

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Harcourt - Semi			Issued on Date	15/12/2022
Assessment Reference	Harcourt - Semi	Prop Type Ref			
Property	Plot, 2 Bed, K, WC, B				
SAP Rating	85 B	DER	15.17	TER	19.55
Environmental	90 B	% DER<TER	22.41		
CO ₂ Emissions (t/year)	0.77	DFEE	40.45	TFEE	51.48
General Requirements Compliance	Pass	% DFEE<TFEE	21.42		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk			Assessor ID	Q920-0001
Client					

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 60 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) 19.55 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.17 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)40.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	OK
Openings	1.22 (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:	4.01 (design value)	
Maximum	10.0	OK

4 Heating efficiency

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

Data from database

Ideal LOGIC COMBI ESP1 30

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power: 0.1700 0.1800

Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average

Windows facing North East: 3.56 m², No overhang

Windows facing South East: 0.66 m², No overhang

Windows facing South West: 5.55 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.09 W/m²K

Floor U-value 0.11 W/m²K

Door U-value 1.00 W/m²K

Window U-value 0.90 W/m²K

Thermal bridging y-value 0.031 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (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) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			6.6200	1.1450	7.5802		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			30.1700	0.1100	3.3187	75.0000	2262.7500 (28a)					
100mm Knauf Supafil 34	76.5600	11.7500	64.8100	0.2500	16.2025	52.8000	3421.9680 (29a)					
Plane Ceiling-500mm Loft Roll	30.1700		30.1700	0.0900	2.7153	9.0000	271.5300 (30)					
Total net area of external elements Aum(A, m2)			136.9000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9728		(33)					
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)					
Timber GF			59.3600			9.0000	534.2400 (32c)					
Timber FF			59.4200			9.0000	534.7800 (32c)					
Internal Floor			30.1700			12.6000	380.1420 (32d)					
Internal Ceiling			30.1700			9.0000	271.5300 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9313.1400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							154.3444 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1980 (36)					
Total fabric heat loss						(33) + (36) =	40.1708 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 24.4920	Feb 24.4920	Mar 24.4920	Apr 24.4920	May 24.4920	Jun 24.4920	Jul 24.4920	Aug 24.4920	Sep 24.4920	Oct 24.4920	Nov 24.4920	Dec 24.4920 (38)
Heat transfer coeff	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628 (39)
Average = Sum(39)m / 12 =												64.6628 (39)
HLP	Jan 1.0716	Feb 1.0716	Mar 1.0716	Apr 1.0716	May 1.0716	Jun 1.0716	Jul 1.0716	Aug 1.0716	Sep 1.0716	Oct 1.0716	Nov 1.0716	Dec 1.0716 (40)
HLP (average)												1.0716 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9912 (42)
Average daily hot water use (litres/day)												81.4917 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)										Total = Sum (45)m =		1282.1824 (45)
Distribution loss (46)m = 0.15 x (45)m	19.9402	17.4399	17.9964	15.6897	15.0546	12.9910	12.0381	13.8138	13.9788	16.2910	17.7829	19.3111 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.5744	13.1424	14.5161	14.0089	14.4476	13.9489	14.3935	14.4285	13.9816	14.4877	14.0655	14.5631 (61)
Total heat required for water heating calculated for each month	147.5093	129.4081	134.4919	118.6067	114.8116	100.5554	94.6472	106.5209	107.1738	123.0942	132.6180	143.3035 (62)
WWHRS	-41.4664	-36.4796	-37.2352	-30.6732	-28.5000	-23.5247	-19.9344	-24.1276	-24.8204	-30.6563	-35.4746	-40.0708 eq. (G10)
Total of WWHRS savings												-372.9632
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	106.0429	92.9285	97.2567	87.9335	86.3116	77.0307	74.7128	82.3932	82.3534	92.4380	97.1434	103.2326 (64)
Total per year (kWh/year) = Sum (64)m =												1079.7774 (64)
Heat gains from water heating, kWh/month	47.8445	41.9439	43.5210	38.2810	36.9829	32.2839	30.2827	34.2278	34.4818	39.7336	42.9351	46.4469 (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	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1277	14.3245	11.6494	8.8194	6.5926	5.5657	6.0140	7.8172	10.4922	13.3223	15.5491	16.5759 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	173.8036	175.6071	171.0623	161.3868	149.1733	137.6943	130.0256	128.2221	132.7669	142.4424	154.6559	166.1349 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562 (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)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492 (71)
Water heating gains (Table 5)	64.3071	62.4166	58.4959	53.1680	49.7083	44.8387	40.7026	46.0051	47.8914	53.4054	59.6321	62.4287 (72)
Total internal gains	310.1068	308.2166	297.0761	279.2427	261.3426	243.9672	232.6107	237.9129	247.0190	265.0385	285.7055	301.0080 (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			
Northeast				3.5600	11.2829	0.4600	0.0000	0.7700	14.2272 (75)			
Southeast				0.6600	36.7938	0.4600	0.0000	0.7700	8.6014 (77)			
Southwest				2.4000	36.7938	0.4600	0.0000	0.7700	31.2777 (79)			
Southwest				3.1500	36.7938	0.4300	0.0000	0.7700	38.3747 (79)			

Solar gains	92.4810	162.2551	234.5568	311.6669	368.2969	374.0808	357.1385	313.5985	261.0572	182.7108	111.6315	78.5876 (83)
Total gains	402.5878	470.4717	531.6329	590.9096	629.6395	618.0481	589.7491	551.5114	508.0762	447.7494	397.3370	379.5956 (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	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073
alpha	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672
util living area	0.9830	0.9695	0.9418	0.8803	0.7673	0.6095	0.4646	0.5120	0.7320	0.9116	0.9714	0.9861 (86)
MIT	19.4416	19.6675	20.0047	20.4026	20.7307	20.9154	20.9760	20.9656	20.8309	20.3978	19.8318	19.3781 (87)
Th 2	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241 (88)
util rest of house	0.9795	0.9633	0.9299	0.8555	0.7204	0.5344	0.3689	0.4141	0.6640	0.8877	0.9646	0.9833 (89)
MIT 2	17.9474	18.2733	18.7558	19.3107	19.7415	19.9558	20.0112	20.0042	19.8716	19.3170	18.5145	17.8554 (90)
Living area fraction	18.2180	18.5258	18.9820	19.5085	19.9207	20.1296	20.1860	20.1784	20.0454	19.5128	18.7531	18.1312 (91)
MIT	18.2180	18.5258	18.9820	19.5085	19.9207	20.1296	20.1860	20.1784	20.0454	19.5128	18.7531	18.1312 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0680	18.3758	18.8320	19.3585	19.7707	19.9796	20.0360	20.0284	19.8954	19.3628	18.6031	17.9812 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	390.2747	446.5417	484.4572	493.5917	444.9836	328.0276	218.2794	228.6408	332.2789	388.3414	377.7173	369.8838 (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	890.2791	871.3836	797.4233	676.2753	521.8713	347.8630	222.1809	234.6198	374.7460	566.6250	743.8218	891.1315 (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	372.0033	285.4938	232.8468	131.5322	57.2044	0.0000	0.0000	0.0000	0.0000	132.6430	263.5952	387.8083 (98)

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Space heating 1863.1270 (98)
 Space heating per m2 (98) / (4) = 30.8771 (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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2058.7039 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	372.0033	285.4938	232.8468	131.5322	57.2044	0.0000	0.0000	0.0000	0.0000	132.6430	263.5952	387.8083	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	411.0533	315.4627	257.2893	145.3394	63.2093	0.0000	0.0000	0.0000	0.0000	146.5669	291.2654	428.5175	(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	106.0429	92.9285	97.2567	87.9335	86.3116	77.0307	74.7128	82.3932	82.3534	92.4380	97.1434	103.2326	(64)
Efficiency of water heater	89.7701	89.6926	89.5331	89.1901	88.5480	87.3000	87.3000	87.3000	87.3000	89.1578	89.6154	89.8079	(216)
(217)m	89.7701	89.6926	89.5331	89.1901	88.5480	87.3000	87.3000	87.3000	87.3000	89.1578	89.6154	89.8079	(217)
Fuel for water heating, kWh/month	118.1272	103.6077	108.6265	98.5911	97.4744	88.2368	85.5817	94.3794	94.3338	103.6790	108.4004	114.9482	(219)
Water heating fuel used												1215.9863	(219)
Annual totals kWh/year													
Space heating fuel - main system												2058.7039	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												41.3203	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												116.3203	(231)
Electricity for lighting (calculated in Appendix L)												284.8198	(232)
Total delivered energy for all uses												3675.8303	(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	2058.7039	0.2160	444.6800	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1215.9863	0.2160	262.6530	(264)
Space and water heating			707.3331	(265)
Pumps and fans	116.3203	0.5190	60.3702	(267)
Energy for lighting	284.8198	0.5190	147.8215	(268)
Total CO2, kg/year			915.5248	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1700	(273)

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

DER	15.1700	ZC1
Total Floor Area	60.3400	TFA
Assumed number of occupants	1.9912	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	17.0687	ZC2
CO2 emissions from cooking, equation (L16)	2.7642	ZC3
Total CO2 emissions	35.0028	ZC4
Residual CO2 emissions offset from biofuel CHP	0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	35.0028	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (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											2 * 10 =	20.0000 (7a)		
Number of passive vents											0 * 10 =	0.0000 (7b)		
Number of flueless gas fires											0 * 40 =	0.0000 (7c)		
												Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										20.0000	/ (5) =	0.1347 (8)	
Pressure test												Yes		
Measured/design AP50												5.0000		
Infiltration rate												0.3847 (18)		
Number of sides sheltered												1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)		
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3559 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)		
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)		
	0.4538	0.4449	0.4360	0.3915	0.3826	0.3381	0.3381	0.3292	0.3559	0.3826	0.4004	0.4182 (22b)		
Effective ac	0.6029	0.5989	0.5950	0.5766	0.5732	0.5572	0.5572	0.5542	0.5633	0.5732	0.5801	0.5874 (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			1.9800	1.0000	1.9800		(26)					
TER Opening Type (Uw = 1.40)			9.7700	1.3258	12.9527		(27)					
FP McCann System			30.1700	0.1300	3.9221		(28a)					
100mm Knauf Supafil 34	76.5600	11.7500	64.8100	0.1800	11.6658		(29a)					
Plane Ceiling-500mm Loft Roll	30.1700		30.1700	0.1300	3.9221		(30)					
Total net area of external elements Aum(A, m2)			136.9000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4427		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0612 (36)					
Total fabric heat loss						(33) + (36) =	42.5039 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.5346	Feb 29.3388	Mar 29.1469	Apr 28.2454	May 28.0767	Jun 27.2915	Jul 27.2915	Aug 27.1461	Sep 27.5940	Oct 28.0767	Nov 28.4179	Dec 28.7747 (38)
Heat transfer coeff	72.0385	71.8427	71.6508	70.7492	70.5806	69.7954	69.7954	69.6500	70.0978	70.5806	70.9218	71.2785 (39)
Average = Sum(39)m / 12 =												70.7484 (39)
HLP	Jan 1.1939	Feb 1.1906	Mar 1.1875	Apr 1.1725	May 1.1697	Jun 1.1567	Jul 1.1567	Aug 1.1543	Sep 1.1617	Oct 1.1697	Nov 1.1754	Dec 1.1813 (40)
HLP (average)												1.1725 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9912 (42)
Average daily hot water use (litres/day)												81.4917 (43)
Daily hot water use	Jan 89.6409	Feb 86.3812	Mar 83.1216	Apr 79.8619	May 76.6022	Jun 73.3426	Jul 73.3426	Aug 76.6022	Sep 79.8619	Oct 83.1216	Nov 86.3812	Dec 89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)										Total = Sum(45)m =		1282.1824 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.9402	17.4399	17.9964	15.6897	15.0546	12.9910	12.0381	13.8138	13.9788	16.2910	17.7829	19.3111 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	45.6800	39.7590	42.3578	39.3840	39.0357	36.1689	37.3746	39.0357	39.3840	42.3578	42.5990	45.6800 (61)
Solar input	178.6149	156.0247	162.3336	143.9818	139.3997	122.7755	117.6283	131.1280	132.5761	150.9644	161.1515	174.4204 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	178.6149	156.0247	162.3336	143.9818	139.3997	122.7755	117.6283	131.1280	132.5761	150.9644	161.1515	174.4204 (64)
	55.6209	48.5981	50.4814	44.6248	43.1300	37.8389	36.0280	40.3796	40.8324	46.7011	50.0684	54.2262 (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	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1277	14.3245	11.6494	8.8194	6.5926	5.5657	6.0140	7.8172	10.4922	13.3223	15.5491	16.5759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	173.8036	175.6071	171.0623	161.3868	149.1733	137.6943	130.0256	128.2221	132.7669	142.4424	154.6559	166.1349	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	(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)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	(71)
Water heating gains (Table 5)	74.7592	72.3186	67.8514	61.9788	57.9704	52.5541	48.4247	54.2737	56.7117	62.7703	69.5395	72.8846	(72)
Total internal gains	320.5590	318.1187	306.4315	288.0535	269.6047	251.6826	240.3328	246.1814	255.8393	274.4035	295.6130	311.4639	(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				
Northeast					3.5600	11.2829	0.6300		0.7000		0.7700	12.2756 (75)				
Southeast					0.6600	36.7938	0.6300		0.7000		0.7700	7.4215 (77)				
Southwest					5.5500	36.7938	0.6300		0.7000		0.7700	62.4079 (79)				
Solar gains					82.1051	143.9328	207.7656	275.5852	325.2481	330.1846	315.3000	277.1350	231.0765	161.9966	99.0855	69.7843 (83)
Total gains					402.6640	462.0514	514.1971	563.6387	594.8529	581.8671	555.6328	523.3164	486.9158	436.4000	394.6985	381.2483 (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	58.1672	58.3257	58.4820	59.2272	59.3687	60.0366	60.0366	60.1619	59.7776	59.3687	59.0831	58.7874	
alpha	4.8778	4.8884	4.8988	4.9485	4.9579	5.0024	5.0024	5.0108	4.9852	4.9579	4.9389	4.9192	
util living area	0.9968	0.9932	0.9836	0.9529	0.8703	0.7079	0.5396	0.5908	0.8301	0.9678	0.9934	0.9976	(86)
MIT	19.7621	19.9220	20.1758	20.5056	20.7849	20.9460	20.9887	20.9826	20.8766	20.5166	20.0802	19.7353	(87)
Th 2	19.9249	19.9275	19.9301	19.9421	19.9443	19.9548	19.9548	19.9567	19.9508	19.9443	19.9398	19.9350	(88)
util rest of house	0.9957	0.9909	0.9778	0.9354	0.8229	0.6153	0.4182	0.4674	0.7543	0.9523	0.9908	0.9967	(89)
MIT 2	18.2860	18.5205	18.8897	19.3654	19.7344	19.9190	19.9507	19.9497	19.8533	19.3902	18.7608	18.2541	(90)
Living area fraction	18.5534	18.7744	19.1227	19.5719	19.9247	20.1051	20.1387	20.1368	20.0387	19.5942	18.9998	18.5224	(91)
MIT	18.5534	18.7744	19.1227	19.5719	19.9247	20.1051	20.1387	20.1368	20.0387	19.5942	18.9998	18.5224	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5534	18.7744	19.1227	19.5719	19.9247	20.1051	20.1387	20.1368	20.0387	19.5942	18.9998	18.5224	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9937	0.9874	0.9719	0.9276	0.8218	0.6297	0.4402	0.4897	0.7617	0.9454	0.9874	0.9951	(94)
Useful gains	400.1085	456.2078	499.7263	522.8445	488.8708	366.3807	244.5905	256.2539	370.8620	412.5711	389.7196	379.3638	(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	1026.7956	996.7720	904.4242	755.0282	580.5032	384.2279	246.9852	260.2648	416.2893	634.8152	843.9560	1020.8784	(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	466.2552	363.2591	301.0952	167.1723	68.1745	0.0000	0.0000	0.0000	0.0000	165.3497	327.0502	477.2869	(98)
Space heating												2335.6431	(98)
Space heating per m2												38.7080	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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												2500.6886 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	466.2552	363.2591	301.0952	167.1723	68.1745	0.0000	0.0000	0.0000	0.0000	165.3497	327.0502	477.2869 (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)	499.2025	388.9284	322.3718	178.9854	72.9920	0.0000	0.0000	0.0000	0.0000	177.0339	350.1608	511.0138 (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	178.6149	156.0247	162.3336	143.9818	139.3997	122.7755	117.6283	131.1280	132.5761	150.9644	161.1515	174.4204 (64)
Efficiency of water heater (217)m	87.3567	87.1081	86.5852	85.4279	83.3588	80.3000	80.3000	80.3000	80.3000	85.2807	86.7964	80.3000 (216)
Fuel for water heating, kWh/month	204.4662	179.1163	187.4843	168.5418	167.2286	152.8960	146.4860	163.2976	165.1010	177.0206	185.6662	199.4379 (219)
Water heating fuel used												2096.7426 (219)
Annual totals kWh/year												
Space heating fuel - main system												2500.6886 (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)												284.8198 (232)
Total delivered energy for all uses												4957.2510 (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	2500.6886	0.2160	540.1487 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2096.7426	0.2160	452.8964 (264)
Space and water heating			993.0451 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	284.8198	0.5190	147.8215 (268)
Total CO2, kg/m2/year			1179.7916 (272)
Emissions per m2 for space and water heating			16.4575 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4498 (272b)
Emissions per m2 for pumps and fans			0.6451 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4575 * 1.00) + 2.4498 + 0.6451, rounded to 2 d.p.			19.5500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (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					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1347 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3352 (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) =	0.3101 (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	0.3954	0.3876	0.3799	0.3411	0.3334	0.2946	0.2946	0.2868	0.3101	0.3334	0.3489	0.3644 (22b)
Effective ac	0.5782	0.5751	0.5721	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5609	0.5664 (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			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			6.6200	1.1450	7.5802		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			30.1700	0.1100	3.3187	75.0000	2262.7500 (28a)
100mm Knauf Supafil 34	76.5600	11.7500	64.8100	0.2500	16.2025	52.8000	3421.9680 (29a)
Plane Ceiling-500mm Loft Roll	30.1700		30.1700	0.0900	2.7153	9.0000	271.5300 (30)
Total net area of external elements Aum(A, m ²)			136.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9728		(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)
Timber GF			59.3600			9.0000	534.2400 (32c)
Timber FF			59.4200			9.0000	534.7800 (32c)
Internal Floor			30.1700			12.6000	380.1420 (32d)
Internal Ceiling			30.1700			9.0000	271.5300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9313.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							154.3444 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1980 (36)
Total fabric heat loss							(33) + (36) = 40.1708 (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	28.3206	28.1719	28.0262	27.3417	27.2136	26.6175	26.6175	26.5071	26.8471	27.2136	27.4727	27.7435 (38)
Heat transfer coeff	68.4913	68.3426	68.1969	67.5125	67.3844	66.7883	66.7883	66.6779	67.0179	67.3844	67.6435	67.9143 (39)
Average = Sum(39)m / 12 =												67.5119 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1351	1.1326	1.1302	1.1189	1.1167	1.1069	1.1069	1.1050	1.1107	1.1167	1.1210	1.1255 (40)
HLP (average)												1.1189 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9912 (42)
Average daily hot water use (litres/day)												81.4917 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1282.1824 (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	28.2487	24.7065	25.4949	22.2270	21.3274	18.4039	17.0539	19.5696	19.8033	23.0789	25.1924	27.3573 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1277	14.3245	11.6494	8.8194	6.5926	5.5657	6.0140	7.8172	10.4922	13.3223	15.5491	16.5759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	173.8036	175.6071	171.0623	161.3868	149.1733	137.6943	130.0256	128.2221	132.7669	142.4424	154.6559	166.1349	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	(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)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	(71)
Water heating gains (Table 5)	37.9686	36.7656	34.2673	30.8709	28.6658	25.5610	22.9219	26.3032	27.5046	31.0200	34.9895	36.7706	(72)
Total internal gains	280.7684	279.5656	269.8475	253.9455	237.3002	221.6895	211.8300	215.2110	223.6323	239.6532	258.0629	272.3499	(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
Northeast			3.5600		11.2829		0.4600		0.0000		0.7700		14.2272 (75)
Southeast			0.6600		36.7938		0.4600		0.0000		0.7700		8.6014 (77)
Southwest			2.4000		36.7938		0.4600		0.0000		0.7700		31.2777 (79)
Southwest			3.1500		36.7938		0.4300		0.0000		0.7700		38.3747 (79)
Solar gains	92.4810	162.2551	234.5568	311.6669	368.2969	374.0808	357.1385	313.5985	261.0572	182.7108	111.6315	78.5876	(83)
Total gains	373.2494	441.8207	504.4043	565.6125	605.5971	595.7703	568.9685	528.8095	484.6895	422.3640	369.6944	350.9375	(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	37.7710	37.8531	37.9340	38.3186	38.3914	38.7341	38.7341	38.7982	38.6014	38.3914	38.2444	38.0919	
alpha	3.5181	3.5235	3.5289	3.5546	3.5594	3.5823	3.5823	3.5865	3.5734	3.5594	3.5496	3.5395	
util living area	0.9868	0.9756	0.9522	0.8975	0.7938	0.6385	0.4919	0.5424	0.7626	0.9272	0.9776	0.9893	(86)
MIT	19.2628	19.4998	19.8593	20.3043	20.6715	20.8939	20.9684	20.9551	20.7908	20.3041	19.6986	19.2174	(87)
Th 2	19.9723	19.9743	19.9762	19.9855	19.9872	19.9952	19.9952	19.9967	19.9921	19.9872	19.9837	19.9800	(88)
util rest of house	0.9840	0.9704	0.9419	0.8748	0.7480	0.5610	0.3895	0.4386	0.6954	0.9062	0.9720	0.9870	(89)
MIT 2	18.3904	18.6261	18.9804	19.4149	19.7498	19.9363	19.9837	19.9789	19.8617	19.4249	18.8322	18.3512	(90)
Living area fraction	18.5485	18.7843	19.1396	19.5760	19.9168	20.1097	20.1620	20.1557	20.0300	19.5842	18.9891	18.5081	(91)
Temperature adjustment	18.5485	18.7843	19.1396	19.5760	19.9168	20.1097	20.1620	20.1557	20.0300	19.5842	18.9891	18.5081	(92)
adjusted MIT	18.5485	18.7843	19.1396	19.5760	19.9168	20.1097	20.1620	20.1557	20.0300	19.5842	18.9891	18.5081	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9787	0.9627	0.9313	0.8640	0.7444	0.5704	0.4072	0.4559	0.6982	0.8959	0.9647	0.9825	(94)
Ext temp.	365.3082	425.3282	469.7664	488.6641	450.8322	339.8491	231.6972	241.0892	338.4169	378.3940	356.6564	344.7805	(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	975.8967	948.8920	861.9839	720.7607	553.6831	367.9861	237.9019	250.4231	397.4180	605.3922	804.2200	971.7221	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	454.2778	351.8349	291.8098	167.1095	76.5210	0.0000	0.0000	0.0000	0.0000	168.8866	322.2457	466.4445	(98)
												2299.1299	(98)
												38.1029	(99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	627.8097	494.2332	506.7518	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8541	0.9066	0.8850	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	536.2330	448.0896	448.5000	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	770.9897	738.2228	692.5294	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	169.0249	215.8591	181.5579	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			566.4418 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	42.2562	53.9648	45.3895	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												141.6105 (107)
Energy for space heating												2.3469 (108)
Energy for space cooling												38.1029 (99)
Total												2.3469 (108)
Dwelling Fabric Energy Efficiency (DFEE)												40.4498 (109)
												40.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (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																2 * 10 =	20.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000	/ (5) =	0.1347 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3847 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.9250 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3559 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4538	0.4449	0.4360	0.3915	0.3826	0.3381	0.3381	0.3292	0.3559	0.3826	0.4004	0.4182	(22b)				
Effective ac	0.6029	0.5989	0.5950	0.5766	0.5732	0.5572	0.5572	0.5542	0.5633	0.5732	0.5801	0.5874	(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			1.9800	1.0000	1.9800		(26)					
TER Opening Type (Uw = 1.40)			9.7700	1.3258	12.9527		(27)					
FP McCann System			30.1700	0.1300	3.9221		(28a)					
100mm Knauf Supafil 34	76.5600	11.7500	64.8100	0.1800	11.6658		(29a)					
Plane Ceiling-500mm Loft Roll	30.1700		30.1700	0.1300	3.9221		(30)					
Total net area of external elements Aum(A, m2)			136.9000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	34.4427		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0612 (36)					
Total fabric heat loss						(33) + (36) =	42.5039 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.5346	Feb 29.3388	Mar 29.1469	Apr 28.2454	May 28.0767	Jun 27.2915	Jul 27.2915	Aug 27.1461	Sep 27.5940	Oct 28.0767	Nov 28.4179	Dec 28.7747 (38)
Heat transfer coeff	72.0385	71.8427	71.6508	70.7492	70.5806	69.7954	69.7954	69.6500	70.0978	70.5806	70.9218	71.2785 (39)
Average = Sum(39)m / 12 =												70.7484 (39)
HLP	Jan 1.1939	Feb 1.1906	Mar 1.1875	Apr 1.1725	May 1.1697	Jun 1.1567	Jul 1.1567	Aug 1.1543	Sep 1.1617	Oct 1.1697	Nov 1.1754	Dec 1.1813 (40)
HLP (average)												1.1725 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9912 (42)
Average daily hot water use (litres/day)												81.4917 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)										Total = Sum(45)m =		1282.1824 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	28.2487	24.7065	25.4949	22.2270	21.3274	18.4039	17.0539	19.5696	19.8033	23.0789	25.1924	27.3573 (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	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616	99.5616 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1277	14.3245	11.6494	8.8194	6.5926	5.5657	6.0140	7.8172	10.4922	13.3223	15.5491	16.5759 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	173.8036	175.6071	171.0623	161.3868	149.1733	137.6943	130.0256	128.2221	132.7669	142.4424	154.6559	166.1349 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562	32.9562 (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)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492 (71)
Water heating gains (Table 5)	37.9686	36.7656	34.2673	30.8709	28.6658	25.5610	22.9219	26.3032	27.5046	31.0200	34.9895	36.7706 (72)
Total internal gains	280.7684	279.5656	269.8475	253.9455	237.3002	221.6895	211.8300	215.2110	223.6323	239.6532	258.0629	272.3499 (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	
Northeast			3.5600	11.2829		0.6300	0.7000		0.7700		12.2756 (75)	
Southeast			0.6600	36.7938		0.6300	0.7000		0.7700		7.4215 (77)	
Southwest			5.5500	36.7938		0.6300	0.7000		0.7700		62.4079 (79)	
Solar gains	82.1051	143.9328	207.7656	275.5852	325.2481	330.1846	315.3000	277.1350	231.0765	161.9966	99.0855	69.7843 (83)
Total gains	362.8734	423.4984	477.6131	529.5307	562.5483	551.8740	527.1300	492.3460	454.7088	401.6497	357.1484	342.1342 (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	58.1672	58.3257	58.4820	59.2272	59.3687	60.0366	60.0366	60.1619	59.7776	59.3687	59.0831	58.7874
alpha	4.8778	4.8884	4.8988	4.9485	4.9579	5.0024	5.0024	5.0108	4.9852	4.9579	4.9389	4.9192
util living area	0.9980	0.9953	0.9879	0.9624	0.8893	0.7349	0.5656	0.6222	0.8575	0.9766	0.9958	0.9985 (86)
MIT	19.7016	19.8642	20.1233	20.4630	20.7579	20.9361	20.9861	20.9781	20.8544	20.4699	20.0237	19.6754 (87)
Th 2	19.9249	19.9275	19.9301	19.9421	19.9443	19.9548	19.9548	19.9567	19.9508	19.9443	19.9398	19.9350 (88)
util rest of house	0.9973	0.9937	0.9834	0.9478	0.8459	0.6428	0.4399	0.4950	0.7872	0.9647	0.9940	0.9980 (89)
MIT 2	18.7457	18.9097	19.1686	19.5091	19.7799	19.9253	19.9513	19.9505	19.8697	19.5224	19.0790	18.7277 (90)
Living area fraction									fLA = Living area / (4) =			0.1811 (91)
MIT	18.9188	19.0826	19.3415	19.6819	19.9570	20.1084	20.1387	20.1367	20.0481	19.6940	19.2501	18.8993 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9188	19.0826	19.3415	19.6819	19.9570	20.1084	20.1387	20.1367	20.0481	19.6940	19.2501	18.8993 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9964	0.9920	0.9802	0.9433	0.8465	0.6575	0.4629	0.5182	0.7949	0.9610	0.9924	0.9973 (94)
Ext temp.	361.5551	420.0932	468.1652	499.5063	476.2035	362.8741	243.9963	255.1178	361.4304	385.9806	354.4347	341.1965 (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	1053.1171	1018.9143	920.1053	762.8091	582.7857	384.4582	246.9866	260.2580	416.9480	641.8616	861.7053	1047.7472 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	514.5222	402.4078	336.2434	189.5780	79.2972	0.0000	0.0000	0.0000	0.0000	190.3754	365.2348	525.6737 (98)
												2603.3326 (98)
												43.1444 (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	656.0766	516.4859	529.3399	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8695	0.9281	0.9064	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	570.4323	479.3623	479.7836	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	719.6824	689.3207	649.9097	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	107.4601	156.2091	126.5738	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												390.2430 (104)

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Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	26.8650	39.0523	31.6435	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												97.5608 (107)
Space cooling per m2												1.6169 (108)
Energy for space heating												43.1444 (99)
Energy for space cooling												1.6169 (108)
Total												44.7612 (109)
Target Fabric Energy Efficiency (TFEE)												51.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (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) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			6.6200	1.1450	7.5802		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			30.1700	0.1100	3.3187	75.0000	2262.7500 (28a)					
100mm Knauf Supafil 34	76.5600	11.7500	64.8100	0.2500	16.2025	52.8000	3421.9680 (29a)					
Plane Ceiling-500mm Loft Roll	30.1700		30.1700	0.0900	2.7153	9.0000	271.5300 (30)					
Total net area of external elements Aum(A, m2)			136.9000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9728		(33)					
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)					
Timber GF			59.3600			9.0000	534.2400 (32c)					
Timber FF			59.4200			9.0000	534.7800 (32c)					
Internal Floor			30.1700			12.6000	380.1420 (32d)					
Internal Ceiling			30.1700			9.0000	271.5300 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9313.1400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							154.3444 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1980 (36)					
Total fabric heat loss						(33) + (36) =	40.1708 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 24.4920	Feb 24.4920	Mar 24.4920	Apr 24.4920	May 24.4920	Jun 24.4920	Jul 24.4920	Aug 24.4920	Sep 24.4920	Oct 24.4920	Nov 24.4920	Dec 24.4920 (38)
Heat transfer coeff	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628 (39)
Average = Sum(39)m / 12 =												64.6628 (39)
HLP	Jan 1.0716	Feb 1.0716	Mar 1.0716	Apr 1.0716	May 1.0716	Jun 1.0716	Jul 1.0716	Aug 1.0716	Sep 1.0716	Oct 1.0716	Nov 1.0716	Dec 1.0716 (40)
HLP (average)												1.0716 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9912 (42)
Average daily hot water use (litres/day)												81.4917 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)										Total = Sum (45)m =		1282.1824 (45)
Distribution loss (46)m = 0.15 x (45)m	19.9402	17.4399	17.9964	15.6897	15.0546	12.9910	12.0381	13.8138	13.9788	16.2910	17.7829	19.3111 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.5744	13.1424	14.5161	14.0089	14.4476	13.9489	14.3935	14.4285	13.9816	14.4877	14.0655	14.5631 (61)
Total heat required for water heating calculated for each month	147.5093	129.4081	134.4919	118.6067	114.8116	100.5554	94.6472	106.5209	107.1738	123.0942	132.6180	143.3035 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	147.5093	129.4081	134.4919	118.6067	114.8116	100.5554	94.6472	106.5209	107.1738	123.0942	132.6180	143.3035 (64)
RHI water heating demand										Total per year (kWh/year) = Sum (64)m =		1452.7406 (64)
Heat gains from water heating, kWh/month	47.8445	41.9439	43.5210	38.2810	36.9829	32.2839	30.2827	34.2278	34.4818	39.7336	42.9351	46.4469 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.3192	35.8112	29.1236	22.0484	16.4815	13.9143	15.0349	19.5430	26.2305	33.3057	38.8727	41.4398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.4084	262.1002	255.3168	240.8759	222.6467	205.5139	194.0681	191.3762	198.1596	212.6006	230.8297	247.9626 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386 (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)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492 (71)
Water heating gains (Table 5)	64.3071	62.4166	58.4959	53.1680	49.7083	44.8387	40.7026	46.0051	47.8914	53.4054	59.6321	62.4287 (72)
Total internal gains	455.7979	452.0912	434.6996	407.8556	380.5997	356.0302	341.5689	348.6876	364.0448	391.0749	421.0977	443.5943 (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
Northeast			3.5600		12.9236		0.4600		0.0000		0.7700		16.2960 (75)
Southeast			0.6600		40.4699		0.4600		0.0000		0.7700		9.4607 (77)
Southwest			2.4000		40.4699		0.4600		0.0000		0.7700		34.4027 (79)
Southwest			3.1500		40.4699		0.4300		0.0000		0.7700		42.2087 (79)
Solar gains	102.3681	161.8974	232.1447	319.7013	369.5572	402.2980	379.6920	339.9022	280.6891	194.9082	126.6420		86.1213 (83)
Total gains	558.1659	613.9886	666.8443	727.5568	750.1569	758.3282	721.2609	688.5898	644.7339	585.9831	547.7397		529.7156 (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	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073
Feb	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672
Mar	0.9484	0.9273	0.8792	0.7804	0.6231	0.4154	0.2761	0.2979	0.5454	0.7999	0.9162	0.9554 (86)
MIT	19.8637	20.0285	20.3322	20.6583	20.8863	20.9811	20.9970	20.9960	20.9467	20.6831	20.2283	19.8108 (87)
Th 2	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241 (88)
util rest of house	0.9386	0.9140	0.8572	0.7425	0.5635	0.3386	0.1901	0.2083	0.4658	0.7562	0.8984	0.9468 (89)
MIT 2	18.5523	18.7846	19.2077	19.6421	19.9190	20.0127	20.0232	20.0228	19.9853	19.6850	19.0718	18.4775 (90)
Living area fraction	18.7898	19.0099	19.4114	19.8262	20.0942	20.1881	20.1996	20.1991	20.1594	19.8658	19.2813	18.7190 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6398	18.8599	19.2614	19.6762	19.9442	20.0381	20.0496	20.0491	20.0094	19.7158	19.1313	18.5690 (93)

8. Space heating requirement

Utilisation	0.9207	0.8943	0.8370	0.7274	0.5583	0.3398	0.1923	0.2106	0.4645	0.7405	0.8782	0.9298 (94)
Useful gains	513.9303	549.1117	558.1474	529.2496	418.8284	257.6599	138.7313	145.0508	299.5005	433.8947	481.0060	492.5556 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	875.5217	857.4227	766.9918	632.1568	449.0330	261.1157	138.9992	145.4341	310.9910	524.7902	719.7781	870.9456 (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	269.0241	207.1850	155.3803	74.0931	22.4722	0.0000	0.0000	0.0000	0.0000	67.6262	171.9159	281.5222 (98)
Space heating												1249.2190 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

1249 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (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) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			6.6200	1.1450	7.5802		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			30.1700	0.1100	3.3187	75.0000	2262.7500 (28a)					
100mm Knauf Supafil 34	76.5600	11.7500	64.8100	0.2500	16.2025	52.8000	3421.9680 (29a)					
Plane Ceiling-500mm Loft Roll	30.1700		30.1700	0.0900	2.7153	9.0000	271.5300 (30)					
Total net area of external elements Aum(A, m2)			136.9000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9728		(33)					
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)					
Timber GF			59.3600			9.0000	534.2400 (32c)					
Timber FF			59.4200			9.0000	534.7800 (32c)					
Internal Floor			30.1700			12.6000	380.1420 (32d)					
Internal Ceiling			30.1700			9.0000	271.5300 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9313.1400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							154.3444 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1980 (36)					
Total fabric heat loss						(33) + (36) =	40.1708 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 24.4920	Feb 24.4920	Mar 24.4920	Apr 24.4920	May 24.4920	Jun 24.4920	Jul 24.4920	Aug 24.4920	Sep 24.4920	Oct 24.4920	Nov 24.4920	Dec 24.4920 (38)
Heat transfer coeff	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628 (39)
Average = Sum(39)m / 12 =												64.6628 (39)
HLP	Jan 1.0716	Feb 1.0716	Mar 1.0716	Apr 1.0716	May 1.0716	Jun 1.0716	Jul 1.0716	Aug 1.0716	Sep 1.0716	Oct 1.0716	Nov 1.0716	Dec 1.0716 (40)
HLP (average)												1.0716 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9912 (42)
Average daily hot water use (litres/day)												81.4917 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)										Total = Sum (45)m =		1282.1824 (45)
Distribution loss (46)m = 0.15 x (45)m	19.9402	17.4399	17.9964	15.6897	15.0546	12.9910	12.0381	13.8138	13.9788	16.2910	17.7829	19.3111 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.5744	13.1424	14.5161	14.0089	14.4476	13.9489	14.3935	14.4285	13.9816	14.4877	14.0655	14.5631 (61)
Total heat required for water heating calculated for each month	147.5093	129.4081	134.4919	118.6067	114.8116	100.5554	94.6472	106.5209	107.1738	123.0942	132.6180	143.3035 (62)
WWHRS	-41.4664	-36.4796	-37.2352	-30.6732	-28.5000	-23.5247	-19.9344	-24.1276	-24.8204	-30.6563	-35.4746	-40.0708 eq. (G10)
Total of WWHRS savings												-372.9632
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	106.0429	92.9285	97.2567	87.9335	86.3116	77.0307	74.7128	82.3932	82.3534	92.4380	97.1434	103.2326 (64)
Total per year (kWh/year) = Sum (64)m =												1079.7774 (64)
Heat gains from water heating, kWh/month	47.8445	41.9439	43.5210	38.2810	36.9829	32.2839	30.2827	34.2278	34.4818	39.7336	42.9351	46.4469 (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	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.3192	35.8112	29.1236	22.0484	16.4815	13.9143	15.0349	19.5430	26.2305	33.3057	38.8727	41.4398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.4084	262.1002	255.3168	240.8759	222.6467	205.5139	194.0681	191.3762	198.1596	212.6006	230.8297	247.9626 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386 (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)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492 (71)
Water heating gains (Table 5)	64.3071	62.4166	58.4959	53.1680	49.7083	44.8387	40.7026	46.0051	47.8914	53.4054	59.6321	62.4287 (72)
Total internal gains	455.7979	452.0912	434.6996	407.8556	380.5997	356.0302	341.5689	348.6876	364.0448	391.0749	421.0977	443.5943 (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	
Northeast				3.5600	11.2829	0.4600	0.0000			0.7700	14.2272 (75)	
Southeast				0.6600	36.7938	0.4600	0.0000			0.7700	8.6014 (77)	
Southwest				2.4000	36.7938	0.4600	0.0000			0.7700	31.2777 (79)	
Southwest				3.1500	36.7938	0.4300	0.0000			0.7700	38.3747 (79)	

Solar gains	92.4810	162.2551	234.5568	311.6669	368.2969	374.0808	357.1385	313.5985	261.0572	182.7108	111.6315	78.5876 (83)
Total gains	548.2789	614.3462	669.2564	719.5225	748.8966	730.1110	698.7073	662.2861	625.1020	573.7858	532.7292	522.1819 (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	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073
alpha	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672
util living area	0.9572	0.9352	0.8951	0.8174	0.6926	0.5339	0.3981	0.4357	0.6389	0.8433	0.9345	0.9634 (86)
MIT	19.7356	19.9373	20.2288	20.5574	20.8116	20.9452	20.9855	20.9797	20.8934	20.5703	20.0865	19.6713 (87)
Th 2	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241 (88)
util rest of house	0.9493	0.9237	0.8766	0.7856	0.6421	0.4628	0.3137	0.3487	0.5690	0.8087	0.9208	0.9566 (89)
MIT 2	18.3683	18.6545	19.0637	19.5101	19.8326	19.9813	20.0166	20.0128	19.9326	19.5391	18.9724	18.2767 (90)
Living area fraction	18.6159	18.8868	19.2747	19.6998	20.0100	20.1559	20.1921	20.1879	20.1067	19.7259	19.0923	18.5293 (91)
MIT	18.6159	18.8868	19.2747	19.6998	20.0100	20.1559	20.1921	20.1879	20.1067	19.7259	19.0923	18.5293 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4659	18.7368	19.1247	19.5498	19.8600	20.0059	20.0421	20.0379	19.9567	19.5759	18.9423	18.3793 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	511.4039	555.7076	572.9626	552.7228	474.0221	336.9224	220.2782	231.8037	352.4125	453.4174	480.2263	491.4369 (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	916.0084	894.7274	816.3495	688.6463	527.6457	349.5623	222.5748	235.2385	378.7078	580.4064	765.7556	916.8730 (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	301.0258	227.8213	181.0798	97.8649	39.8960	0.0000	0.0000	0.0000	0.0000	94.4798	205.5811	316.5245 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating
Space heating per m2

(98) / (4) = 1464.2732 (98)
24.2670 (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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1617.9814 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	301.0258	227.8213	181.0798	97.8649	39.8960	0.0000	0.0000	0.0000	0.0000	94.4798	205.5811	316.5245	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	332.6251	251.7362	200.0882	108.1381	44.0840	0.0000	0.0000	0.0000	0.0000	104.3976	227.1614	349.7508	(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	106.0429	92.9285	97.2567	87.9335	86.3116	77.0307	74.7128	82.3932	82.3534	92.4380	97.1434	103.2326	(64)
Efficiency of water heater	89.6440	89.5490	89.3555	88.9568	88.2868	87.3000	87.3000	87.3000	87.3000	88.8887	89.4479	89.6915	(216)
(217)m	118.2934	103.7739	108.8424	98.8497	97.7627	88.2368	85.5817	94.3794	94.3338	103.9930	108.6034	115.0975	(217)
Fuel for water heating, kWh/month													(219)
Water heating fuel used												1217.7476	(219)
Annual totals kWh/year													
Space heating fuel - main system												1617.9814	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												41.3203	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												116.3203	(231)
Electricity for lighting (calculated in Appendix L)												284.8198	(232)
Total delivered energy for all uses												3236.8692	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1617.9814	3.4800	56.3058	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1217.7476	3.4800	42.3776	(247)
Mechanical ventilation fans	41.3203	13.1900	5.4501	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	284.8198	13.1900	37.5677	(250)
Additional standing charges			120.0000	(251)
Total energy cost			271.5938	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	1.0829	(257)
SAP value	84.8940	
SAP rating (Section 12)	85	(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	1617.9814	0.2160	349.4840	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1217.7476	0.2160	263.0335	(264)
Space and water heating			612.5175	(265)
Pumps and fans	116.3203	0.5190	60.3702	(267)
Energy for lighting	284.8198	0.5190	147.8215	(268)
Total kg/year			820.7092	(272)
CO2 emissions per m2			13.6000	(273)
EI value			89.5600	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8859 = 3.928$, stars = 5
Water heating environmental impact	$0.216 / 0.8859 = 0.2438$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															4.0100		
Infiltration rate															0.2005 (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) =					0.1855 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate																	
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			6.6200	1.1450	7.5802		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			30.1700	0.1100	3.3187	75.0000	2262.7500 (28a)					
100mm Knauf Supafil 34	76.5600	11.7500	64.8100	0.2500	16.2025	52.8000	3421.9680 (29a)					
Plane Ceiling-500mm Loft Roll	30.1700		30.1700	0.0900	2.7153	9.0000	271.5300 (30)					
Total net area of external elements Aum(A, m2)			136.9000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9728		(33)					
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)					
Timber GF			59.3600			9.0000	534.2400 (32c)					
Timber FF			59.4200			9.0000	534.7800 (32c)					
Internal Floor			30.1700			12.6000	380.1420 (32d)					
Internal Ceiling			30.1700			9.0000	271.5300 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9313.1400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							154.3444 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1980 (36)					
Total fabric heat loss						(33) + (36) =	40.1708 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 24.4920	Feb 24.4920	Mar 24.4920	Apr 24.4920	May 24.4920	Jun 24.4920	Jul 24.4920	Aug 24.4920	Sep 24.4920	Oct 24.4920	Nov 24.4920	Dec 24.4920 (38)
Heat transfer coeff	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628 (39)
Average = Sum(39)m / 12 =												64.6628 (39)
HLP	Jan 1.0716	Feb 1.0716	Mar 1.0716	Apr 1.0716	May 1.0716	Jun 1.0716	Jul 1.0716	Aug 1.0716	Sep 1.0716	Oct 1.0716	Nov 1.0716	Dec 1.0716 (40)
HLP (average)												1.0716 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9912 (42)
Average daily hot water use (litres/day)												81.4917 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)										Total = Sum (45)m =		1282.1824 (45)
Distribution loss (46)m = 0.15 x (45)m	19.9402	17.4399	17.9964	15.6897	15.0546	12.9910	12.0381	13.8138	13.9788	16.2910	17.7829	19.3111 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.5744	13.1424	14.5161	14.0089	14.4476	13.9489	14.3935	14.4285	13.9816	14.4877	14.0655	14.5631 (61)
Total heat required for water heating calculated for each month	147.5093	129.4081	134.4919	118.6067	114.8116	100.5554	94.6472	106.5209	107.1738	123.0942	132.6180	143.3035 (62)
WWHRS	-41.4664	-36.4796	-37.2352	-30.6732	-28.5000	-23.5247	-19.9344	-24.1276	-24.8204	-30.6563	-35.4746	-40.0708 eq. (G10)
Total of WWHRS savings												-372.9632
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	106.0429	92.9285	97.2567	87.9335	86.3116	77.0307	74.7128	82.3932	82.3534	92.4380	97.1434	103.2326 (64)
Heat gains from water heating, kWh/month	47.8445	41.9439	43.5210	38.2810	36.9829	32.2839	30.2827	34.2278	34.4818	39.7336	42.9351	46.4469 (65)
Total per year (kWh/year) = Sum (64)m =												1079.7774 (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	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.3192	35.8112	29.1236	22.0484	16.4815	13.9143	15.0349	19.5430	26.2305	33.3057	38.8727	41.4398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.4084	262.1002	255.3168	240.8759	222.6467	205.5139	194.0681	191.3762	198.1596	212.6006	230.8297	247.9626 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386 (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)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492 (71)
Water heating gains (Table 5)	64.3071	62.4166	58.4959	53.1680	49.7083	44.8387	40.7026	46.0051	47.8914	53.4054	59.6321	62.4287 (72)
Total internal gains	455.7979	452.0912	434.6996	407.8556	380.5997	356.0302	341.5689	348.6876	364.0448	391.0749	421.0977	443.5943 (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	
Northeast					3.5600	12.9236	0.4600	0.0000	0.7700		16.2960 (75)	
Southeast					0.6600	40.4699	0.4600	0.0000	0.7700		9.4607 (77)	
Southwest					2.4000	40.4699	0.4600	0.0000	0.7700		34.4027 (79)	
Southwest					3.1500	40.4699	0.4300	0.0000	0.7700		42.2087 (79)	
Solar gains	102.3681	161.8974	232.1447	319.7013	369.5572	402.2980	379.6920	339.9022	280.6891	194.9082	126.6420	86.1213 (83)
Total gains	558.1659	613.9886	666.8443	727.5568	750.1569	758.3282	721.2609	688.5898	644.7339	585.9831	547.7397	529.7156 (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	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073
alpha	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672
util living area	0.9484	0.9273	0.8792	0.7804	0.6231	0.4154	0.2761	0.2979	0.5454	0.7999	0.9162	0.9554 (86)
MIT	19.8637	20.0285	20.3322	20.6583	20.8863	20.9811	20.9970	20.9960	20.9467	20.6831	20.2283	19.8108 (87)
Th 2	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241 (88)
util rest of house	0.9386	0.9140	0.8572	0.7425	0.5635	0.3386	0.1901	0.2083	0.4658	0.7562	0.8984	0.9468 (89)
MIT 2	18.5523	18.7846	19.2077	19.6421	19.9190	20.0127	20.0232	20.0228	19.9853	19.6850	19.0718	18.4775 (90)
Living area fraction	18.7898	19.0099	19.4114	19.8262	20.0942	20.1881	20.1996	20.1991	20.1594	19.8658	19.2813	18.7190 (91)
MIT	18.6398	18.8599	19.2614	19.6762	19.9442	20.0381	20.0496	20.0491	20.0094	19.7158	19.1313	18.5690 (93)
Temperature adjustment												-0.1500
adjusted MIT												18.5690 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	513.9303	549.1117	558.1474	529.2496	418.8284	257.6599	138.7313	145.0508	299.5005	433.8947	481.0060	492.5556 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	875.5217	857.4227	766.9918	632.1568	449.0330	261.1157	138.9992	145.4341	310.9910	524.7902	719.7781	870.9456 (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	269.0241	207.1850	155.3803	74.0931	22.4722	0.0000	0.0000	0.0000	0.0000	67.6262	171.9159	281.5222 (98)

FULL SAP CALCULATION PRINTOUT

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

Space heating 1249.2190 (98)
 Space heating per m2 (98) / (4) = 20.7030 (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 %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1380.3524	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	269.0241	207.1850	155.3803	74.0931	22.4722	0.0000	0.0000	0.0000	0.0000	67.6262	171.9159	281.5222	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	297.2642	228.9337	171.6909	81.8709	24.8311	0.0000	0.0000	0.0000	0.0000	74.7251	189.9623	311.0742	(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	106.0429	92.9285	97.2567	87.9335	86.3116	77.0307	74.7128	82.3932	82.3534	92.4380	97.1434	103.2326	(64)
Efficiency of water heater	89.5717	89.4843	89.2407	88.7348	87.9424	87.3000	87.3000	87.3000	87.3000	88.6240	89.3179	87.3000	(216)
(217)m	89.5717	89.4843	89.2407	88.7348	87.9424	87.3000	87.3000	87.3000	87.3000	88.6240	89.3179	89.6186	(217)
Fuel for water heating, kWh/month	118.3888	103.8488	108.9824	99.0970	98.1457	88.2368	85.5817	94.3794	94.3338	104.3036	108.7614	115.1911	(219)
Water heating fuel used												1219.2505	(219)
Annual totals kWh/year													
Space heating fuel - main system												1380.3524	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												41.3203	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												116.3203	(231)
Electricity for lighting (calculated in Appendix L)												284.8198	(232)
Total delivered energy for all uses												3000.7431	(238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1380.3524	3.9200	54.1098	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1219.2505	3.9200	47.7946	(247)
Mechanical ventilation fans	41.3203	16.9600	7.0079	(249)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	284.8198	16.9600	48.3054	(250)
Additional standing charges			88.0000	(251)
Total energy cost			257.9378	(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	1380.3524	0.2160	298.1561	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1219.2505	0.2160	263.3581	(264)
Space and water heating			561.5142	(265)
Pumps and fans	116.3203	0.5190	60.3702	(267)
Energy for lighting	284.8198	0.5190	147.8215	(268)
Total kg/year			769.7060	(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	1380.3524	1.2200	1684.0300	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1219.2505	1.2200	1487.4856	(264)
Space and water heating			3171.5156	(265)
Pumps and fans	116.3203	3.0700	357.1033	(267)
Energy for lighting	284.8198	3.0700	874.3969	(268)
Primary energy kWh/year			4403.0158	(272)
Primary energy kWh/m2/year			72.9701	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 90

(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	Recommended
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	+ 1.0	-£ 19	-124 kg (16.1%)
U Solar photovoltaic panels	+ 12.7	-£ 309	-947 kg (146.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£19	2.05 kg/m²	B 86 B 91
Solar photovoltaic panels	£309	15.69 kg/m²	A 99 A 103
Total Savings	£328	17.74 kg/m²	

Potential energy efficiency rating: A 99
Potential environmental impact rating: A 103

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£68	£77	-£8
Mains gas	£190	£163	£27
Space heating	£162	£162	£0
Water heating	£48	£29	£19
Lighting	£48	£48	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£258	-£69	£328
Total cost of uses	£258	-£70	£328
Delivered energy	50 kWh/m²	9 kWh/m²	41 kWh/m²
Carbon dioxide emissions	0.8 tonnes	-0.3 tonnes	1.1 tonnes
CO2 emissions per m²	13 kg/m²	-5 kg/m²	18 kg/m²
Primary energy	73 kWh/m²	-31 kWh/m²	104 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (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) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			6.6200	1.1450	7.5802		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			30.1700	0.1100	3.3187	75.0000	2262.7500 (28a)					
100mm Knauf Supafil 34	76.5600	11.7500	64.8100	0.2500	16.2025	52.8000	3421.9680 (29a)					
Plane Ceiling-500mm Loft Roll	30.1700		30.1700	0.0900	2.7153	9.0000	271.5300 (30)					
Total net area of external elements Aum(A, m2)			136.9000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9728		(33)					
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)					
Timber GF			59.3600			9.0000	534.2400 (32c)					
Timber FF			59.4200			9.0000	534.7800 (32c)					
Internal Floor			30.1700			12.6000	380.1420 (32d)					
Internal Ceiling			30.1700			9.0000	271.5300 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9313.1400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							154.3444 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1980 (36)					
Total fabric heat loss						(33) + (36) =	40.1708 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 24.4920	Feb 24.4920	Mar 24.4920	Apr 24.4920	May 24.4920	Jun 24.4920	Jul 24.4920	Aug 24.4920	Sep 24.4920	Oct 24.4920	Nov 24.4920	Dec 24.4920 (38)
Heat transfer coeff	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628 (39)
Average = Sum(39)m / 12 =												64.6628 (39)
HLP	Jan 1.0716	Feb 1.0716	Mar 1.0716	Apr 1.0716	May 1.0716	Jun 1.0716	Jul 1.0716	Aug 1.0716	Sep 1.0716	Oct 1.0716	Nov 1.0716	Dec 1.0716 (40)
HLP (average)												1.0716 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9912 (42)
Average daily hot water use (litres/day)												81.4917 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)										Total = Sum (45)m =		1282.1824 (45)
Distribution loss (46)m = 0.15 x (45)m	19.9402	17.4399	17.9964	15.6897	15.0546	12.9910	12.0381	13.8138	13.9788	16.2910	17.7829	19.3111 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.5744	13.1424	14.5161	14.0089	14.4476	13.9489	14.3935	14.4285	13.9816	14.4877	14.0655	14.5631 (61)
Total heat required for water heating calculated for each month	147.5093	129.4081	134.4919	118.6067	114.8116	100.5554	94.6472	106.5209	107.1738	123.0942	132.6180	143.3035 (62)
WWHRS	-41.4664	-36.4796	-37.2352	-30.6732	-28.5000	-23.5247	-19.9344	-24.1276	-24.8204	-30.6563	-35.4746	-40.0708 eq. (G10)
Total of WWHRS savings												-372.9632
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												1.9947 (H8)
Utilisation factor												0.3943 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												81.4917 (H14)
Volume ratio Veff/V												0.9203 (H15)
Solar storage volume factor												0.9834 (H16)
Solar input												-618.3108 (H17)
Solar input	-17.9298	-29.9196	-50.9566	-68.2919	-84.3689	-82.9480	-81.8518	-71.5144	-56.0101	-38.2483	-21.2673	-15.0042 (63)
Solar input (sum of months) = Sum (63)m =												-618.3108 (63)
Output from w/h	88.1131	63.0088	46.3001	19.6416	1.9428	0.0000	0.0000	10.8789	26.3433	54.1897	75.8761	88.2285 (64)
Total per year (kWh/year) = Sum (64)m =												474.5229 (64)
Heat gains from water heating, kWh/month	47.8445	41.9439	43.5210	38.2810	36.9829	32.2839	30.2827	34.2278	34.4818	39.7336	42.9351	46.4469 (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	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.3192	35.8112	29.1236	22.0484	16.4815	13.9143	15.0349	19.5430	26.2305	33.3057	38.8727	41.4398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.4084	262.1002	255.3168	240.8759	222.6467	205.5139	194.0681	191.3762	198.1596	212.6006	230.8297	247.9626	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	(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)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	(71)
Water heating gains (Table 5)	64.3071	62.4166	58.4959	53.1680	49.7083	44.8387	40.7026	46.0051	47.8914	53.4054	59.6321	62.4287	(72)
Total internal gains	455.7979	452.0912	434.6996	407.8556	380.5997	356.0302	341.5689	348.6876	364.0448	391.0749	421.0977	443.5943	(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
Northeast				3.5600	11.2829	0.4600	0.0000			0.7700			14.2272 (75)
Southeast				0.6600	36.7938	0.4600	0.0000			0.7700			8.6014 (77)
Southwest				2.4000	36.7938	0.4600	0.0000			0.7700			31.2777 (79)
Southwest				3.1500	36.7938	0.4300	0.0000			0.7700			38.3747 (79)

Solar gains	92.4810	162.2551	234.5568	311.6669	368.2969	374.0808	357.1385	313.5985	261.0572	182.7108	111.6315	78.5876	(83)
Total gains	548.2789	614.3462	669.2564	719.5225	748.8966	730.1110	698.7073	662.2861	625.1020	573.7858	532.7292	522.1819	(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	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	
alpha	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	
util living area	0.9572	0.9352	0.8951	0.8174	0.6926	0.5339	0.3981	0.4357	0.6389	0.8433	0.9345	0.9634	(86)
MIT	19.7356	19.9373	20.2288	20.5574	20.8116	20.9452	20.9855	20.9797	20.8934	20.5703	20.0865	19.6713	(87)
Th 2	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	(88)
util rest of house	0.9493	0.9237	0.8766	0.7856	0.6421	0.4628	0.3137	0.3487	0.5690	0.8087	0.9208	0.9566	(89)
MIT 2	18.3683	18.6545	19.0637	19.5101	19.8326	19.9813	20.0166	20.0128	19.9326	19.5391	18.8724	18.2767	(90)
Living area fraction									fLA = Living area / (4) =			0.1811	(91)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT	18.6159	18.8868	19.2747	19.6998	20.0100	20.1559	20.1921	20.1879	20.1067	19.7259	19.0923	18.5293 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4659	18.7368	19.1247	19.5498	19.8600	20.0059	20.0421	20.0379	19.9567	19.5759	18.9423	18.3793 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9327	0.9046	0.8561	0.7682	0.6330	0.4615	0.3153	0.3500	0.5638	0.7902	0.9014	0.9411 (94)	
Useful gains	511.4039	555.7076	572.9626	552.7228	474.0221	336.9224	220.2782	231.8037	352.4125	453.4174	480.2263	491.4369 (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													
916.0084	894.7274	816.3495	688.6463	527.6457	349.5623	222.5748	235.2385	378.7078	580.4064	765.7556	916.8730 (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													
301.0258	227.8213	181.0798	97.8649	39.8960	0.0000	0.0000	0.0000	0.0000	94.4798	205.5811	316.5245 (98)		
Space heating												1464.2732 (98)	
Space heating per m2												24.2670 (99)	

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	90.5000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	1617.9814 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	301.0258	227.8213	181.0798	97.8649	39.8960	0.0000	0.0000	0.0000	0.0000	94.4798	205.5811	316.5245 (98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)	
Space heating fuel (main heating system)	332.6251	251.7362	200.0882	108.1381	44.0840	0.0000	0.0000	0.0000	0.0000	104.3976	227.1614	349.7508 (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	88.1131	63.0088	46.3001	19.6416	1.9428	0.0000	0.0000	10.8789	26.3433	54.1897	75.8761	88.2285 (64)	
Efficiency of water heater (217)m	89.7550	89.7870	89.8295	89.9489	90.3462	87.3000	87.3000	87.3000	87.3000	89.3068	89.6145	89.7826 (217)	
Fuel for water heating, kWh/month	98.1707	70.1759	51.5422	21.8364	2.1504	0.0000	0.0000	12.4615	30.1756	60.6781	84.6695	98.2690 (219)	
Water heating fuel used												530.1292 (219)	
Annual totals kWh/year													
Space heating fuel - main system												1617.9814 (211)	
Space heating fuel - secondary												0.0000 (215)	

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)	
mechanical ventilation fans (SFP = 0.2282)	41.3203 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
pump for solar water heating	50.0000 (230g)
Total electricity for the above, kWh/year	166.3203 (231)
Electricity for lighting (calculated in Appendix L)	284.8198 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =	-1727.2394	-1727.2394 (233)
Total delivered energy for all uses		872.0114 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1617.9814	3.4800	56.3058 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	530.1292	3.4800	18.4485 (247)	
Mechanical ventilation fans	41.3203	13.1900	5.4501 (249)	
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)	
Pump for solar water heating	50.0000	13.1900	6.5950 (249)	
Energy for lighting	284.8198	13.1900	37.5677 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229 (252)	
Total energy cost			26.4368 (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] =	0.1054 (257)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP value 98.5296
SAP rating (Section 12) 99 (258)
SAP band A

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	1617.9814	0.2160	349.4840 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	530.1292	0.2160	114.5079 (264)
Space and water heating			463.9919 (265)
Pumps and fans	166.3203	0.5190	86.3202 (267)
Energy for lighting	284.8198	0.5190	147.8215 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			-198.3036 (272)
CO2 emissions per m2			-3.2900 (273)
EI value			102.5226
EI rating			103 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	30.1700 (1b)	x 2.3100 (2b)	= 69.6927 (1b) - (3b)
First floor	30.1700 (1c)	x 2.6100 (2c)	= 78.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.4364 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.0100		
Number of sides sheltered															0.2005 (18)		
															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.1855 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate																	
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			6.6200	1.1450	7.5802		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			30.1700	0.1100	3.3187	75.0000	2262.7500 (28a)					
100mm Knauf Supafil 34	76.5600	11.7500	64.8100	0.2500	16.2025	52.8000	3421.9680 (29a)					
Plane Ceiling-500mm Loft Roll	30.1700		30.1700	0.0900	2.7153	9.0000	271.5300 (30)					
Total net area of external elements Aum(A, m2)			136.9000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9728		(33)					
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)					
Timber GF			59.3600			9.0000	534.2400 (32c)					
Timber FF			59.4200			9.0000	534.7800 (32c)					
Internal Floor			30.1700			12.6000	380.1420 (32d)					
Internal Ceiling			30.1700			9.0000	271.5300 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9313.1400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							154.3444 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1980 (36)					
Total fabric heat loss						(33) + (36) =	40.1708 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 24.4920	Feb 24.4920	Mar 24.4920	Apr 24.4920	May 24.4920	Jun 24.4920	Jul 24.4920	Aug 24.4920	Sep 24.4920	Oct 24.4920	Nov 24.4920	Dec 24.4920 (38)
Heat transfer coeff	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628	64.6628 (39)
Average = Sum(39)m / 12 =												64.6628 (39)
HLP	Jan 1.0716	Feb 1.0716	Mar 1.0716	Apr 1.0716	May 1.0716	Jun 1.0716	Jul 1.0716	Aug 1.0716	Sep 1.0716	Oct 1.0716	Nov 1.0716	Dec 1.0716 (40)
HLP (average)												1.0716 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9912 (42)
Average daily hot water use (litres/day)												81.4917 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Daily hot water use	89.6409	86.3812	83.1216	79.8619	76.6022	73.3426	73.3426	76.6022	79.8619	83.1216	86.3812	89.6409 (44)
Energy conte	132.9349	116.2657	119.9758	104.5978	100.3641	86.6066	80.2537	92.0923	93.1922	108.6065	118.5525	128.7403 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	19.9402	17.4399	17.9964	15.6897	15.0546	12.9910	12.0381	13.8138	13.9788	16.2910	17.7829	19.3111 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.5744	13.1424	14.5161	14.0089	14.4476	13.9489	14.3935	14.4285	13.9816	14.4877	14.0655	14.5631 (61)
Total heat required for water heating calculated for each month												
	147.5093	129.4081	134.4919	118.6067	114.8116	100.5554	94.6472	106.5209	107.1738	123.0942	132.6180	143.3035 (62)
WWHRS	-41.4664	-36.4796	-37.2352	-30.6732	-28.5000	-23.5247	-19.9344	-24.1276	-24.8204	-30.6563	-35.4746	-40.0708 eq. (G10)
Total of WWHRS savings												-372.9632
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												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												2.1066 (H8)
Utilisation factor												0.3779 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												81.4917 (H14)
Volume ratio Veff/V												0.9203 (H15)
Solar storage volume factor												0.9834 (H16)
Solar input												-625.9250 (H17)
Solar input	-19.2657	-28.9562	-48.7660	-67.4095	-81.1837	-85.4423	-83.3907	-74.4684	-58.1229	-39.5399	-23.4179	-15.9617 (63)
Solar input (sum of months) = Sum (63)m =												-625.9250 (63)
Output from w/h												
	86.7773	63.9722	48.4907	20.5240	5.1279	0.0000	0.0000	7.9248	24.2305	52.8981	73.7255	87.2709 (64)
Total per year (kWh/year) = Sum (64)m =												470.9419 (64)
Heat gains from water heating, kWh/month												
	47.8445	41.9439	43.5210	38.2810	36.9829	32.2839	30.2827	34.2278	34.4818	39.7336	42.9351	46.4469 (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	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	119.4739	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.3192	35.8112	29.1236	22.0484	16.4815	13.9143	15.0349	19.5430	26.2305	33.3057	38.8727	41.4398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.4084	262.1002	255.3168	240.8759	222.6467	205.5139	194.0681	191.3762	198.1596	212.6006	230.8297	247.9626	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	48.9386	(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)	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	-79.6492	(71)
Water heating gains (Table 5)	64.3071	62.4166	58.4959	53.1680	49.7083	44.8387	40.7026	46.0051	47.8914	53.4054	59.6321	62.4287	(72)
Total internal gains	455.7979	452.0912	434.6996	407.8556	380.5997	356.0302	341.5689	348.6876	364.0448	391.0749	421.0977	443.5943	(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	
Northeast	3.5600	12.9236	0.4600	0.0000	0.7700	16.2960	(75)
Southeast	0.6600	40.4699	0.4600	0.0000	0.7700	9.4607	(77)
Southwest	2.4000	40.4699	0.4600	0.0000	0.7700	34.4027	(79)
Southwest	3.1500	40.4699	0.4300	0.0000	0.7700	42.2087	(79)
Solar gains	102.3681	161.8974	232.1447	319.7013	369.5572	402.2980	379.6920
Total gains	558.1659	613.9886	666.8443	727.5568	750.1569	758.3282	721.2609

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	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	40.0073	
alpha	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	3.6672	
util living area	0.9484	0.9273	0.8792	0.7804	0.6231	0.4154	0.2761	0.2979	0.5454	0.7999	0.9162	0.9554	(86)
MIT	19.8637	20.0285	20.3322	20.6583	20.8863	20.9811	20.9970	20.9960	20.9467	20.6831	20.2283	19.8108	(87)
Th 2	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	(88)
util rest of house													
	0.9386	0.9140	0.8572	0.7425	0.5635	0.3386	0.1901	0.2083	0.4658	0.7562	0.8984	0.9468	(89)
MIT 2	18.5523	18.7846	19.2077	19.6421	19.9190	20.0127	20.0232	20.0228	19.9853	19.6850	19.0718	18.4775	(90)
Living area fraction													fLA = Living area / (4) = 0.1811 (91)

MIT	18.7898	19.0099	19.4114	19.8262	20.0942	20.1881	20.1996	20.1991	20.1594	19.8658	19.2813	18.7190 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6398	18.8599	19.2614	19.6762	19.9442	20.0381	20.0496	20.0491	20.0094	19.7158	19.1313	18.5690 (93)

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating - main system 1	1380.3524	0.2160	298.1561 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	526.5078	0.2160	113.7257 (264)
Space and water heating			411.8818 (265)
Pumps and fans	166.3203	0.5190	86.3202 (267)
Energy for lighting	284.8198	0.5190	147.8215 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			-300.7153 (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	1380.3524	1.2200	1684.0300 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	526.5078	1.2200	642.3395 (264)
Space and water heating			2326.3695 (265)
Pumps and fans	166.3203	3.0700	510.6033 (267)
Energy for lighting	284.8198	3.0700	874.3969 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-1888.8004 (272)
Primary energy kWh/m2/year			-31.3026 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	154.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	195.94 (P1)
Transmission heat loss coefficient	40.17 (37)
Summer heat loss coefficient	236.11 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South 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
North East	3.5600	98.8453	0.4600	0.0000	0.9000	145.6821
South East	0.6600	119.9223	0.4600	0.0000	0.9000	32.7676
South West	2.4000	119.9223	0.4600	0.0000	0.9000	119.1548
South West	3.1500	119.9223	0.4300	0.0000	0.9000	146.1913

total:						443.7959
Solar gains	Jun	Jul	Aug			(P3/P4)
Internal gains	470	444	397			
Total summer gains	353	339	346			(P5)
	823	782	743			
Summer gain/loss ratio	3.49	3.31	3.15			(P6)
Summer external temperature	16.00	17.90	17.80			
Thermal mass temperature increment (TMP = 154.3)	0.92	0.92	0.92			
Threshold temperature	20.41	22.13	21.87			(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight			
Assessment of likelihood of high internal temperature:	Medium					