6d	Gains W	
East				7.9700	19.6403		0.6300		0.7000	0.7700	47.8385 (76)	
Southwest				0.6800	36.7938		0.6300		0.7000	0.7700	7.6464 (79)	
West				5.7600	19.6403		0.6300		0.7000	0.7700	34.5734 (80)	
Northwest				0.6800	11.2829		0.6300		0.7000	0.7700	2.3448 (81)	
Solar gains	92.4030	179.0126	291.9183	423.4166	518.2602	530.5725	505.0877	434.0533	338.5599	211.5231	114.8668	76.2301 (83)
Total gains	512.6343	596.9990	694.9973	801.9530	871.7669	860.0776	819.5361	755.4848	673.0210	570.7492	501.8743	484.0981 (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	62.2097	62.3869	62.5615	63.3948	63.5532	64.3010	64.3010	64.4414	64.0109	63.5532	63.2336	62.9029				
alpha	5.1473	5.1591	5.1708	5.2263	5.2369	5.2867	5.2867	5.2961	5.2674	5.2369	5.2156	5.1935				
util living area	0.9986	0.9967	0.9895	0.9596	0.8697	0.6965	0.5271	0.5895	0.8523	0.9809	0.9971	0.9990				(86)
MIT	19.7611	19.9135	20.1804	20.5315	20.8131	20.9583	20.9920	20.9862	20.8777	20.4957	20.0654	19.7384				(87)
Th 2	19.9875	19.9901	19.9927	20.0046	20.0068	20.0172	20.0172	20.0191	20.0132	20.0068	20.0023	19.9976				(88)
util rest of house	0.9982	0.9956	0.9857	0.9444	0.8237	0.6081	0.4143	0.4727	0.7834	0.9712	0.9959	0.9987				(89)
MIT 2	18.3291	18.5534	18.9432	19.4516	19.8237	19.9896	20.0143	20.0134	19.9133	19.4107	18.7846	18.3030				(90)
Living area fraction										fLA = Living area / (4) =		0.1961				(91)
MIT	18.6100	18.8202	19.1858	19.6634	20.0177	20.1796	20.2060	20.2042	20.1025	19.6235	19.0358	18.5845				(92)
Temperature adjustment												0.0000				
adjusted MIT	18.6100	18.8202	19.1858	19.6634	20.0177	20.1796	20.2060	20.2042	20.1025	19.6235	19.0358	18.5845				(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Useful gains	0.9972	0.9936	0.9815	0.9378	0.8242	0.6237	0.4365	0.4956	0.7907	0.9661	0.9941	0.9979				(94)
Ext temp.	511.1954	593.1899	682.1605	752.1056	718.5483	536.4006	357.7569	374.3893	532.1252	551.3965	498.9130	483.0813				(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	1478.2508	1433.8986	1303.1059	1091.0949	841.0740	557.6341	360.3957	379.3724	602.6199	912.4388	1213.0317	1469.5740				(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	719.4893	564.9562	461.9833	244.0723	91.1591	0.0000	0.0000	0.0000	0.0000	268.6155	514.1655	733.9506				(98)
Space heating per m2												3598.3918				(98)
												(98) / (4) =				(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3852.6679 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	719.4893	564.9562	461.9833	244.0723	91.1591	0.0000	0.0000	0.0000	0.0000	268.6155	514.1655	733.9506	(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)	770.3311	604.8782	494.6288	261.3194	97.6008	0.0000	0.0000	0.0000	0.0000	287.5969	550.4984	785.8143	(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	209.7616	184.9173	193.9222	171.9992	166.5256	146.6664	140.5176	156.6442	158.3742	180.3405	190.9367	204.7508	(64)
Efficiency of water heater (217)m	87.9042	87.6804	87.1588	85.9319	83.6044	80.3000	80.3000	80.3000	80.3000	86.0523	87.4224	80.3000	(216)
Fuel for water heating, kWh/month	238.6252	210.8991	222.4929	200.1575	199.1827	182.6481	174.9908	195.0737	197.2281	209.5708	218.4071	232.7082	(219)
Water heating fuel used												2481.9841	(219)
Annual totals kWh/year													
Space heating fuel - main system												3852.6679	(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)												398.7732	(232)
Total delivered energy for all uses												6808.4253	(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	3852.6679	0.2160	832.1763 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2481.9841	0.2160	536.1086 (264)
Space and water heating			1368.2848 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	398.7732	0.5190	206.9633 (268)
Total CO2, kg/m2/year			1614.1731 (272)
Emissions per m2 for space and water heating			14.7859 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2365 (272b)
Emissions per m2 for pumps and fans			0.4206 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7859 * 1.00) + 2.2365 + 0.4206, rounded to 2 d.p.			17.4400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1354 (8)
Pressure test					Yes
Measured/design AP50					4.8900
Infiltration rate					0.3799 (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) =	0.3514 (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	0.4481	0.4393	0.4305	0.3866	0.3778	0.3338	0.3338	0.3251	0.3514	0.3778	0.3953	0.4129 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5528	0.5617	0.5714	0.5781	0.5852 (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			1.9600	0.9000	1.7640		(26)
Window (Uw = 1.40)			11.9400	1.3258	15.8295		(27)
French (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500 (28a)
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520 (29a)
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300 (30)
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m ²)			190.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296		(33)
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000 (32)
GF Masonry			41.2600			39.0000	1609.1400 (32c)
GF Timber			34.3700			9.0000	309.3300 (32c)
1F Timber			81.4300			9.0000	732.8700 (32c)
1F Metal			34.9000			20.0000	698.0000 (32c)
Internal Floor			45.7700			18.0000	823.8600 (32d)
Internal Floor			45.7700			9.0000	411.9300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16891.8520 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.5357 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5835 (36)
Total fabric heat loss						(33) + (36) =	63.0131 (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	43.8942	43.6092	43.3299	42.0179	41.7724	40.6297	40.6297	40.4181	41.0699	41.7724	42.2690	42.7881 (38)
Heat transfer coeff	106.9073	106.6223	106.3430	105.0310	104.7855	103.6428	103.6428	103.4312	104.0829	104.7855	105.2821	105.8012 (39)
Average = Sum(39)m / 12 =												105.0298 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1553	1.1522	1.1492	1.1350	1.1323	1.1200	1.1200	1.1177	1.1247	1.1323	1.1377	1.1433 (40)
HLP (average)												1.1350 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (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 FABRIC ENERGY EFFICIENCY 09 Jan 2014

Daily hot water use	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total =	Sum (45)m =	1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.7456	29.5141	30.4559	26.5522	25.4775	21.9851	20.3724	23.3777	23.6569	27.5698	30.0946	32.6808 (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	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5802	20.0555	16.3102	12.3479	9.2302	7.7925	8.4201	10.9448	14.6900	18.6524	21.7701	23.2078 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.6738	246.2024	239.8305	226.2654	209.1420	193.0483	182.2968	179.7682	186.1401	199.7052	216.8287	232.9223 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566 (71)
Water heating gains (Table 5)	45.3570	43.9198	40.9354	36.8780	34.2439	30.5349	27.3823	31.4216	32.8568	37.0562	41.7981	43.9258 (72)
Total internal gains	374.4947	373.0614	359.9598	338.3751	315.4998	294.2595	280.9829	285.0183	296.5707	318.2975	343.2805	362.9396 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
East				4.8200	19.6403	0.7100	0.7000	0.7700	32.6050 (76)			
Southwest				0.6800	36.7938	0.7100	0.7000	0.7700	8.6173 (79)			
West				5.7600	19.6403	0.7100	0.7000	0.7700	38.9636 (80)			
Northwest				0.6800	11.2829	0.7100	0.7000	0.7700	2.6425 (81)			
East				3.1500	19.6403	0.7100	0.7000	0.7700	21.3082 (76)			
Solar gains	104.1367	201.7443	328.9873	477.1838	584.0710	597.9468	569.2258	489.1712	381.5517	238.3831	129.4531	85.9101 (83)
Total gains	478.6314	574.8057	688.9471	815.5589	899.5708	892.2062	850.2088	774.1895	678.1223	556.6806	472.7336	448.8497 (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	43.8902	44.0075	44.1231	44.6743	44.7789	45.2726	45.2726	45.3653	45.0812	44.7789	44.5677	44.3490
alpha	3.9260	3.9338	3.9415	3.9783	3.9853	4.0182	4.0182	4.0244	4.0054	3.9853	3.9712	3.9566
util living area	0.9958	0.9910	0.9765	0.9311	0.8301	0.6686	0.5151	0.5780	0.8225	0.9651	0.9924	0.9968 (86)
MIT	19.3137	19.5210	19.8784	20.3378	20.7049	20.9132	20.9765	20.9632	20.7918	20.2843	19.7136	19.2814 (87)
Th 2	19.9560	19.9585	19.9609	19.9724	19.9745	19.9846	19.9846	19.9864	19.9807	19.9745	19.9702	19.9656 (88)
util rest of house	0.9948	0.9886	0.9701	0.9122	0.7844	0.5862	0.4056	0.4659	0.7573	0.9521	0.9900	0.9959 (89)
MIT 2	18.4128	18.6209	18.9762	19.4299	19.7654	19.9390	19.9768	19.9731	19.8528	19.3886	18.8226	18.3880 (90)
Living area fraction	18.5895	18.7975	19.1532	19.6080	19.9497	20.1301	20.1729	20.1673	20.0370	19.5643	18.9974	18.5632 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5895	18.7975	19.1532	19.6080	19.9497	20.1301	20.1729	20.1673	20.0370	19.5643	18.9974	18.5632 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	475.1689	566.2438	664.0073	737.3510	704.5290	534.3130	362.7793	377.0398	516.3319	526.2490	466.5436	446.3057 (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	1527.6513	1481.7793	1345.5766	1124.6702	864.4488	573.1541	370.3045	389.6537	617.9366	939.3283	1252.5784	1519.6465 (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	783.0469	615.2399	507.0876	278.8698	118.9803	0.0000	0.0000	0.0000	0.0000	307.3310	565.9451	798.5656 (98)
Space heating												3975.0661 (98)
Space heating per m2										(98) / (4) =		42.9551 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	974.2422	766.9566	786.0769	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8593	0.9135	0.8859	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	837.1902	700.5772	696.3651	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1143.8376	1092.6370	1005.6436	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	220.7861	291.6924	230.1032	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									fC = cooled area / (4) =			742.5817	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	55.1965	72.9231	57.5258	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												185.6454	(107)
Energy for space heating												2.0061	(108)
Energy for space cooling												42.9551	(99)
Total												2.0061	(108)
Dwelling Fabric Energy Efficiency (DFEE)												44.9612	(109)
												45.0	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1354 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3854 (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) =					0.3565 (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	0.4545	0.4456	0.4367	0.3922	0.3832	0.3387	0.3387	0.3298	0.3565	0.3832	0.4011	0.4189	(22b)				
Effective ac	0.6033	0.5993	0.5954	0.5769	0.5734	0.5574	0.5574	0.5544	0.5635	0.5734	0.5804	0.5877	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9600	1.0000	1.9600		(26)					
TER Opening Type (Uw = 1.40)			15.0900	1.3258	20.0057		(27)					
Heat Loss Floor			46.7700	0.1300	6.0801		(28a)					
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.1800	14.3712		(29a)					
External Plane Roof	45.7700		45.7700	0.1300	5.9501		(30)					
Bay	1.0100		1.0100	0.1300	0.1313		(30)					
Total net area of external elements Aum(A, m2)			190.4400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.4984	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6954 (36)					
Total fabric heat loss						(33) + (36) =	59.1938 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 44.1082	Feb 43.8149	Mar 43.5274	Apr 42.1772	May 41.9246	Jun 40.7485	Jul 40.7485	Aug 40.5307	Sep 41.2015	Oct 41.9246	Nov 42.4356	Dec 42.9699 (38)
Heat transfer coeff	103.3020	103.0087	102.7212	101.3710	101.1183	99.9423	99.9423	99.7245	100.3953	101.1183	101.6294	102.1637 (39)
Average = Sum(39)m / 12 =												101.3698 (39)
HLP	Jan 1.1163	Feb 1.1131	Mar 1.1100	Apr 1.0954	May 1.0927	Jun 1.0800	Jul 1.0800	Aug 1.0776	Sep 1.0849	Oct 1.0927	Nov 1.0982	Dec 1.1040 (40)
HLP (average)												1.0954 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (43)
Daily hot water use	Jan 107.0842	Feb 103.1902	Mar 99.2962	Apr 95.4022	May 91.5083	Jun 87.6143	Jul 87.6143	Aug 91.5083	Sep 95.4022	Oct 99.2962	Nov 103.1902	Dec 107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)												Total = Sum(45)m = 1531.6825 (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)

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	33.7456	29.5141	30.4559	26.5522	25.4775	21.9851	20.3724	23.3777	23.6569	27.5698	30.0946	(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	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5802	20.0555	16.3102	12.3479	9.2302	7.7925	8.4201	10.9448	14.6900	18.6524	21.7701	23.2078	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.6738	246.2024	239.8305	226.2654	209.1420	193.0483	182.2968	179.7682	186.1401	199.7052	216.8287	232.9223	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	(71)
Water heating gains (Table 5)	45.3570	43.9198	40.9354	36.8780	34.2439	30.5349	27.3823	31.4216	32.8568	37.0562	41.7981	43.9258	(72)
Total internal gains	374.4947	373.0614	359.9598	338.3751	315.4998	294.2595	280.9829	285.0183	296.5707	318.2975	343.2805	362.9396	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					7.9700	19.6403	0.6300	0.7000	0.7700		47.8385 (76)	
Southwest					0.6800	36.7938	0.6300	0.7000	0.7700		7.6464 (79)	
West					5.7600	19.6403	0.6300	0.7000	0.7700		34.5734 (80)	
Northwest					0.6800	11.2829	0.6300	0.7000	0.7700		2.3448 (81)	

Solar gains	92.4030	179.0126	291.9183	423.4166	518.2602	530.5725	505.0877	434.0533	338.5599	211.5231	114.8668	76.2301 (83)
Total gains	466.8977	552.0740	651.8781	761.7917	833.7600	824.8319	786.0707	719.0717	635.1306	529.8206	458.1474	439.1696 (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	62.2097	62.3869	62.5615	63.3948	63.5532	64.3010	64.3010	64.4414	64.0109	63.5532	63.2336	62.9029		
alpha	5.1473	5.1591	5.1708	5.2263	5.2369	5.2867	5.2867	5.2961	5.2674	5.2369	5.2156	5.1935		
util living area	0.9991	0.9977	0.9921	0.9669	0.8856	0.7186	0.5477	0.6152	0.8746	0.9861	0.9981	0.9994	(86)	
MIT	19.7147	19.8683	20.1385	20.4977	20.7928	20.9518	20.9905	20.9832	20.8590	20.4573	20.0212	19.6926	(87)	
Th 2	19.9875	19.9901	19.9927	20.0046	20.0068	20.0172	20.0172	20.0191	20.0132	20.0068	20.0023	19.9976	(88)	
util rest of house	0.9988	0.9969	0.9892	0.9539	0.8428	0.6302	0.4315	0.4953	0.8108	0.9788	0.9973	0.9992	(89)	
MIT 2	18.8089	18.9643	19.2350	19.5956	19.8660	19.9950	20.0148	20.0143	19.9324	19.5631	19.1270	18.7949	(90)	
Living area fraction									fLA = Living area / (4) =			0.1961	(91)	
MIT	18.9866	19.1416	19.4122	19.7725	20.0478	20.1826	20.2061	20.2043	20.1141	19.7385	19.3024	18.9710	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9866	19.1416	19.4122	19.7725	20.0478	20.1826	20.2061	20.2043	20.1141	19.7385	19.3024	18.9710	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	466.1472	549.8440	643.3513	723.8520	704.3593	532.9453	357.2212	373.2099	519.8146	517.1489	456.5400	438.6575	(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	1517.1547	1467.0055	1326.3538	1102.1583	844.1124	557.9414	360.4068	379.3832	603.7875	924.0688	1240.1191	1509.0549	(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	781.9496	616.3325	508.1538	272.3805	103.9763	0.0000	0.0000	0.0000	0.0000	302.7484	564.1770	796.3757	(98)	
Space heating												3946.0937	(98)	
Space heating per m2												42.6420	(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	939.4577	739.5731	757.9064	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8887	0.9416	0.9169	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	834.8790	696.3824	694.9377	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1065.0884	1017.6703	941.2201	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														

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Calculation Type: New Build (As Built)



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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	165.7508	239.0382	183.2341	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												588.0230 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	41.4377	59.7595	45.8085	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												147.0058 (107)
Energy for space heating												1.5886 (108)
Energy for space cooling												42.6420 (99)
Total												1.5886 (108)
Target Fabric Energy Efficiency (TFEE)												44.2306 (109)
												50.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (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)					40.0000 / (5) = 0.1805 (8)
Pressure test					Yes
Measured/design AP50					4.8900
Infiltration rate					0.4250 (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) =	0.3932 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.4128	0.3833	0.3932	0.3735	0.3735	0.3637	0.3539	0.3440	0.3342	0.3637	0.3440	0.3637 (22b)
	0.5852	0.5735	0.5773	0.5698	0.5698	0.5661	0.5626	0.5592	0.5558	0.5661	0.5592	0.5661 (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			1.9600	0.9000	1.7640		(26)
Window (Uw = 1.40)			11.9400	1.3258	15.8295		(27)
French (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500 (28a)
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520 (29a)
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300 (30)
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m ²)			190.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296		(33)
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000 (32)
GF Masonry			41.2600			39.0000	1609.1400 (32c)
GF Timber			34.3700			9.0000	309.3300 (32c)
1F Timber			81.4300			9.0000	732.8700 (32c)
1F Metal			34.9000			20.0000	698.0000 (32c)
Internal Floor			45.7700			18.0000	823.8600 (32d)
Internal Floor			45.7700			18.0000	823.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17303.7820 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							186.9871 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5835 (36)
Total fabric heat loss						(33) + (36) =	63.0131 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	42.7855	41.9273	42.2063	41.6553	41.6553	41.3904	41.1326	40.8819	40.6382	41.3904	40.8819	41.3904 (38)
Average = Sum(39)m / 12 =	105.7986	104.9404	105.2194	104.6684	104.6684	104.4035	104.1457	103.8950	103.6513	104.4035	103.8950	104.4035 (39)
												104.5077 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1433	1.1340	1.1370	1.1311	1.1311	1.1282	1.1254	1.1227	1.1201	1.1282	1.1227	1.1282 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (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	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum (45)m =		1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0464	18.9901	20.9755	20.2193	20.8354	20.0965	20.7248	20.7965	20.1634	20.9175	20.3157	21.0249 (61)
Total heat required for water heating calculated for each month												
Solar input	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (62)
Solar input (sum of months) = Sum(63)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 (63)
Output from w/h	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	58.0635	50.9284	52.8984	46.6012	45.0736	39.4244	37.0581	41.7783	42.0569	48.3680	52.1681	56.3920 (65)
												1778 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.4505	50.1388	40.7756	30.8698	23.0755	19.4813	21.0503	27.3619	36.7251	46.6310	54.4252	58.0194 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.6923	367.4663	357.9559	337.7096	312.1522	288.1318	272.0848	268.3108	277.8211	298.0675	323.6249	347.6452 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566 (71)
Water heating gains (Table 5)	78.0424	75.7863	71.1000	64.7239	60.5828	54.7560	49.8092	56.1536	58.4124	65.0108	72.4557	75.7958 (72)
Total internal gains	607.9758	603.1821	579.6223	543.0939	505.6012	472.1599	452.7350	461.6170	482.7493	519.4999	560.2965	591.2511 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
East					4.8200	25.1925	0.7100	0.7000	0.7700	41.8224 (76)		
Southwest					0.6800	45.1778	0.7100	0.7000	0.7700	10.5809 (79)		
West					5.7600	25.1925	0.7100	0.7000	0.7700	49.9786 (80)		
Northwest					0.6800	14.6176	0.7100	0.7000	0.7700	3.4235 (81)		
East					3.1500	25.1925	0.7100	0.7000	0.7700	27.3320 (76)		
Solar gains	133.1375	219.5422	360.2956	524.0978	608.1362	675.6123	638.3866	563.2690	440.7991	279.7715	164.9897	107.9449 (83)
Total gains	741.1133	822.7244	939.9179	1067.1918	1113.7374	1147.7722	1091.1215	1024.8860	923.5484	799.2714	725.2862	699.1960 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	45.4317	45.8032	45.6818	45.9222	45.9222	46.0387	46.1527	46.2641	46.3729	46.0387	46.2641	46.0387
alpha	4.0288	4.0535	4.0455	4.0615	4.0615	4.0692	4.0768	4.0843	4.0915	4.0692	4.0843	4.0692
util living area	0.9799	0.9691	0.9344	0.8475	0.7038	0.5006	0.3681	0.3899	0.6465	0.8819	0.9628	0.9830 (86)
MIT	19.7597	19.9184	20.2439	20.6192	20.8653	20.9739	20.9942	20.9929	20.9287	20.6211	20.1548	19.7477 (87)
Th 2	19.9656	19.9732	19.9707	19.9755	19.9755	19.9779	19.9801	19.9823	19.9845	19.9779	19.9823	19.9779 (88)
util rest of house	0.9750	0.9617	0.9188	0.8131	0.6427	0.4179	0.2739	0.2908	0.5625	0.8456	0.9521	0.9787 (89)
MIT 2	18.3457	18.5784	19.0376	19.5492	19.8513	19.9615	19.9780	19.9797	19.9316	19.5679	18.9275	18.3373 (90)
Living area fraction	18.6230	18.8413	19.2742	19.7590	20.0502	20.1600	20.1773	20.1784	20.1272	19.7745	19.1682	18.6139 (92)
MIT	18.6230	18.8413	19.2742	19.7590	20.0502	20.1600	20.1773	20.1784	20.1272	19.7745	19.1682	18.6139 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4730	18.6913	19.1242	19.6090	19.9002	20.0100	20.0273	20.0284	19.9772	19.6245	19.0182	18.4639 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9651	0.9493	0.9027	0.7990	0.6378	0.4205	0.2783	0.2954	0.5618	0.8304	0.9386	0.9698 (94)
Ext temp.	715.2205	781.0006	848.4254	852.6658	710.3912	482.6917	303.6529	302.7471	518.8772	663.7160	680.7750	678.0880 (95)
Heat loss rate W	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Month fracti	1436.0078	1405.2833	1275.6987	1058.0975	774.5646	491.7449	304.8688	304.2500	546.9880	858.6680	1155.1239	1405.6800 (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)
	536.2658	419.5179	317.8913	147.9109	47.7450	0.0000	0.0000	0.0000	0.0000	145.0443	341.5312	541.3285 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	2497.2348 (98)
RHI space heating demand	2497 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (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							4 * 10 =	40.0000 (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) =						40.0000 / (5) =	0.1805 (8)				
Pressure test							Yes					
Measured/design AP50								4.8900				
Infiltration rate								0.4250 (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) =	0.3932 (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	0.5013	0.4915	0.4816	0.4325	0.4227	0.3735	0.3735	0.3637	0.3932	0.4227	0.4423	0.4620 (22b)
Effective ac	0.6256	0.6208	0.6160	0.5935	0.5893	0.5698	0.5698	0.5661	0.5773	0.5893	0.5978	0.6067 (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			1.9600	0.9000	1.7640			(26)					
Window (Uw = 1.40)			11.9400	1.3258	15.8295			(27)					
French (Uw = 1.40)			3.1500	1.3258	4.1761			(27)					
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500	(28a)					
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520	(29a)					
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300	(30)					
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900	(30)					
Total net area of external elements Aum(A, m2)			190.4400					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296			(33)					
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000	(32)					
GF Masonry			41.2600			39.0000	1609.1400	(32c)					
GF Timber			34.3700			9.0000	309.3300	(32c)					
1F Timber			81.4300			9.0000	732.8700	(32c)					
1F Metal			34.9000			20.0000	698.0000	(32c)					
Internal Floor			45.7700			18.0000	823.8600	(32d)					
Internal Floor			45.7700			18.0000	823.8600	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17303.7820	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							186.9871	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5835	(36)					
Total fabric heat loss						(33) + (36) =	63.0131	(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	45.7416	45.3849	45.0352	43.3930	43.0857	41.6553	41.6553	41.3904	42.2063	43.0857	43.7073	44.3571	(38)
Heat transfer coeff	108.7547	108.3979	108.0483	106.4060	106.0988	104.6684	104.6684	104.4035	105.2194	106.0988	106.7204	107.3702	(39)
Average = Sum(39)m / 12 =												106.4046	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1752	1.1714	1.1676	1.1498	1.1465	1.1311	1.1311	1.1282	1.1370	1.1465	1.1532	1.1603	(40)
HLP (average)												1.1498	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (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	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum (45)m =		1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0464	18.9901	20.9755	20.2193	20.8354	20.0965	20.7248	20.7965	20.1634	20.9175	20.3157	21.0249 (61)
Total heat required for water heating calculated for each month	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (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	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (64)
Heat gains from water heating, kWh/month	58.0635	50.9284	52.8984	46.6012	45.0736	39.4244	37.0581	41.7783	42.0569	48.3680	52.1681	56.3920 (65)
Total per year (kWh/year) = Sum (64)m =												1777.7885 (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	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.4505	50.1388	40.7756	30.8698	23.0755	19.4813	21.0503	27.3619	36.7251	46.6310	54.4252	58.0194 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.6923	367.4663	357.9559	337.7096	312.1522	288.1318	272.0848	268.3108	277.8211	298.0675	323.6249	347.6452 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566 (71)
Water heating gains (Table 5)	78.0424	75.7863	71.1000	64.7239	60.5828	54.7560	49.8092	56.1536	58.4124	65.0108	72.4557	75.7958 (72)
Total internal gains	607.9758	603.1821	579.6223	543.0939	505.6012	472.1599	452.7350	461.6170	482.7493	519.4999	560.2965	591.2511 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
East					4.8200	19.6403	0.7100	0.7000			0.7700			32.6050 (76)
Southwest					0.6800	36.7938	0.7100	0.7000			0.7700			8.6173 (79)
West					5.7600	19.6403	0.7100	0.7000			0.7700			38.9636 (80)
Northwest					0.6800	11.2829	0.7100	0.7000			0.7700			2.6425 (81)
East					3.1500	19.6403	0.7100	0.7000			0.7700			21.3082 (76)
Solar gains	104.1367	201.7443	328.9873	477.1838	584.0710	597.9468	569.2258	489.1712	381.5517	238.3831	129.4531	85.9101	(83)	
Total gains	712.1125	804.9264	908.6096	1020.2778	1089.6722	1070.1067	1021.9608	950.7883	864.3009	757.8831	689.7496	677.1612	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.1968	44.3422	44.4857	45.1723	45.3031	45.9222	45.9222	46.0387	45.6818	45.3031	45.0393	44.7667
alpha	3.9465	3.9561	3.9657	4.0115	4.0202	4.0615	4.0615	4.0692	4.0455	4.0202	4.0026	3.9844
util living area	0.9847	0.9742	0.9481	0.8814	0.7592	0.5875	0.4407	0.4891	0.7265	0.9185	0.9745	0.9873 (86)
MIT	19.5950	19.7879	20.1097	20.5079	20.7978	20.9475	20.9871	20.9806	20.8753	20.4833	19.9726	19.5645 (87)
Th 2	19.9399	19.9430	19.9460	19.9603	19.9630	19.9755	19.9755	19.9779	19.9707	19.9630	19.9576	19.9519 (88)
util rest of house	0.9810	0.9680	0.9355	0.8532	0.7058	0.5067	0.3427	0.3875	0.6505	0.8925	0.9673	0.9842 (89)
MIT 2	18.0899	18.3701	18.8315	19.3915	19.7631	19.9375	19.9698	19.9683	19.8674	19.3741	18.6499	18.0540 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.3851	18.6482	19.0822	19.6105	19.9661	20.1356	20.1693	20.1669	20.0651	19.5917	18.9093	18.3502 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2351	18.4982	18.9322	19.4605	19.8161	19.9856	20.0193	20.0169	19.9151	19.4417	18.7593	18.2002 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9724	0.9564	0.9198	0.8371	0.6974	0.5076	0.3470	0.3915	0.6460	0.8760	0.9557	0.9766 (94)
Useful gains	692.4820	769.8113	835.7785	854.0947	759.9851	543.1563	354.5962	372.2517	558.2824	663.9265	659.1701	661.3490 (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	1515.5061	1474.0123	1343.2742	1123.7005	861.1052	563.7047	357.8918	377.6144	611.8634	938.0884	1244.2824	1503.2083 (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	612.3299	473.2231	377.5768	194.1162	75.2334	0.0000	0.0000	0.0000	0.0000	203.9764	421.2809	626.3433 (98)
Space heating												2984.0799 (98)

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Space heating per m2 (98) / (4) = 32.2464 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3315.6444 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	612.3299	473.2231	377.5768	194.1162	75.2334	0.0000	0.0000	0.0000	0.0000	203.9764	421.2809	626.3433	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	680.3666	525.8034	419.5298	215.6847	83.5926	0.0000	0.0000	0.0000	0.0000	226.6405	468.0899	695.9370	(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	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168	(64)
Efficiency of water heater (217)m	89.2289	89.1511	88.9732	88.5578	87.8218	86.7000	86.7000	86.7000	86.7000	88.5679	89.0588	86.7000	(216)
Fuel for water heating, kWh/month	201.5592	177.0926	184.6595	163.9278	160.2442	142.5096	134.4811	150.8755	151.6607	170.1044	181.8319	89.2587	(217)
Water heating fuel used												195.8542	(219)
Annual totals kWh/year												2014.8006	(219)
Space heating fuel - main system													
Space heating fuel - secondary												3315.6444	(211)
												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)													398.7732 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 + 0.81 + 908 + 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5215.9287	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3315.6444	3.4800	115.3844	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2014.8006	3.4800	70.1151	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	398.7732	13.1900	52.5982	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			290.3948	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)				
SAP value		$[(255) \times (256)] / [(4) + 45.0] =$	0.8868	(257)
			87.6296	
SAP rating (Section 12)			88	(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	3315.6444	0.2160	716.1792	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2014.8006	0.2160	435.1969	(264)
Space and water heating			1151.3761	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.7732	0.5190	206.9633	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			1091.9421	(272)
CO2 emissions per m2			11.8000	(273)
EI value			89.3616	
EI rating			89	(274)
EI band			B	

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Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8812 = 3.949$, stars = 4
Water heating environmental impact	$0.216 / 0.8812 = 0.2451$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (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)					40.0000 / (5) = 0.1805 (8)
Pressure test					Yes
Measured/design AP50					4.8900
Infiltration rate					0.4250 (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)	=	0.3932 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.4128	0.3833	0.3932	0.3735	0.3735	0.3637	0.3539	0.3440	0.3342	0.3637	0.3440	0.3637 (22b)
	0.5852	0.5735	0.5773	0.5698	0.5698	0.5661	0.5626	0.5592	0.5558	0.5661	0.5592	0.5661 (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			1.9600	0.9000	1.7640		(26)
Window (Uw = 1.40)			11.9400	1.3258	15.8295		(27)
French (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500 (28a)
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520 (29a)
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300 (30)
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m ²)			190.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296		(33)
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000 (32)
GF Masonry			41.2600			39.0000	1609.1400 (32c)
GF Timber			34.3700			9.0000	309.3300 (32c)
1F Timber			81.4300			9.0000	732.8700 (32c)
1F Metal			34.9000			20.0000	698.0000 (32c)
Internal Floor			45.7700			18.0000	823.8600 (32d)
Internal Floor			45.7700			18.0000	823.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17303.7820 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							186.9871 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5835 (36)
Total fabric heat loss						(33) + (36) =	63.0131 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	42.7855	41.9273	42.2063	41.6553	41.6553	41.3904	41.1326	40.8819	40.6382	41.3904	40.8819	41.3904 (38)
Average = Sum(39)m / 12 =	105.7986	104.9404	105.2194	104.6684	104.6684	104.4035	104.1457	103.8950	103.6513	104.4035	103.8950	104.4035 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1433	1.1340	1.1370	1.1311	1.1311	1.1282	1.1254	1.1227	1.1201	1.1282	1.1227	1.1282 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (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	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum (45)m =		1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0464	18.9901	20.9755	20.2193	20.8354	20.0965	20.7248	20.7965	20.1634	20.9175	20.3157	21.0249 (61)
Total heat required for water heating calculated for each month	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (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 =								130.8090	131.4899	150.6578	161.9373	174.8168 (64)
Output from w/h	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (64)
Heat gains from water heating, kWh/month	58.0635	50.9284	52.8984	46.6012	45.0736	39.4244	37.0581	41.7783	42.0569	48.3680	52.1681	56.3920 (65)
Total per year (kWh/year) = Sum (64)m =								41.7783	42.0569	48.3680	52.1681	1777.7885 (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	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.4505	50.1388	40.7756	30.8698	23.0755	19.4813	21.0503	27.3619	36.7251	46.6310	54.4252	58.0194 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.6923	367.4663	357.9559	337.7096	312.1522	288.1318	272.0848	268.3108	277.8211	298.0675	323.6249	347.6452 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566 (71)
Water heating gains (Table 5)	78.0424	75.7863	71.1000	64.7239	60.5828	54.7560	49.8092	56.1536	58.4124	65.0108	72.4557	75.7958 (72)
Total internal gains	607.9758	603.1821	579.6223	543.0939	505.6012	472.1599	452.7350	461.6170	482.7493	519.4999	560.2965	591.2511 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	

East					4.8200	25.1925	0.7100	0.7000	0.7700		41.8224 (76)	
Southwest					0.6800	45.1778	0.7100	0.7000	0.7700		10.5809 (79)	
West					5.7600	25.1925	0.7100	0.7000	0.7700		49.9786 (80)	
Northwest					0.6800	14.6176	0.7100	0.7000	0.7700		3.4235 (81)	
East					3.1500	25.1925	0.7100	0.7000	0.7700		27.3320 (76)	

Solar gains	133.1375	219.5422	360.2956	524.0978	608.1362	675.6123	638.3866	563.2690	440.7991	279.7715	164.9897	107.9449 (83)
Total gains	741.1133	822.7244	939.9179	1067.1918	1113.7374	1147.7722	1091.1215	1024.8860	923.5484	799.2714	725.2862	699.1960 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.4317	45.8032	45.6818	45.9222	45.9222	46.0387	46.1527	46.2641	46.3729	46.0387	46.2641	46.0387
alpha	4.0288	4.0535	4.0455	4.0615	4.0615	4.0692	4.0768	4.0843	4.0915	4.0692	4.0843	4.0692
util living area	0.9799	0.9691	0.9344	0.8475	0.7038	0.5006	0.3681	0.3899	0.6465	0.8819	0.9628	0.9830 (86)
MIT	19.7597	19.9184	20.2439	20.6192	20.8653	20.9739	20.9942	20.9929	20.9287	20.6211	20.1548	19.7477 (87)
Th 2	19.9656	19.9732	19.9707	19.9755	19.9755	19.9779	19.9801	19.9823	19.9845	19.9779	19.9823	19.9779 (88)
util rest of house	0.9750	0.9617	0.9188	0.8131	0.6427	0.4179	0.2739	0.2908	0.5625	0.8456	0.9521	0.9787 (89)
MIT 2	18.3457	18.5784	19.0376	19.5492	19.8513	19.9615	19.9780	19.9797	19.9316	19.5679	18.9275	18.3373 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.6230	18.8413	19.2742	19.7590	20.0502	20.1600	20.1773	20.1784	20.1272	19.7745	19.1682	18.6139 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4730	18.6913	19.1242	19.6090	19.9002	20.0100	20.0273	20.0284	19.9772	19.6245	19.0182	18.4639 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9651	0.9493	0.9027	0.7990	0.6378	0.4205	0.2783	0.2954	0.5618	0.8304	0.9386	0.9698 (94)
Useful gains	715.2205	781.0006	848.4254	852.6658	710.3912	482.6917	303.6529	302.7471	518.8772	663.7160	680.7750	678.0880 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1436.0078	1405.2833	1275.6987	1058.0975	774.5646	491.7449	304.8688	304.2500	546.9880	858.6680	1155.1239	1405.6800 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	536.2658	419.5179	317.8913	147.9109	47.7450	0.0000	0.0000	0.0000	0.0000	145.0443	341.5312	541.3285 (98)
Space heating												2497.2348 (98)

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Space heating per m2 (98) / (4) = 26.9855 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2774.7053 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	536.2658	419.5179	317.8913	147.9109	47.7450	0.0000	0.0000	0.0000	0.0000	145.0443	341.5312	541.3285	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	595.8508	466.1310	353.2125	164.3454	53.0500	0.0000	0.0000	0.0000	0.0000	161.1603	379.4791	601.4761	(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	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168	(64)
Efficiency of water heater (217)m	89.1478	89.0730	88.8477	88.3346	87.5129	86.7000	86.7000	86.7000	86.7000	88.2879	88.9115	86.7000	(216)
Fuel for water heating, kWh/month	201.7426	177.2479	184.9202	164.3419	160.8098	142.5096	134.4811	150.8755	151.6607	170.6438	182.1332	196.0457	(219)
Water heating fuel used												2017.4121	(219)
Annual totals kWh/year													
Space heating fuel - main system													2774.7053 (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)													398.7732 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993			-668.0993 (233)
Total delivered energy for all uses													4597.7914 (238)

10a. Fuel costs - using BEDF prices (450)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2774.7053	3.9300	109.0459 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2017.4121	3.9300	79.2843 (247)
Pumps and fans for heating	75.0000	17.5600	13.1700 (249)
Energy for lighting	398.7732	17.5600	70.0246 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-668.0993	17.5600	-117.3182 (252)
Total energy cost			242.2066 (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	2774.7053	0.2160	599.3364 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2017.4121	0.2160	435.7610 (264)
Space and water heating			1035.0974 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	398.7732	0.5190	206.9633 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	0.5190	-346.7435 (269)
Total kg/year			934.2421 (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	2774.7053	1.2200	3385.1405 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2017.4121	1.2200	2461.2428 (264)
Space and water heating			5846.3833 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	398.7732	3.0700	1224.2338 (268)

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Energy saving/generation technologies			
PV Unit	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			5249.8022 (272)
Primary energy kWh/m2/year			56.7301 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 31	-195 kg (20.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£31 2.11 kg/m²	B 89	B 91
Total Savings	£31 2.11 kg/m²		

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

Fuel prices for cost data on this page from database revision number 450 TEST (30 Oct 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£83	£92	-£9
Mains gas	£276	£236	£40
Space heating	£210	£210	£0
Water heating	£79	£48	£31
Lighting	£70	£70	£0
Generated (PV)	-£117	-£117	£0
Total cost of fuels	£242	£211	£31
Total cost of uses	£242	£211	£31
Delivered energy	50 kWh/m²	39 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	57 kWh/m²	45 kWh/m²	12 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (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)					40.0000 / (5) = 0.1805 (8)
Pressure test					Yes
Measured/design AP50					4.8900
Infiltration rate					0.4250 (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) =	0.3932 (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	0.5013	0.4915	0.4816	0.4325	0.4227	0.3735	0.3735	0.3637	0.3932	0.4227	0.4423	0.4620 (22b)
Effective ac	0.6256	0.6208	0.6160	0.5935	0.5893	0.5698	0.5698	0.5661	0.5773	0.5893	0.5978	0.6067 (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			1.9600	0.9000	1.7640		(26)
Window (Uw = 1.40)			11.9400	1.3258	15.8295		(27)
French (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500 (28a)
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520 (29a)
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300 (30)
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m ²)			190.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296		(33)
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000 (32)
GF Masonry			41.2600			39.0000	1609.1400 (32c)
GF Timber			34.3700			9.0000	309.3300 (32c)
1F Timber			81.4300			9.0000	732.8700 (32c)
1F Metal			34.9000			20.0000	698.0000 (32c)
Internal Floor			45.7700			18.0000	823.8600 (32d)
Internal Floor			45.7700			18.0000	823.8600 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		17303.7820 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							186.9871 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5835 (36)
Total fabric heat loss						(33) + (36) =	63.0131 (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	45.7416	45.3849	45.0352	43.3930	43.0857	41.6553	41.6553	41.3904	42.2063	43.0857	43.7073	44.3571 (38)
Heat transfer coeff	108.7547	108.3979	108.0483	106.4060	106.0988	104.6684	104.6684	104.4035	105.2194	106.0988	106.7204	107.3702 (39)
Average = Sum(39)m / 12 =												106.4046 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1752	1.1714	1.1676	1.1498	1.1465	1.1311	1.1311	1.1282	1.1370	1.1465	1.1532	1.1603 (40)
HLP (average)												1.1498 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum (45)m =		1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0464	18.9901	20.9755	20.2193	20.8354	20.0965	20.7248	20.7965	20.1634	20.9175	20.3157	21.0249 (61)
Total heat required for water heating calculated for each month	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (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												1.1841 (H8)
Utilisation factor												0.5703 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.3492 (H14)
Volume ratio Veff/V												0.7704 (H15)
Solar storage volume factor												0.9478 (H16)
Solar input												-861.9358 (H17)
Solar input	-24.9944	-41.7085	-71.0344	-95.2000	-117.6116	-115.6310	-114.1028	-99.6922	-78.0790	-53.3188	-29.6470	-20.9161 (63)
Solar input (sum of months) = Sum (63)m =												-861.9358 (63)
Output from w/h	154.8547	116.1715	93.2631	49.9708	23.1177	7.9249	2.4922	31.1168	53.4109	97.3390	132.2903	153.9008 (64)
Total per year (kWh/year) = Sum (64)m =												915.8527 (64)
Heat gains from water heating, kWh/month	58.0635	50.9284	52.8984	46.6012	45.0736	39.4244	37.0581	41.7783	42.0569	48.3680	52.1681	56.3920 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.4505	50.1388	40.7756	30.8698	23.0755	19.4813	21.0503	27.3619	36.7251	46.6310	54.4252	58.0194	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.6923	367.4663	357.9559	337.7096	312.1522	288.1318	272.0848	268.3108	277.8211	298.0675	323.6249	347.6452	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	(71)
Water heating gains (Table 5)	78.0424	75.7863	71.1000	64.7239	60.5828	54.7560	49.8092	56.1536	58.4124	65.0108	72.4557	75.7958	(72)
Total internal gains	607.9758	603.1821	579.6223	543.0939	505.6012	472.1599	452.7350	461.6170	482.7493	519.4999	560.2965	591.2511	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W

East				4.8200	19.6403		0.7100		0.7000		0.7700		32.6050 (76)
Southwest				0.6800	36.7938		0.7100		0.7000		0.7700		8.6173 (79)
West				5.7600	19.6403		0.7100		0.7000		0.7700		38.9636 (80)
Northwest				0.6800	11.2829		0.7100		0.7000		0.7700		2.6425 (81)
East				3.1500	19.6403		0.7100		0.7000		0.7700		21.3082 (76)

Solar gains	104.1367	201.7443	328.9873	477.1838	584.0710	597.9468	569.2258	489.1712	381.5517	238.3831	129.4531		85.9101 (83)
Total gains	712.1125	804.9264	908.6096	1020.2778	1089.6722	1070.1067	1021.9608	950.7883	864.3009	757.8831	689.7496		677.1612 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.1968	44.3422	44.4857	45.1723	45.3031	45.9222	45.9222	46.0387	45.6818	45.3031	45.0393	44.7667
alpha	3.9465	3.9561	3.9657	4.0115	4.0202	4.0615	4.0615	4.0692	4.0455	4.0202	4.0026	3.9844
util living area	0.9847	0.9742	0.9481	0.8814	0.7592	0.5875	0.4407	0.4891	0.7265	0.9185	0.9745	0.9873 (86)
MIT	19.5950	19.7879	20.1097	20.5079	20.7978	20.9475	20.9871	20.9806	20.8753	20.4833	19.9726	19.5645 (87)
Th 2	19.9399	19.9430	19.9460	19.9603	19.9630	19.9755	19.9755	19.9779	19.9707	19.9630	19.9576	19.9519 (88)
util rest of house	0.9810	0.9680	0.9355	0.8532	0.7058	0.5067	0.3427	0.3875	0.6505	0.8925	0.9673	0.9842 (89)
MIT 2	18.0899	18.3701	18.8315	19.3915	19.7631	19.9375	19.9698	19.9683	19.8674	19.3741	18.6499	18.0540 (90)
Living area fraction	18.3851	18.6482	19.0822	19.6105	19.9661	20.1356	20.1693	20.1669	20.0651	19.5917	18.9093	18.3502 (92)
									fLA = Living area / (4) =			0.1961 (91)
MIT												

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Temperature adjustment													-0.1500
adjusted MIT	18.2351	18.4982	18.9322	19.4605	19.8161	19.9856	20.0193	20.0169	19.9151	19.4417	18.7593		18.2002 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9724	0.9564	0.9198	0.8371	0.6974	0.5076	0.3470	0.3915	0.6460	0.8760	0.9557	0.9766	(94)
Useful gains	692.4820	769.8113	835.7785	854.0947	759.9851	543.1563	354.5962	372.2517	558.3024	663.9265	659.1701	661.3490	(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													
	1515.5061	1474.0123	1343.2742	1123.7005	861.1052	563.7047	357.8918	377.6144	611.8634	938.0884	1244.2824	1503.2083	(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													
	612.3299	473.2231	377.5768	194.1162	75.2334	0.0000	0.0000	0.0000	0.0000	203.9764	421.2809	626.3433	(98)
Space heating													2984.0799 (98)
Space heating per m2													(98) / (4) = 32.2464 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3315.6444 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	612.3299	473.2231	377.5768	194.1162	75.2334	0.0000	0.0000	0.0000	0.0000	203.9764	421.2809	626.3433	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	680.3666	525.8034	419.5298	215.6847	83.5926	0.0000	0.0000	0.0000	0.0000	226.6405	468.0899	695.9370	(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	154.8547	116.1715	93.2631	49.9708	23.1177	7.9249	2.4922	31.1168	53.4109	97.3390	132.2903	153.9008	(64)
Efficiency of water heater (217)m	89.3138	89.3298	89.3265	89.3041	89.2019	86.7000	86.7000	86.7000	86.7000	88.9068	89.1887	86.7000	(216)
Fuel for water heating, kWh/month	173.3827	130.0478	104.4069	55.9557	25.9161	9.1406	2.8745	35.8902	61.6042	109.4844	148.3263	172.2847	(219)
Water heating fuel used													1029.3142 (219)
Annual totals kWh/year													
Space heating fuel - main system													3315.6444 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													398.7732 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895			-588.2895 (233)
Total delivered energy for all uses													4280.4422 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3315.6444	3.4800	115.3844	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1029.3142	3.4800	35.8201	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	398.7732	13.1900	52.5982	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			262.6949	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.8022 (257)
SAP value			88.8096
SAP rating (Section 12)			89 (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	3315.6444	0.2160	716.1792 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1029.3142	0.2160	222.3319 (264)
Space and water heating			938.5110 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	398.7732	0.5190	206.9633 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			905.0271 (272)
CO2 emissions per m2			9.7800 (273)
EI value			91.1827
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (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)					40.0000 / (5) = 0.1805 (8)
Pressure test					Yes
Measured/design AP50					4.8900
Infiltration rate					0.4250 (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)	=	0.3932 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.4128	0.3833	0.3932	0.3735	0.3735	0.3637	0.3539	0.3440	0.3342	0.3637	0.3440	0.3637 (22b)
	0.5852	0.5735	0.5773	0.5698	0.5698	0.5661	0.5626	0.5592	0.5558	0.5661	0.5592	0.5661 (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			1.9600	0.9000	1.7640		(26)
Window (Uw = 1.40)			11.9400	1.3258	15.8295		(27)
French (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500 (28a)
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520 (29a)
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300 (30)
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m ²)			190.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296		(33)
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000 (32)
GF Masonry			41.2600			39.0000	1609.1400 (32c)
GF Timber			34.3700			9.0000	309.3300 (32c)
1F Timber			81.4300			9.0000	732.8700 (32c)
1F Metal			34.9000			20.0000	698.0000 (32c)
Internal Floor			45.7700			18.0000	823.8600 (32d)
Internal Floor			45.7700			18.0000	823.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17303.7820 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							186.9871 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5835 (36)
Total fabric heat loss						(33) + (36) =	63.0131 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	42.7855	41.9273	42.2063	41.6553	41.6553	41.3904	41.1326	40.8819	40.6382	41.3904	40.8819	Dec 41.3904 (38)
Heat transfer coeff	105.7986	104.9404	105.2194	104.6684	104.6684	104.4035	104.1457	103.8950	103.6513	104.4035	103.8950	104.4035 (39)
Average = Sum(39)m / 12 =												104.5077 (39)

HLP	Jan 1.1433	Feb 1.1340	Mar 1.1370	Apr 1.1311	May 1.1311	Jun 1.1282	Jul 1.1254	Aug 1.1227	Sep 1.1201	Oct 1.1282	Nov 1.1227	Dec 1.1282 (40)
HLP (average)												1.1293 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (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	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum (45)m =		1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0464	18.9901	20.9755	20.2193	20.8354	20.0965	20.7248	20.7965	20.1634	20.9175	20.3157	21.0249 (61)
Total heat required for water heating calculated for each month	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3251 (H8)
Utilisation factor												0.5298 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.3492 (H14)
Volume ratio Veff/V												0.7704 (H15)
Solar storage volume factor												0.9478 (H16)
Solar input												-896.2419 (H17)
Solar input	-29.2376	-41.5740	-71.4557	-96.4103	-113.2396	-120.9578	-118.4140	-105.9842	-82.9783	-57.3683	-34.5804	-24.0418 (63)
Solar input (sum of months) = Sum (63)m =												-896.2419 (63)
Output from w/h	150.6116	116.3060	92.8418	48.7605	27.4897	2.5980	0.0000	24.8249	48.5116	93.2895	127.3570	150.7750 (64)
Total per year (kWh/year) = Sum (64)m =												883.3655 (64)
Heat gains from water heating, kWh/month	58.0635	50.9284	52.8984	46.6012	45.0736	39.4244	37.0581	41.7783	42.0569	48.3680	52.1681	56.3920 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.4505	50.1388	40.7756	30.8698	23.0755	19.4813	21.0503	27.3619	36.7251	46.6310	54.4252	58.0194	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.6923	367.4663	357.9559	337.7096	312.1522	288.1318	272.0848	268.3108	277.8211	298.0675	323.6249	347.6452	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	(71)
Water heating gains (Table 5)	78.0424	75.7863	71.1000	64.7239	60.5828	54.7560	49.8092	56.1536	58.4124	65.0108	72.4557	75.7958	(72)
Total internal gains	607.9758	603.1821	579.6223	543.0939	505.6012	472.1599	452.7350	461.6170	482.7493	519.4999	560.2965	591.2511	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					4.8200	25.1925		0.7100	0.7000	0.7700		41.8224 (76)	
Southwest					0.6800	45.1778		0.7100	0.7000	0.7700		10.5809 (79)	
West					5.7600	25.1925		0.7100	0.7000	0.7700		49.9786 (80)	
Northwest					0.6800	14.6176		0.7100	0.7000	0.7700		3.4235 (81)	
East					3.1500	25.1925		0.7100	0.7000	0.7700		27.3320 (76)	
Solar gains	133.1375	219.5422	360.2956	524.0978	608.1362	675.6123	638.3866	563.2690	440.7991	279.7715	164.9897	107.9449 (83)	
Total gains	741.1133	822.7244	939.9179	1067.1918	1113.7374	1147.7722	1091.1215	1024.8860	923.5484	799.2714	725.2862	699.1960 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.4317	45.8032	45.6818	45.9222	45.9222	46.0387	46.1527	46.2641	46.3729	46.0387	46.2641	46.0387
alpha	4.0288	4.0535	4.0455	4.0615	4.0615	4.0692	4.0768	4.0843	4.0915	4.0692	4.0843	4.0692
util living area	0.9799	0.9691	0.9344	0.8475	0.7038	0.5006	0.3681	0.3899	0.6465	0.8819	0.9628	0.9830 (86)
MIT	19.7597	19.9184	20.2439	20.6192	20.8653	20.9739	20.9942	20.9929	20.9287	20.6211	20.1548	19.7477 (87)
Th 2	19.9656	19.9732	19.9707	19.9755	19.9755	19.9779	19.9801	19.9823	19.9845	19.9779	19.9823	19.9779 (88)
util rest of house	0.9750	0.9617	0.9188	0.8131	0.6427	0.4179	0.2739	0.2908	0.5625	0.8456	0.9521	0.9787 (89)
MIT 2	18.3457	18.5784	19.0376	19.5492	19.8513	19.9615	19.9780	19.9797	19.9316	19.5679	18.9275	18.3373 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.6230	18.8413	19.2742	19.7590	20.0502	20.1600	20.1773	20.1784	20.1272	19.7745	19.1682	18.6139 (92)

Temperature adjustment													-0.1500
adjusted MIT	18.4730	18.6913	19.1242	19.6090	19.9002	20.0100	20.0273	20.0284	19.9772	19.6245	19.0182	18.4639	(93)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2774.7053	0.2160	599.3364 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	993.4129	0.2160	214.5772 (264)
Space and water heating			813.9135 (265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	398.7732	0.5190	206.9633 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	0.5190	-346.7435 (269)
Total kg/year			739.0083 (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	2774.7053	1.2200	3385.1405 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	993.4129	1.2200	1211.9638 (264)
Space and water heating			4597.1043 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	398.7732	3.0700	1224.2338 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			4154.0232 (272)
Primary energy kWh/m2/year			44.8889 (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	West
Overshading	Average or unknown
Thermal mass parameter	187.0 (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	292.44 (P1)
Transmission heat loss coefficient	63.01 (37)
Summer heat loss coefficient	355.46 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	4.8200	125.2818	0.7100	0.7000	0.9000	243.0952
South West	0.6800	127.3119	0.7100	0.7000	0.9000	34.8513
West	5.7600	125.2818	0.7100	0.7000	0.9000	290.5038
North West	0.6800	106.0502	0.7100	0.7000	0.9000	29.0310
East	3.1500	125.2818	0.7100	0.7000	0.9000	158.8693

total: 756.3506

	Jun	Jul	Aug	
Solar gains	814	756	665	(P3)
Internal gains	469	450	459	
Total summer gains	1283	1206	1124	(P5)

Summer gain/loss ratio	3.61	3.39	3.16	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 187.0)	0.69	0.69	0.69	
Threshold temperature	19.70	21.38	21.15	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight